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Effect of small group competition on seventh grade mathematics achievement

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Effect of small group competition on seventh grade mathematics achievement

Abstract

Mathematics is an area which has shown some decline in standardized test scores as well as a shortage in the number of educators graduating in the field. In mathematics, average SAT scores have fallen 40 points since 1963, and a 1981 survey of 45 states revealed a shortage of mathematics teachers in 43 states. This report by the National Commission on Excellence in Education (1983) states that "We are a nation at risk" because of this decline in educational achievement since the early 1960s. This decrease in mathematics achievement is a concern of many educators, including the researcher. What may be done to motivate students in order to increase their level of achievement in mathematics?

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INTRODUCTION

Statement of the Problem

Mathematics is an area which has shown some decline in standardized test scores as well as a shortage in the number of educators graduating in the field. In mathematics, average SAT scores have fallen 40 points since 1963, and a 1981 survey of 45 states revealed a shortage of mathematics teachers in 43 states. This report by the National Commission on Excellence in Education (1983) states that "We are a nation at risk" because of this decline in educational achievement since the early 1960s. This decrease in mathematics achievement is a concern of many educators, including the researcher. What may be done to motivate students in order to increase their level of achievement in mathematics?

The researcher has observed in his own mathematics classroom that the students are often competing with one another for grades, but only a small minority of these students actually thrive on this competition. When the majority of the students find that they cannot compete with the better students, they may soon lose

interest and give up because they feel they are losers. Society has taught people to be "number one" and not to settle for anything less. In the classroom, these "losers" will usually become apathetic toward mathematics. They may not complete the work, and, as a result, they may not improve in the area of mathematics achievement.

A classroom of this nature has been labeled in the literature as a competitive goal structure and this structure seems to be the one used by many instructors in today's classrooms. This structure exists when students perceive that they can obtain their goal only when other students with whom they are linked fail to obtain their goal (Deutsch, 1949a). Therefore, the methods used in teaching mathematics may have to change in order to promote student achievement.

An alternative to the traditional competitive approach is called a cooperative goal structure. This structure exists when students perceive that they can obtain their goal if, and only if, the other students with whom they are linked can obtain their goal (Deutsch, 1949a). If success is important to a small group of students working together, then it may produce

greater individual achievement among the members. The "losers" of the classroom seem to be extrinsically motivated at best. After working together with other students, this motivation may become more intrinsic. The purpose of this paper is to review and compare cooperative learning strategies which may better motivate the student to increase the level of achievement.

Review of the Literature

A number of classroom experiments have shown the advantages of cooperative learning strategies. Deutsch (1949b) found in his study that students in a cooperative group were more secure than students in a competitive group. Johnson & Johnson (1975) found that the establishment of a cooperative goal structure does facilitate a climate in which it is possible to benefit from mistakes as compared with a competitive goal structure in which mistakes may be hidden in order to avoid ridicule. In order to motivate students to learn, a climate of trust should be built. Trust is built through cooperative interaction and destroyed through competitive interaction (Johnson & Johnson, 1975). This is very important to the students since

they sometimes are afraid to question the teacher about concepts which are not well understood. Students who do not learn these basic concepts may find it difficult or impossible to master more complex concepts later on.

Additional research has shown that students in cooperative groups believe that their peers have a positive interest in their success in learning and therefore attach greater importance to achievement as compared with students in competition with one another (Hulten, 1974). Furthermore, it has been found that the achievement level may increase and that students become more enthusiastic about working and learning when working as a group (Bany & Johnson, 1975).

Achievement motivation is a problem in any classroom. According to Atkinson (1964), motivation to achieve is related to the probability of success of a task and the incentive value of success. Since students work toward a common goal in a cooperative structure and are dependent on one another, then working toward a common goal could possibly give students an incentive to put forth more effort. Atkinson (1964) also states that if both of these factors are high, motivation will be high; if either is low, motivation will be low. A cooperative method

which implements both factors has been used by Robert Slavin (1977, 1978a, 1978b, 1980a, 1980b, 1982) and will be described later.

Cooperative learning has been under investigation throughout the last decade. Various methods have been developed, but all are based on the same idea: students working on learning activities in small groups and receiving rewards or recognition based on their group's performance. Reviews of these methods have been done by both Robert E. Slavin (1980a) and Schlomo Sharan (1980).

Four general strategies have developed from the cooperative learning research. They include Group-Investigation (Sharon, 1980), Learning Together (Johnson, Johnson & Scott, 1978), Jigsaw (Aronson, et al, 1978), Teams-Games-Tournaments (DeVries & Slavin, 1978), and Student Teams Achievement Divisions (Slavin, 1978a). Group-Investigation is a strategy found to be the most complex of the cooperative learning methods. Students in small groups decide what they will learn, organize themselves to learn it, and report it to classmates (Sharon, 1980). Learning Together (Johnson, Johnson & Scott, 1978) is a strategy in which students are assigned to small groups and are

instructed to work together to complete a single assignment as a group. The Jigsaw method is based on students studying different sections of the material and teaching this to their group (Aronson, et al, 1978). Teams-Games-Tournaments (DeVries & Slavin, 1978) and Student Teams Achievement Division (Slavin, 1978a) are similar in nature because they combine competition between groups and cooperation within groups. The former method uses competitive games or tournaments and the latter method uses individual quizzes as a second motivational technique.

From the cooperative learning strategies the researcher has selected Student Teams Achievement Divisions (STAD) for use in the classroom. This method is a highly structured cycle composed of 40 minutes of worksheet study within the group and a 20 minute quiz for each student (Slavin, 1980b). This method combines intrateam cooperation with interteam competition. Students are assigned to teams of four or five members; each team contains high, average, and low achievers and each team has boys, girls, and members of ethnic groups in approximately the same proportion as represented in the whole class (Slavin, 1980b).

Thus, the teams are balanced in academic ability as well as in racial/ethnic background.

The STAD process consists of highly structured events. The teacher presents the lesson, students study the worksheets in teams to review the lesson, and then students take a quiz individually over the material. Each student is awarded points based on the degree to which he/she surpasses his/her own past average. These points are added together for a team total and then are compared with the other teams' totals in the classroom (Slavin, 1980b). Students are continually trying to improve their average, and this may increase motivation to achieve because it gives each student an equal chance to receive a relatively high score. STAD will help to implement the factors, probability of success and incentive value of success, according to Atkinson's achievement motivation theory. The students in STAD are not competing with the top students in the class as they do in the traditional classroom. Each student works to improve his/her own previous score; therefore, one competes with oneself rather than with the top students in the classroom. This improves the probability of each student being

successful and of everyone having an equal chance to gain maximum points for his/her team.

Team competition has been found to affect peer norms. This gives students more incentive to succeed because students give their classmates more support for doing well academically and are more spontaneous about helping each other learn the material. In theory, teams increase performance because they increase peer norms favoring performance and also because they motivate students to help one another (Slavin, 1978a).

One interesting study done by Slavin & Wodarski (1977) found that the elements of team competition and the team reward system are very important to the student. In this study, teams were first allowed to compete with one another for a short period of time. Then when the team competition was eliminated, with students still being allowed to peer tutor within the teams, academic performance dropped considerably ($p < .10$). Because these results were present in grades three to nine, it seems that the intrateam cooperation combined with the interteam competition are very important elements in motivating the student (Slavin & Wodarski, 1977).

Research indicates that STAD has been strongest

when the subject matter focused on lower level skills such as mathematics computation, language mechanics, and vocabulary rather than with more complex skills such as reading comprehension, mathematics concepts, and social studies (Slavin, 1980a). STAD has shown positive effects on achievement in language arts (Slavin, 1977) and mathematics (Slavin & Karweit, 1982). The only mathematics study using STAD resulted in lower achievers increasing their performance (Slavin & Karweit, 1982). This year-long study consisted of ninth grade general mathematics students in 49 classrooms located in inner-city Philadelphia. It evaluated the achievement effects of a group-paced mastery learning model, student team learning (STAD), a combination of the two, and a focused instruction model (students working individually). It was found that classes of very low achieving inner-city students who received the team treatment had significantly higher achievement ($p<.01$) on the standardized posttest than did the non-team classes.

Other literature on cooperative learning has resulted in findings which support important components of STAD. Neil Davidson (1978) has suggested using four students per group since more than four may be too

large for effective cooperation and participation among members. He also has found that most groups need a minimum of three to five class periods to begin to function well as a group. These findings support the use of four member groups used in STAD. In addition, the study should extend much longer than three or five class periods, which should allow sufficient time for a group to function.

Webb (1981) conducted a study using seventh, eighth, and ninth graders in two average and two above average general mathematics classes. Each class had students from all three grades, and group competition was used based on the average score of the four students in each group. Webb found that students in mixed ability groups performed significantly better than uniform ability groups on a consumer mathematics unit test ($p < .03$). It was concluded that off-task behavior occurred in uniform ability groups more than mixed ability groups and that students' questions were answered more often in the mixed ability groups. These results support the use of mixed ability grouping which is also used in STAD.

Fifth grade students from intact classes were placed in groups made up of one high, one low, and two

medium-ability students in a study done by Swing & Peterson (1982). It was found that low-ability students were more often the target of explanation than the higher ability students; consequently they obtained higher scores on the achievement test than the low-ability students of the control group. A similar result was noted by Edwards & DeVries (1972) when teams incorporated with games (teams-games-tournaments) versus the traditional classroom method were compared. Students were assigned to four-member mixed-ability groups in two intact seventh grade general mathematics classrooms. The experimental classrooms achieved more than the two traditional classrooms overall. Although the lower ability students from the experimental classes had the lowest pretest scores, they finished with the highest posttest scores when compared with the lower ability students of the traditional classrooms. This suggests that the mixed ability grouping may be more beneficial to the students, especially those of low ability.

Julian & Perry (1967) placed undergraduate psychology students in four-person laboratory groups and assessed both quality and quantity of performance of purely cooperative groups and competitive groups.

It was found that team members wrote more, produced more ideas, and offered more explanations for their data in the competitive situation. These students from the competitive groups were found to be more highly motivated and had a better quality of performance than students in the purely cooperative group conditions. This study supports the use of group competition which is used in STAD to help motivate the students.

No research has been done using STAD with seventh grade mathematics students; however, the results using STAD with other subjects have been for the most part very positive. Since this method is more structured than the other cooperative learning methods, it would be appropriate to use with seventh grade students. Because STAD has been shown to be most useful when teaching lower level skills, it would be an appropriate technique for a fraction unit. In addition, a teacher may keep more accurate records of student performance since this technique involves weekly quizzes. With the positive effects and results documented on cooperative learning, this method may be beneficial to the student and teacher. The use of STAD in the classroom may give the teacher another technique to motivate students to achieve in the area of mathematics.

In summary, STAD has been used to increase the achievement level of basic skills. The class may be separated into teams of four, each team being balanced according to academic ability and racial/ethnic background. The motivation factors, probability of success and incentive value of success, are important components of STAD and give every student an equal chance to gain points for his/her team. The competition between teams can be very useful in motivating low achieving students.

Purpose of the Study

The purpose of this study was to investigate whether the cooperative learning technique, STAD, would increase the achievement on a fraction unit (concepts and computation) for seventh grade mathematics students compared with the traditional competitive classroom. The review of the literature has shown evidence to suggest that STAD may increase achievement in this area.

Statement of Research Hypothesis

Seventh grade mathematics students of low-average to average ability will perform better on a fraction

unit (concepts and computation) using STAD than those students taught in a traditional manner.

Average and low-average achievers seldom seem to be very motivated in the classroom. Using STAD should help to increase the probability of success of each student. Once each student understands the importance of group success, the result may be an increase in the overall achievement of fractions (concepts and computation). STAD is one strategy which could be considered in helping to increase achievement in any classroom, especially in the junior high school where many students are bored with the material and see little reason to put forth their best effort to learn. The students who participated in the study and the method will be described in more detail in Chapter 2.

Chapter 2

METHOD

Subjects

The Ankeny School District has an enrollment of approximately 340 students in the seventh grade. The mathematics classes are tracked so that approximately 100 students are in the pre-algebra classes, 200 are in the practical mathematics classes, and 40 are in the basic mathematics classes. The 46 subjects who were involved in the study were from two intact classes in the practical mathematics sections. Mean grade equivalent scores from the Iowa Test of Basic Skills sixth grade mathematics tests were 58.7 and 61.4 for the two intact classes. When compared with the national norm of 62, these students could be considered low average to average in ability (Iowa Tests of Basic Skills, 1982). The researcher also was involved in the study and taught both the control and experimental classes.

Design

The design used was the non-equivalent control group design described by Campbell & Stanley (1963). t-tests were used on various data (see Table 1) to

Table 1

Equivalency Measures Comparing Groups

Variable	Group	N	Mean	Standard Deviation	t	Degrees of Freedom	2-tailed Probability
ITBS Reading	STAD	24	56.08	16.42	-0.12	44	.91
	TCL	22	56.59	11.84			
ITBS Math Concepts	STAD	24	58.79	13.37	-1.39	44	.17
	TCL	22	63.72	10.43			
ITBS Math Computation	STAD	24	58.50	7.96	-0.27	44	.79
	TCL	22	59.14	7.90			
ITBS Math Total	STAD	24	58.71	9.81	-1.00	44	.32
	TCL	22	61.41	8.38			
Fraction Concepts	STAD	22	68.41	13.52	-0.08	41	.94
	TCL	21	68.71	10.52			
Age in Months	STAD	24	154.00	8.35	0.63	44	.53
	TCL	22	152.73	4.78			

Note: None of the t-tests were significant at the $p < .05$ level.
STAD = Student Teams Achievement Divisions
TCL = Traditional Classroom Learning

show equivalency between the two intact classes. These measures included the grade equivalent scores of the sixth grade Iowa Test of Basic Skills Subtests: Reading, Mathematics Concepts, Mathematics Computation, and Mathematics Total. The Fraction Concept Test developed by Payne and Muangnapoe (1975) was also given three months prior to the study to determine if one class had an advantage over the other in this area. No significant difference was found between the two classes.

The Fraction/Mixed Number Subtest from the Iowa Eighth Grade Mathematics Assessment Test (1976) was also given to assess knowledge in the area of fractions. This pretest consisted of 33 items: 15 multiple choice questions concerning basic concepts and 18 problems dealing with computation of fractions and mixed numbers. Each computational problem was to be answered in simplest form and all improper fractions were to be changed to whole or mixed numbers.

The posttest was an alternate form of the pretest and was given at the end of the fraction unit. The results of the study will be reported in Chapter 3.

Variables

Independent Variable

The method of instruction used for the two intact classes: STAD was used by the experimental group and the traditional method of instruction was used for the control group.

Experimental Group

Student Teams Achievement Divisions (STAD). Students were assigned to four-member teams at the beginning of the study based on their pretest scores. Team assignments were made so that high, middle, and low achievers were included on each team. The teacher presented the lesson; students then formed into their teams and worked together on worksheets. Two or three days later students were quizzed individually over the material. Students' individual quiz scores were compared with their base scores. This original base score had been figured previously using a process developed by Slavin (1980b). The base score was the minimum score a student could receive on the quiz before he or she earned points for the team. Any points beyond this base score were added to the team total. The teams competed against one another for top scores.

Control Group

Traditional Classroom Learning (TCL). The teacher presented the lesson and students then worked on worksheets individually in their seats. Two or three days later students were quizzed individually over the material. Thus, each TCL student was competing individually for top scores in the class.

Both STAD and TCL will be described in more detail in the procedure section.

Dependent Variable

Mathematics achievement of fractions (concepts and computation) was measured by a Fraction/Mixed Number Subtest from the Iowa Eighth Grade Mathematics Assessment Test (1976). It consisted of 42 items and was given at the end of the six-week study as a posttest (see Appendix C).

Procedure

The experimental group used STAD (Slavin, 1980a) which is made up of class presentations, teams, quizzes, individual improvement scores, and team recognition. The students in the experimental class were placed on teams according to the following system. Students were ranked from top to bottom according to their

pretest scores. After ranking the students, the top student, the bottom student, and the two middle students were placed on one team. This same process continued until all names had been chosen. If there had been any names left over, each one would have been placed on a team so as not to have more than five students per team. Since the experimental class consisted of 24 students, this resulted in six teams with four students per team. This system of choosing teams was developed by Slavin (1980b).

Students in the STAD class were also assigned a base score (minimum score to improve upon) before taking any quizzes. This was computed using the same class ranking referred to previously. The top three students were given a base score of 20, the next three a base score of 19, the next three 18, . . . (until all students were assigned a base score). This score was used as a base score to determine students' improvement on the 30 point quizzes.

The following rules and regulations were to be followed by students in their teams and were similar to those used by Neil Davidson (1978):

1. All students work together to get one solution.

2. Everyone must understand the solution before going to the next problem.

3. No person should act as the boss.

4. Do not race with other teams to get finished.

5. Stay in your team; you may leave your seat only with teacher permission.

6. Students should try to figure the answers within the team and only ask the teacher as a last resort.

7. Everyone cooperates! Remember, your degree of improvement helps the team total.

These rules were placed on a poster in the classroom and were referred to frequently during the study. Each team decided on its own name and this team name was written on all quizzes and was used for team recognition.

During the first class of STAD, the teacher lectured 15-20 minutes, the students then formed their teams, and worked on worksheets for the remainder of the class. No worksheets were taken out of class, and two answer sheets were given to each team so they could work with partners and check their solutions. For the second class period the same process occurred as before. On the third day of class, students

reviewed in teams for 15 minutes and then took quizzes individually.

The improvement points for each of the students were figured by subtracting the base score from the quiz score. The minimum score a student could receive was zero, even if the difference was a negative number. The maximum score was ten; a perfect quiz score was considered ten points. For example, if the student had a base score of 15 and a quiz score of 28, the maximum improvement points would be ten since this was the limit. The improvement points from each team member were then added together to form a team total score. These improvement points were recorded on a team summary sheet which included students' base scores, quiz scores, and team total scores (see Appendix B).

This cycle (teacher lecture, team study with worksheets, and individual quizzes) was used throughout the study. New base scores were computed after every two quizzes using a table of base scores developed by Slavin (1980b) (see Appendix B). A newsletter called the "Math Scoreboard" was also printed after every two quizzes (see Appendix B). This consisted of team standings, top teams of the week, and names of students

who had earned nine or ten points for their team. The students seemed to enjoy reading their names in this newsletter as well as the point totals for each team.

The TCL class was taught in a traditional manner with a 15-20 minute teacher lecture followed by students working individually in their seats on the same worksheets as the STAD class. These students repeated the same cycle as the STAD class which consisted of the teacher presenting the lesson, students finishing worksheets as daily assignments, and then students taking a 30 point quiz individually, two or three days later. Worksheets were corrected the following day in the TCL class and these students were allowed to finish the assignments out of class. All quizzes were taken in class, graded by the researcher, and returned the following day. A newsletter was not printed for this group, and they did not receive base scores as did the students in the STAD class.

Chapter 3

RESULTS AND ANALYSIS

There were 24 students in the STAD classroom and 22 students in the traditional classroom. All students who began the study also completed it. The posttest was given after the final fractions curriculum test (see Appendix A). The traditional class finished two days earlier than the experimental class because they had more time to finish the assignments outside of class whereas the STAD students could only work on the worksheets in class. The traditional class worked on a decimal review and time conversion assignment (weeks, days, hours, minutes, and seconds) from the textbook during these two days.

The original hypothesis stated that the students from the STAD class would perform better on the fraction unit (concepts and computation) than the TCL students. The t-test was chosen as the most appropriate statistical method to test the difference of the mean scores since there were enough students to approach a normal distribution of scores (see Figures 1, 2, 3, and 4). The pretest and posttest comparisons for the two classes are given in Tables 2 and 3. The t values

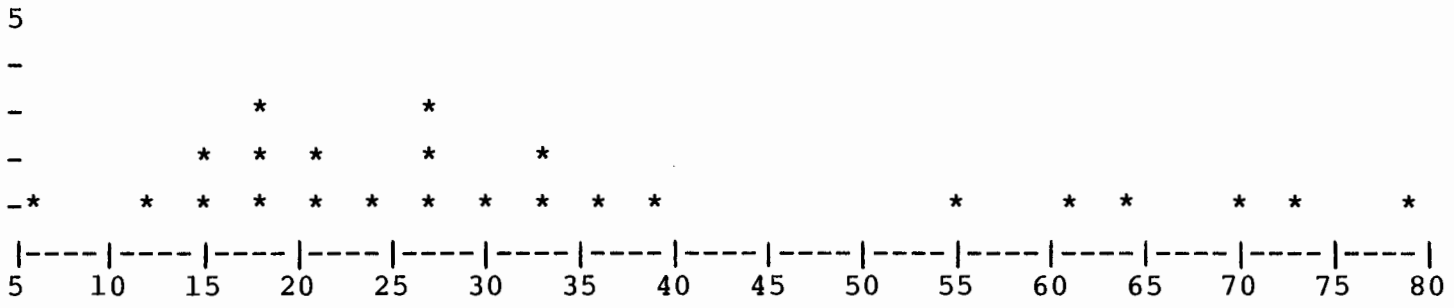

Figure 1

Histogram of Percentage Scores on Fraction Pretest--STAD Group

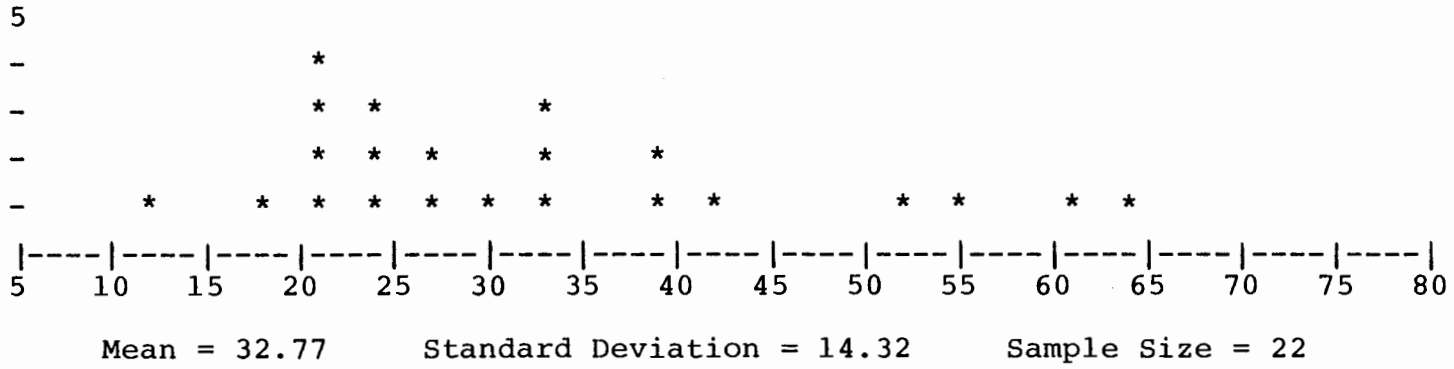

Figure 2

Histogram of Percentage Scores on Fraction Pretest-TCL Group

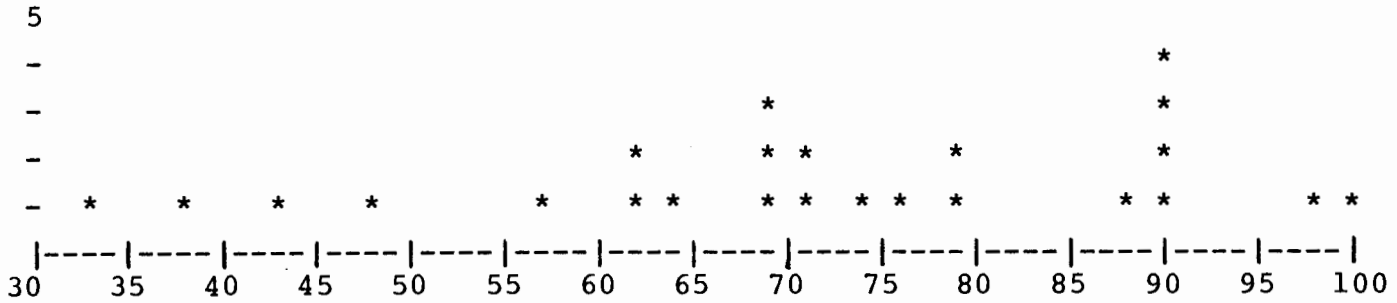

Figure 3

Histogram of Percentage Scores on Fraction Posttest--STAD Group

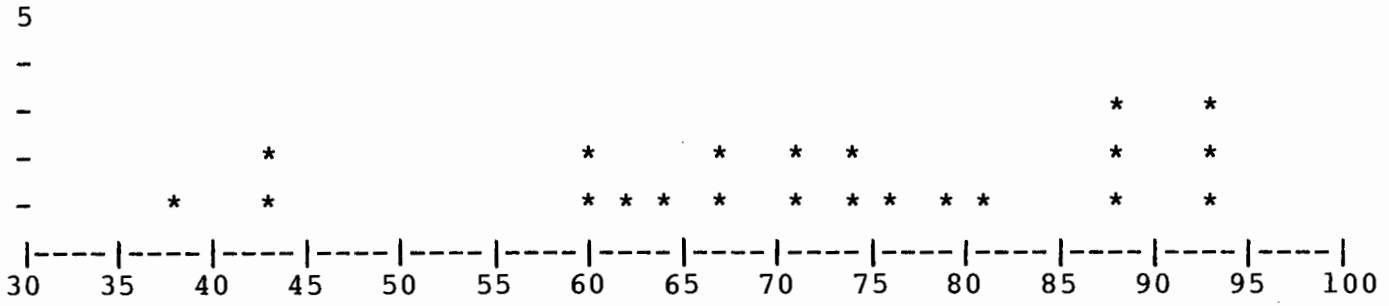

Figure 4

Histogram of Percentage Scores on Fraction Posttest--TCL Group

Table 2

Results of Fraction Pretest

Group	N	Mean	Standard Deviation	t	Degrees of Freedom	2-tailed Probability
STAD	24	34.25	21.16	0.27	44	.78
TCL	22	32.77	14.32			

Note: The t-test was not significant at the $p < .05$ level.

Table 3

Results of Fraction Posttest

Group	N	Mean	Standard Deviation	t	Degrees of Freedom	2-tailed Probability
STAD	24	71.25	18.33	-0.05	44	.96
TCL	22	71.50	16.30			

Note: The t-test was not significant at the $p < .05$ level.

on these two measures are 0.27 and -0.05, respectively. Since these were not significant at the .05 level for two tailed tests, the null hypothesis (no difference between the two methods) was not rejected.

Data was also gathered on students who answered less than 25% of the items correctly on the pretest. A post-hoc analysis of this data was done using scores of the students from each class who scored in this range. These students could possibly be considered as low-ability students who knew very little in the area of fractions. On all equivalency measures except mathematics computation, these STAD students had a lower mean score than the TCL students (see Table 4).

The results of the pretest and posttest for these low-ability students are contained in Tables 5 and 6. The STAD students had a mean score of 16.80 on the pretest and 60.00 on the posttest whereas the TCL students had means of 20.67 and 58.56, respectively.

An item analysis was also done for both the pretest and posttest. This occurs in Appendix C and shows the percentage of each class which correctly answered each item. The items are also separated into categories, concepts and computation.

Table 4

Equivalency Measures for Low-ability Students

Variable	Group	N	Mean	Standard Deviation	t	Degrees of Freedom	2-tailed Probability
ITBS Reading	STAD	10	50.20	19.45	-0.56	17	.59
	TCL	9	53.89	3.98			
ITBS Math Concepts	STAD	10	47.50	5.64	-2.67*	17	.02
	TCL	9	56.00	8.12			
ITBS Math Computation	STAD	10	56.50	6.43	0.50	17	.62
	TCL	9	54.78	8.50			
ITBS Math Total	STAD	10	51.20	5.05	-1.72	17	.10
	TCL	9	55.56	5.96			
Fraction Concepts	STAD	9	56.56	10.04	-1.67	16	.12
	TCL	9	62.56	4.00			
Age in Months	STAD	10	156.20	11.97	0.88	17	.39
	TCL	9	152.33	5.94			

Note: * marks the only t-test which was significant at the $p < .05$ level.

Table 5

Results of Pretest for Low-ability Students

Group	N	Mean	Standard Deviation	t	Degrees of Freedom	2-tailed Probability
STAD	10	16.80	5.14	-1.85	17	.08
TCL	9	20.67	3.81			

Note: The t-test was not significant at the $p < .05$ level.

Table 6

Results of Posttest for Low-ability Students

Group	N	Mean	Standard Deviation	t	Degrees of Freedom	2-tailed Probability
STAD	10	60.0	16.63	0.20	17	.84
TCL	9	58.56	14.02			

Note: The t-test was not significant at the $p < .05$ level.

Chapter 4

DISCUSSION AND CONCLUSIONS

The results of the fraction pretest indicated that the two classes lacked knowledge in the area of fractional concepts and computation. The posttest results have indicated that there was a considerable increase in learning these concepts, especially in the area of computation of fractions.

The item analysis (see Appendix C), which is separated into the two areas of concepts and computation, reveals a very strong increase in computation for both classes. None of the students were able to multiply and divide fractions, whole numbers, and mixed numbers on the pretest. An average of 57% were able to accomplish this task on the posttest. The researcher was pleased with the amount of growth indicated by the posttest scores of each group. It is important to note that both groups had an average posttest score that was more than twice that of the average pretest score (see Tables 2 and 3). Although there was much improvement, these two classes were so very close in comparison in all areas of fractions that neither method used in the classroom resulted in any significant difference.

The STAD class had a lower mean score on all areas of the equivalency measures (see Table 1) than the traditional classroom, and it was surprising to the researcher that the STAD class had the higher mean score on the fraction pretest. Before the experiment began, the STAD class had a few students who often had incomplete assignments and an apparent lack of motivation. The researcher observed this type of student working harder and trying to please the other team members during the fraction unit. One explanation for this may be that there were no out-of-class assignments and other members of the team were constantly urging each other to finish and do well on the quizzes.

Other observations from the STAD class are also worth mentioning. Although students were informed not to rely on the teacher's help, several students continually asked the teacher for assistance. One of these students could not speak English fluently and team members could not understand all of his questions. He proceeded to ask for the teacher's help on many occasions. Another case involved a student who enjoyed working alone and was more independent than others on his team. He also asked the teacher to assist him.

One team had three boys and only one girl who frequently asked to be changed to a different team. The girl finally began to help the boys after a three-day period of working by herself. From these previous examples, it was observed that student individuality was a factor in a group's ability to function. In time the team members seemed to adjust to one another. Perhaps this study would have been more effective if conducted at the beginning of the school year as students have not yet developed opinions of their peers.

It also was noted that some students did not handle the freedom of STAD very well. They had to be told to get back on task by their own team members and finally by the teacher. The STAD method was not as structured as the TCL classroom where students were not allowed to talk to others during class time. If STAD were to be used again, there should be some sort of negative consequence for students continually off-task, such as taking away team points. The researcher also observed that the teams that worked together the best usually did well on quizzes and took pride in being one of the top teams listed in the newsletter. The members who worked more as individuals did not score as well as a team, possibly because they did not

learn the concepts as well as they could have by helping others. It seemed as though the teams that were successful were disappointed to see STAD end. On the other hand, teams that did not show vast improvement were pleased to return to the accustomed traditional method of learning.

It is also of interest to mention the results of a post-hoc analysis. Tables 4 and 5 contain the statistics which describe students who answered less than 25% of the items correctly on the pretest. Students from both classes were compared and may be considered as the low end of the class or as individuals who knew very little in the area of fractions.

These low-achieving students in the STAD class had a lower mean score in the areas of Mathematics Concepts, Fraction Concepts, Mathematics Total, and the Fraction Pretest. However, it is interesting to note that these STAD students had a higher mean score on the posttest than the TCL students (see Table 6). Since the sample size is only 19, there is some doubt as to the validity of these findings. One might infer that these STAD students gained more with this method than the TCL students. Since this was also noted in

the research done by Slavin and Karweit (1982), it could possibly be hypothesized that lower ability mathematics students may achieve more in the STAD classroom than in the traditional classroom. One may conclude that the low achiever feels successful when scoring beyond his/her base score thus pleasing the other members of the team. The low-ability student is also the target of others' attention on the team because members know this person needs assistance in learning the concepts. Students seem to concentrate their effort on helping the low-ability student so they may see their team succeed. This study contained only a small sample of low-ability students; therefore, more research should be done to validate these findings.

Limitations

This study was done in one school and in one grade only. Subjects were not randomly selected. Intact classes were shown to be equivalent by comparison of various measures. Each class was given alternate forms of a fraction pretest and posttest. The instruction of both classes was done by the researcher. He was very conscious of his bias throughout the experiment and gave equal attention and

experiences to both classes as much as possible. One must be careful in generalizing these results to other populations because the sample was limited to seventh grade mathematics students who were average in ability.

Recommendations for STAD

Problems may partially be eliminated if a pilot study is done using STAD on a small scale before implementing it for a longer period of time in the classroom. This is highly recommended since STAD requires much organization. STAD involves organizing and forming the teams according to ability, race, and sex. Worksheets, answer keys, and quizzes also must be prepared ahead of time as well as the charts on which to record the statistics of each team's progress. In addition, there should be written rules for individuals and teams to follow and negative consequences if the guidelines are not followed. The teacher is an important part of this team learning method and should be aware of group roles and processes in order to know when to step in and assist the group. A pilot study would definitely help the teacher become aware of these problems and others which may occur in the STAD classroom.

In conclusion, although there was found to be no significant difference between these two methods, the results of this study support that of Slavin (1980a): Studies comparing team learning with the traditional methods have always resulted in the former method being statistically equivalent or superior to the latter method in achievement. STAD is a new and exciting learning method for the students. If the teacher is willing to take the time to organize the materials and record team statistics, then this is a worthwhile teaching method. Teachers need to experience other learning strategies in order to be able to select methods which may motivate the students to increase their achievement. Students also need to experience other learning strategies in order to develop more successful patterns of behavior. STAD is just one of many techniques available for classroom use.

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APPENDIX A

Lesson Plans

Exercises

Answers to Exercises

The lesson plans are arranged with each day's objectives and examples, followed by a worksheet. A quiz was given every two or three days which tested the objectives of previous lessons. Worksheets were not handed out on the days that quizzes were given and therefore lesson plans were not written for quiz days. Answers to all exercises are located at the end of the appendix. Both the experimental and control groups were given the same worksheets, quizzes, and tests. Presentation of the lesson and examples used were as similar as possible for both groups.

Textbooks and materials used for worksheet exercises are given below:

Heath Mathematics (7th grade) (1975), Lexington, Mass.: D. C. Heath & Company.

HBJ Mathematics (7th grade) (1981), New York: Harcourt Brace Jovanovich.

Modern School Mathematics (Course 1) (1972), Boston: Houghton Mifflin.

Curriculum for Student Team Learning (7th grade) (1978), Baltimore, Md.: John Hopkins University.

Mathematics Essentials and Applications (7th grade) (1980), Columbus, Ohio: Charles E. Merrill.

Day 1 : Fractional Concepts

Objectives:

1) Students will be able to describe the shaded portion of a diagram with a fraction.
2) Students will be able to identify a fraction on a number line.
3) Students will be able to name the numerator and denominator of a given fraction.
4) Students will be able to develop fractions equivalent to a given fraction.

Procedure: The class will be given examples of fractions.

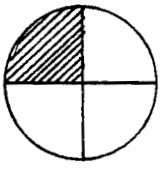
A fraction names a part of a whole. The numerator is the part and the denominator is the whole.

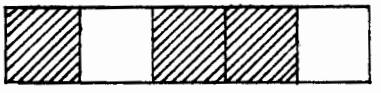
Examples:

One out of ten is written $\frac{1}{10}$

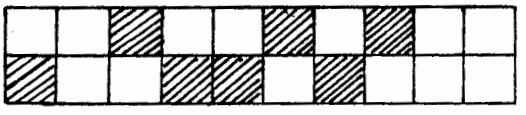
The numerator is 1
The denominator is 10

20 out of 30 is written $\frac{20}{30}$

$\frac{1}{4}$ of this circle is shaded 

$\frac{3}{5}$ of this rectangle is shaded 

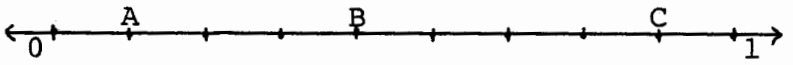
What fractional part of this region is shaded?



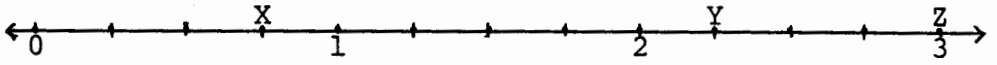
$\frac{7}{20}$

Day 1: (Continued)

Describe the fraction identified with the corresponding letters on the number lines:



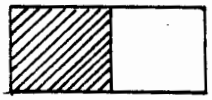
$A = \frac{2}{10}$ $B = \frac{5}{10}$ $C = \frac{9}{10}$

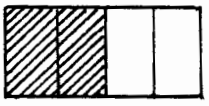


$X = \frac{3}{4}$ $Y = 2\frac{1}{4}$ $Z = 3$

Fractions that name the same number are called equivalent fractions.

One half and two fourths are equivalent fractions.

$\frac{1}{2}$ 

$\frac{2}{4}$ 

Observe that the rectangles have the same area but are divided into different size parts.

$\frac{1}{2} = \frac{2}{4}$ $\frac{1}{2} \times 1 = \frac{1}{2} \times \frac{2}{2} = \frac{2}{4}$ Multiply by a fraction equivalent to one.

$\frac{1}{2} \times \frac{3}{3} = \frac{3}{6}$

$\frac{1}{2} \times \frac{4}{4} = \frac{4}{8}$

$\frac{1}{2}, \frac{2}{4}, \frac{3}{6}, \frac{4}{8}$ are all equivalent fractions.

Day 1: (Continued)

Fill in the numerator to make the fractions equivalent:

$\frac{6}{7} = \frac{\square}{42}$ $\frac{7}{9} = \frac{\square}{36}$

$\square = 36$ $\square = 28$

$\frac{1}{4} = \frac{\square}{16}$

$\square = 4$

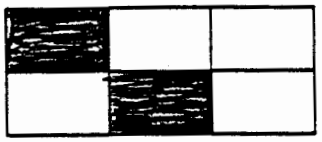
Fill in the denominator to make the fractions equivalent:

$\frac{4}{12} = \frac{28}{\square}$ $\frac{7}{10} = \frac{21}{\square}$

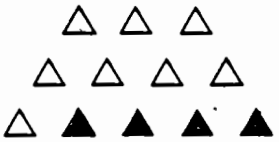
$\square = 84$ $\square = 30$

Day 1: Worksheet on concepts, equivalent fractions

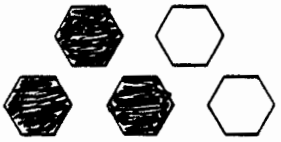
1. What part is shaded?



2. What part is shaded?

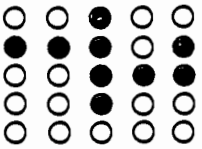


3. What part is shaded?

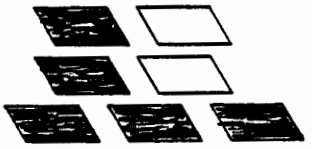


4. What part is shaded?

5. What part is shaded?



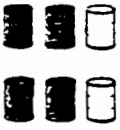
6. What part is shaded?



What part of the figures are shaded?

7.

8.

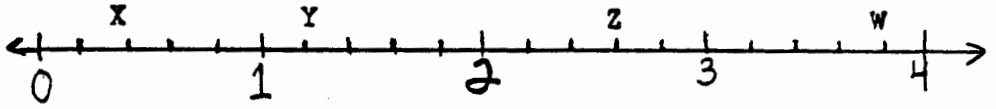


9.

10.

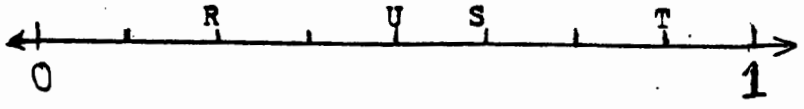
11. What fraction is designated by the letters? X ____ W____

Y ____ Z____



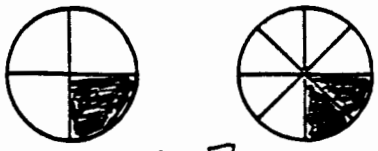
12. What fraction is designated by the letters? R ____ T____

S ____ U____



Day 1 : Worksheet on concepts , equivalent fractions

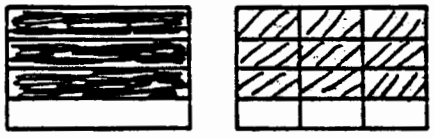
Complete.

1. 

$\frac{1}{4} = \frac{\square}{8}$

2. 

$\frac{2}{3} = \frac{\square}{6}$

3. 

$\frac{3}{4} = \frac{\square}{12}$

4. 

$\frac{5}{8} = \frac{\square}{16}$

5. $\frac{1 \times 3}{3 \times 3} = \frac{\square}{9}$

6. $\frac{2 \times 2}{5 \times 2} = \frac{\square}{10}$

7. $\frac{3 \times 4}{7 \times 4} = \frac{\square}{28}$

8. $\frac{5 \times \square}{6 \times 2} = \frac{10}{12}$

9. $\frac{1 \times \square}{4 \times 5} = \frac{5}{20}$

10. $\frac{7 \times \square}{10 \times 10} = \frac{70}{100}$

11. $\frac{1 \times \square}{5 \times \square} = \frac{3}{15}$

12. $\frac{2 \times \square}{7 \times \square} = \frac{4}{14}$

13. $\frac{3 \times \square}{5 \times \square} = \frac{12}{20}$

14. $\frac{6}{7} = \frac{\square}{28}$

15. $\frac{5}{9} = \frac{\square}{27}$

16. $\frac{7}{12} = \frac{\square}{36}$

17. $\frac{1}{2} = \frac{\square}{14}$

18. $\frac{1}{6} = \frac{\square}{24}$

19. $\frac{2}{3} = \frac{\square}{12}$

20. $\frac{3}{8} = \frac{\square}{40}$

21. $\frac{5}{16} = \frac{\square}{32}$

22. $\frac{7}{9} = \frac{\square}{45}$

23. $\frac{9}{32} = \frac{\square}{64}$

24. $\frac{9}{10} = \frac{\square}{50}$

25. $\frac{21}{25} = \frac{\square}{100}$

The chart below lists the first four members of the set of equivalent fractions that name the given number. For each number, give the next four fractions in the list.

	Number	Multiply numerator and denominator by 1	2	3	4	5	6	7	8
26.	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{2}{8}$	$\frac{3}{12}$	$\frac{4}{16}$	—	—	—	—
27.	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{4}{6}$	$\frac{6}{9}$	$\frac{8}{12}$	—	—	—	—
28.	$\frac{3}{5}$	$\frac{3}{5}$	$\frac{6}{10}$	$\frac{9}{15}$	$\frac{12}{20}$	—	—	—	—
29.	$\frac{4}{7}$	$\frac{4}{7}$	$\frac{8}{14}$	$\frac{12}{21}$	$\frac{16}{28}$	—	—	—	—
30.	$\frac{9}{8}$	$\frac{9}{8}$	$\frac{18}{16}$	$\frac{27}{24}$	$\frac{36}{32}$	—	—	—	—
31.	$\frac{5}{4}$	$\frac{5}{4}$	$\frac{10}{8}$	$\frac{15}{12}$	$\frac{20}{16}$	—	—	—	—
32.	2	$\frac{2}{1}$	$\frac{4}{2}$	$\frac{6}{3}$	$\frac{8}{4}$	—	—	—	—

Write each fraction.

33. numerator 5, denominator 9

34. denominator 11, numerator 7

35. numerator 9, denominator 11

Day 2 : Word names for fractions and renaming fractions in simplest form.

Objectives:

1) Given a fraction, students will spell it correctly in word form.
2) Students will be able to rename fractions in simplest form.

Procedure: The teacher will write word names for fractions and discuss renaming of fractions in simplest form.

Examples:

When writing a word name for a fraction, first write the numerator and then the denominator. The denominator ends in "ths" most of the time.

$\frac{5}{6}$ is written as five sixths

$\frac{9}{8}$ is written as nine eights

$\frac{7}{40}$ is written as seven fortieths

A mixed number is a whole number and a fraction. When writing a mixed number, first write the whole number, "and," then the fraction.

$3\frac{2}{3}$ is written as three and two thirds

$17\frac{1}{2}$ is written as seventeen and one half

A fraction is renamed in simplest form when the greatest common factor of the numerator and denominator is one.

$\frac{32}{100}$ $\quad 32 = 2x2x2x2x2$ $\quad 100 = 5x5x2x2$ $\quad GCF = 2x2 = 4$

Day 2 (Continued)

Divide both terms by the GCF which is a fraction equivalent to one.

$\frac{32}{100} \div \frac{4}{4} = \frac{8}{25}$ This has been renamed in simplest form.

Rename each in simplest form:

$\frac{5}{20} = \frac{1}{4}$ $\frac{10}{12} = \frac{5}{6}$ $5\frac{12}{16} = 5\frac{3}{4}$

$\frac{32}{48} = \frac{2}{3}$ $\frac{64}{72} = \frac{8}{9}$ $7\frac{15}{45} = 7\frac{1}{3}$

Day 2 : Worksheet on renaming, writing fractions in words

Find the common factor. Then divide to find the missing term and write the equal fractions.

1. $\frac{8}{10}=\frac{?}{5}$ 2, $\frac{4}{5}$
2. $\frac{8}{12}=\frac{?}{3}$
3. $\frac{21}{28}=\frac{?}{4}$
4. $\frac{6}{9}=\frac{?}{3}$
5. $\frac{42}{49}=\frac{6}{?}$
6. $\frac{10}{14}=\frac{5}{?}$
7. $\frac{24}{27}=\frac{8}{?}$
8. $\frac{8}{10}=\frac{4}{?}$
9. $\frac{24}{36}=\frac{2}{?}$
10. $\frac{36}{60}=\frac{3}{?}$

Find the common factor. Then multiply or divide to find the missing term and write the equal fractions.

11. $\frac{8}{60}=\frac{?}{120}$
12. $\frac{12}{21}=\frac{4}{?}$
13. $\frac{7}{5}=\frac{?}{20}$
14. $\frac{18}{24}=\frac{3}{?}$
15. $\frac{6}{7}=\frac{24}{?}$

Change each fraction to simplest form.

16. $\frac{2}{4}$
17. $\frac{4}{16}$
18. $\frac{6}{10}$
19. $\frac{6}{8}$
20. $\frac{6}{24}$
21. $\frac{14}{18}$
22. $\frac{10}{25}$
23. $\frac{6}{16}$
24. $\frac{9}{24}$
25. $\frac{8}{12}$
26. $\frac{10}{16}$
27. $\frac{3}{24}$
28. $\frac{14}{16}$
29. $\frac{10}{15}$
30. $\frac{15}{18}$
31. $\frac{15}{20}$
32. $\frac{10}{12}$
33. $\frac{12}{14}$
34. $\frac{32}{48}$
35. $\frac{24}{32}$

Write each of the following in words. Spell correctly.

36. $\frac{5}{8}$ _____
37. $\frac{9}{10}$ _____
38. $\frac{4}{7}$ _____
39. $\frac{7}{16}$ _____
40. $\frac{14}{15}$ _____
41. $\frac{11}{20}$ _____
42. $6\frac{1}{4}$ _____
43. $9\frac{3}{5}$ _____
44. $1\frac{11}{12}$ _____
45. $4\frac{1}{2}$ _____

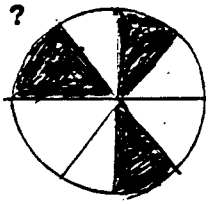
Which two fractions in each group are equal? (Hint: rename in simplest form.)

46. $\frac{12}{20}, \frac{5}{12}, \frac{24}{48}, \frac{25}{60}, \frac{20}{36}$
47. $\frac{6}{18}, \frac{14}{28}, \frac{30}{54}, \frac{16}{36}, \frac{15}{27}$
48. $\frac{20}{48}, \frac{10}{15}, \frac{35}{63}, \frac{12}{36}, \frac{1}{3}$
49. $\frac{5}{10}, \frac{8}{14}, \frac{14}{21}, \frac{25}{50}, \frac{16}{44}$
50. $\frac{12}{42}, \frac{2}{7}, \frac{22}{24}, \frac{20}{50}, \frac{10}{24}$
51. $\frac{48}{84}, \frac{42}{98}, \frac{24}{60}, \frac{21}{49}, \frac{11}{44}$

Day 3 : Quiz on basic fractional concepts, equivalent fractions, fractions in lowest terms.

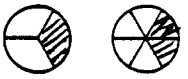
. What fractional part of the diagram is shaded ?

1. ____ 

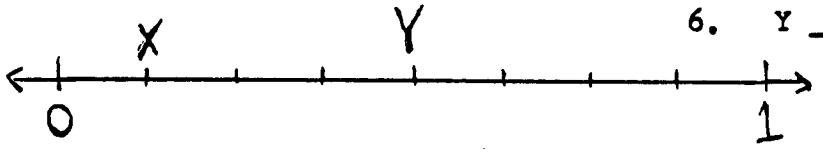
2. ____ 

State two equivalent fractions suggested by the figures.

3. 
_____

4. 
_____

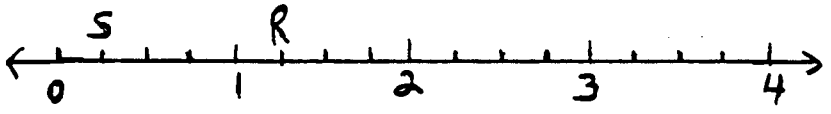
What fraction is designated by the letters?



5. X ____

6. Y ____

What fraction is designated by the letters?



7. R ____

8. S ____

9. In the fraction $\frac{5}{6}$, the 5 is called the _____.

Complete the following:

10. $\frac{13}{25} = \frac{\square}{100}$

11. $\frac{7}{9} = \frac{\square}{45}$

12. $\frac{11}{12} = \frac{\square}{96}$

13. $\frac{3}{4} = \frac{\square}{20}$

Day 3 : Quiz (continued)

14. Give the next four equivalent fractions to $\frac{3}{5}$: _____

Complete the following:

15. $\frac{8}{12} = \frac{\square}{3}$

16. $\frac{36}{80} = \frac{9}{\square}$

17. $\frac{6}{7} = \frac{24}{\square}$

18. $\frac{12}{21} = \frac{\square}{7}$

19. $\frac{3}{18} = \frac{\square}{6}$

20. $\frac{7}{50} = \frac{35}{\square}$

Rename in simplest form.

21. $\frac{5}{40} =$

22. $\frac{16}{48} =$

23. $\frac{75}{100} =$

24. $\frac{22}{121} =$

25. $\frac{28}{35} =$

Write each of the following in words . Spell correctly.

26. $\frac{11}{12}$ _____

27. $5\frac{3}{8}$ _____

28. $\frac{7}{16}$ _____

Which two fractions in each group are equivalent (circle them) ?

29. $\frac{14}{16}$, $\frac{32}{36}$, $\frac{7}{9}$, $\frac{21}{24}$, $\frac{40}{48}$

30. $\frac{11}{44}$, $\frac{21}{49}$, $\frac{24}{60}$, $\frac{42}{98}$, $\frac{48}{84}$

Day 4 : Changing improper fractions to mixed numerals.

Objective: Students will be able to change an improper fraction to a mixed numeral.

Procedure: The teacher will discuss the term 'improper fraction' and the relationship of this to a mixed number.

Examples:

A fraction with numerator equal to or greater than the denominator is called an improper fraction.

$\frac{9}{8}, \frac{4}{4}, \frac{100}{7}$ are improper fractions.

An improper fraction can be changed to a whole number or mixed number equivalent to it.

$\frac{9}{8} = \frac{8}{8} + \frac{1}{8} = 1 + \frac{1}{8} = 1\frac{1}{8}$

$\frac{10}{5} = \frac{5}{5} + \frac{5}{5} = 1 + 1 = 2$

To shorten this method divide the numerator by the denominator, the remainder is the numerator and the divisor is the denominator.

$\frac{7}{5}$ $5\overline{)7}$ $\begin{matrix}1 \\ \frac{5}{2}\end{matrix}$ Remainder 2 $= 1\frac{2}{5}$ $\qquad$ $\frac{10}{5}$ $5\overline{)10}$ $\begin{matrix}2 \\ \end{matrix}$ R 0 $= 2$

Try these: $\frac{18}{4} = 4\frac{2}{4} = 4\frac{1}{2}$ $\qquad$ $\frac{27}{3} = 9\ \frac{0}{3} = 9$

$\frac{99}{88} = 1\frac{11}{88} = 1\frac{1}{8}$

Day 4 : Worksheet changing improper fractions to mixed numbers

Laura Gray finds the miles per gallon (MPG) for her car. To do this, she writes the number of miles driven over the number of gallons of gasoline used.

$$\frac{\text{miles driven}}{\text{gallons used}} = \frac{97}{5}$$ The numerator is greater than the denominator.

The fraction $\frac{97}{5}$ means $97 \div 5$.

$$\frac{97}{5} \blacktriangleright \quad 5\overline{)97} \quad \begin{matrix} 19 \text{ R2} \\ \end{matrix} \quad \blacktriangleright \quad 19\frac{2}{5}$$ Write the remainder as a fraction.

Laura's MPG is $19\frac{2}{5}$. This is a mixed numeral.

To change a fraction to a mixed numeral, divide the numerator by the denominator. Write the remainder as a fraction. The mixed numeral is in simplest form when the fraction part is in simplest form.

Change each fraction to a mixed numeral in simplest form.

1. $\frac{7}{5}$	2. $\frac{13}{8}$	3. $\frac{25}{16}$	4. $\frac{19}{12}$	5. $\frac{13}{10}$	6. $\frac{15}{8}$
7. $\frac{9}{2}$	8. $\frac{13}{4}$	9. $\frac{22}{7}$	10. $\frac{32}{9}$	11. $\frac{29}{6}$	12. $\frac{67}{12}$
13. $\frac{6}{4}$	14. $\frac{14}{8}$	15. $\frac{9}{6}$	16. $\frac{14}{10}$	17. $\frac{28}{16}$	18. $\frac{15}{9}$
19. $\frac{14}{6}$	20. $\frac{18}{8}$	21. $\frac{15}{6}$	22. $\frac{14}{4}$	23. $\frac{25}{10}$	24. $\frac{27}{12}$
25. $\frac{34}{6}$	26. $\frac{33}{9}$	27. $\frac{40}{12}$	28. $\frac{45}{20}$	29. $\frac{40}{16}$	30. $\frac{65}{15}$

Find the miles per gallon (MPG) as a mixed numeral.

	Miles	Gallons
31.	245	8
32.	147	10
33.	299	12

	Miles	Gallons
34.	226	11
35.	157	7
36.	230	17

Change each fraction to a whole number or a mixed numeral. (Do this mentally.)

37. $\frac{5}{3}$	38. $\frac{7}{2}$	39. $\frac{5}{4}$	40. $\frac{5}{2}$	41. $\frac{11}{4}$	42. $\frac{8}{5}$
43. $\frac{9}{8}$	44. $\frac{6}{6}$	45. $\frac{9}{5}$	46. $\frac{15}{5}$	47. $\frac{7}{6}$	48. $\frac{11}{3}$
49. $\frac{9}{4}$	50. $\frac{11}{8}$	51. $\frac{7}{3}$	52. $\frac{9}{2}$	53. $\frac{8}{3}$	54. $\frac{13}{8}$
55. $\frac{25}{6}$	56. $\frac{21}{3}$	57. $\frac{10}{2}$	58. $\frac{10}{3}$	59. $\frac{0}{3}$	60. $\frac{19}{2}$

Day 5 : Comparing fractions using a common denominator.

Objectives:

1) Students will be able to find a common denominator given two or more fractions.
2) Students will be able to order fractions as well as compare any two fractions.

Procedure: The teacher will explain how to find a common denominator and then compare these fractions.

Examples:

In order to compare fractions one must find a common denominator. To do this one may find the least common multiple of the denominator or another way is to multiply these denominators.

$\frac{5}{6}$ and $\frac{3}{10}$ $\quad 6 = 2x3$, $10 = 2x5$ $\quad$ LCM = 2x3x5 = 30

The common denominator is 30.

$\frac{5}{6} \times \frac{5}{5} = \frac{25}{30}$ and $\frac{3}{10} \times \frac{3}{3} = \frac{9}{30}$

Another method is to multiply denominators: 6 x 10 = 60

$\frac{5}{6} \times \frac{10}{10} = \frac{50}{60}$ $\quad \frac{50}{60}$ is also equivalent to $\frac{25}{30}$

$\frac{3}{10} \times \frac{6}{6} = \frac{18}{60}$ $\quad \frac{18}{60}$ is also equivalent to $\frac{9}{30}$

Try these: Find the common denominator and then write as like fractions.

$\frac{3}{7}$ and $\frac{5}{9}$? $\quad \frac{3}{7} \times \frac{9}{9} = \frac{27}{63}$, $\frac{5}{9} \times \frac{7}{7} = \frac{35}{63}$

$\frac{5}{8}$ and $\frac{3}{16}$? $\quad \frac{5}{8} \times \frac{2}{2} = \frac{10}{16}$, $\frac{3}{16} \times \frac{1}{1} = \frac{3}{16}$

Day 5: (Continued)

$4\frac{1}{3}$ and $3\frac{7}{18}$?

$\frac{1}{3} \times \frac{6}{6} = \frac{6}{18}$ Therefore $4\frac{1}{3} = 4\frac{6}{18}$

$\frac{7}{18} \times \frac{1}{1} = \frac{7}{18}$ and $3\frac{7}{18} = 3\frac{7}{18}$

To compare fractions, first find a common denominator, compare numerators, and then use the symbols $>$, $<$, $=$

Compare $\frac{1}{3}$ & $\frac{2}{3}$ since $1 < 2$ then $\frac{1}{3} < \frac{2}{3}$

Compare $\frac{3}{10}$ & $\frac{7}{12}$ common denominator is 60.

$\frac{3}{10} = \frac{18}{60}$

$\frac{7}{12} = \frac{35}{60}$

Therefore since $\frac{18}{60} < \frac{35}{60}$ then $\frac{3}{10} < \frac{7}{12}$

Day 5 : Worksheet on comparing fractions, finding LCD Of fractions

Find the least common denominator. Change to like fractions.

1. $\frac{2}{3}$ and $\frac{1}{4}$ $\boxed{\frac{8}{12}, \frac{3}{12}}$
2. $\frac{5}{9}$ and $\frac{7}{12}$
3. $\frac{5}{12}$ and $\frac{7}{18}$
4. $\frac{1}{9}$ and $\frac{5}{6}$
5. $\frac{7}{8}$ and $\frac{5}{9}$
6. $\frac{2}{3}$ and $\frac{1}{5}$
7. $\frac{5}{8}$ and $\frac{1}{2}$
8. $\frac{1}{4}$ and $\frac{5}{12}$
9. $\frac{5}{6}$ and $\frac{7}{10}$
10. $\frac{3}{5}$ and $\frac{7}{10}$
11. $\frac{7}{100}$ and $\frac{9}{20}$
12. $\frac{5}{7}$ and $\frac{1}{8}$

Order the fractions. Replace ◯ with < or >.

13. $\frac{7}{9} \bigcirc \frac{3}{9}$
14. $\frac{4}{7} \bigcirc \frac{3}{7}$
15. $\frac{5}{11} \bigcirc \frac{8}{11}$
16. $\frac{5}{9} \bigcirc \frac{8}{9}$
17. $\frac{12}{17} \bigcirc \frac{9}{17}$
18. $\frac{11}{13} \bigcirc \frac{6}{13}$
19. $\frac{7}{15} \bigcirc \frac{11}{15}$
20. $\frac{7}{18} \bigcirc \frac{5}{18}$
21. $\frac{6}{12} \bigcirc \frac{8}{12}$
22. $\frac{14}{23} \bigcirc \frac{19}{23}$

Find the least common denominator. Then change to like fractions and compare numerators. Replace ◯ with < or > , or =.

23. $\frac{2}{7} \bigcirc \frac{3}{9}$
24. $\frac{2}{4} \bigcirc \frac{2}{3}$
25. $\frac{5}{11} \bigcirc \frac{4}{9}$
26. $\frac{3}{7} \bigcirc \frac{5}{12}$
27. $\frac{5}{8} \bigcirc \frac{6}{9}$
28. $\frac{3}{8} \bigcirc \frac{5}{12}$
29. $\frac{3}{5} \bigcirc \frac{4}{7}$
30. $\frac{7}{3} \bigcirc \frac{5}{2}$
31. $\frac{2}{9} \bigcirc \frac{3}{13}$
32. $\frac{5}{4} \bigcirc \frac{6}{5}$
33. $\frac{1}{4} \blacksquare \frac{1}{3}$
34. $\frac{2}{3} \blacksquare \frac{5}{8}$
35. $\frac{3}{4} \blacksquare \frac{5}{6}$
36. $\frac{1}{5} \blacksquare \frac{1}{8}$
37. $\frac{3}{8} \blacksquare \frac{1}{4}$
38. $\frac{7}{10} \blacksquare \frac{14}{20}$
39. $\frac{1}{5} \blacksquare \frac{3}{10}$
40. $\frac{5}{8} \blacksquare \frac{11}{16}$
41. $\frac{13}{16} \blacksquare \frac{5}{6}$
42. $\frac{1}{2} \blacksquare \frac{4}{8}$
43. $\frac{7}{10} \blacksquare \frac{5}{12}$
44. $\frac{5}{12} \blacksquare \frac{3}{16}$

Day 6 : Ordering and comparing fractions and mixed numbers.

Objective: Students will be able to compare and order fractions and mixed numbers.

Procedure: The teacher will demonstrate how to compare fractions and mixed numbers and order them using common denominators.

Examples:

A mixed number is larger than a proper fraction.

Compare $1\frac{4}{5}$ & $\frac{4}{8}$ $\quad 1\frac{4}{5} > \frac{4}{8}$

Compare $1\frac{3}{7}$ & $1\frac{5}{9}$ $\quad$ Since $\frac{3}{7} = \frac{27}{63}$ and $\frac{5}{9} = \frac{35}{63}$

therefore $1\frac{3}{7} < 1\frac{5}{9}$

Compare $2\frac{1}{3}$ & $2\frac{4}{7}$ $\quad 2\frac{1}{3} = 2\frac{7}{21}$ $\quad 2\frac{4}{7} = 2\frac{12}{21}$

therefore $2\frac{1}{3} < 2\frac{4}{7}$

Put these in order from smallest to largest:

$\frac{3}{5}, \frac{2}{3}, \frac{7}{10}$

$\frac{3}{5} = \frac{18}{30}$

$\frac{2}{3} = \frac{20}{30}$

$\frac{7}{10} = \frac{21}{30}$

Since $\frac{18}{30}$, $\frac{20}{30}$, $\frac{21}{30}$ are in order from smallest to largest, then $\frac{3}{5}$, $\frac{2}{3}$, $\frac{7}{10}$ are also in this order.

Day 6: (Continued)

Put these in order from largest to smallest.

$\frac{2}{3}, \quad \frac{5}{9}, \quad \frac{5}{6}$

$\frac{5}{9} = \frac{10}{18}$

$\frac{2}{3} = \frac{12}{18}$

$\frac{5}{6} = \frac{15}{18}$

Since $\frac{15}{18}, \quad \frac{12}{18}, \quad \frac{10}{18}$ are in order from largest to smallest, then $\frac{5}{6}, \frac{2}{3}, \frac{5}{9}$ are also in this order.

Day 6 : Worksheet on ordering fractions

Find a common denominator for each group of fractions and then put in order from smallest to largest.

1. $\frac{1}{2}, \frac{2}{5}, \frac{3}{7}$

2. $\frac{6}{7}, \frac{3}{8}, \frac{1}{4}$

3. $\frac{7}{11}, \frac{5}{7}, \frac{63}{77}$

4. $\frac{5}{6}, \frac{4}{5}, \frac{2}{3}, \frac{27}{30}$

5. $\frac{6}{5}, \frac{3}{2}, \frac{4}{3}$

6. $\frac{4}{9}, \frac{1}{6}, \frac{5}{12}$

Find a common denominator for each group of fractions and put in order from largest to smallest.

7. $\frac{2}{3}, \frac{4}{5}, \frac{1}{2}$

8. $\frac{3}{16}, \frac{1}{8}, \frac{5}{12}$

9. $3\frac{2}{3}, 3\frac{4}{5}, 1\frac{3}{20}$

10. $1\frac{3}{8}, 1\frac{11}{12}, 1\frac{1}{18}$

Replace ◯ with <, >, or =. Hint: Change improper fractions to mixed numbers.

11. $\frac{15}{7}$ ◯ $2\frac{2}{7}$

12. $\frac{20}{7}$ ◯ $3\frac{4}{7}$

13. $\frac{10}{6}$ ◯ $3\frac{1}{3}$

14. $\frac{87}{16}$ ◯ $5\frac{9}{16}$

15. $\frac{35}{8}$ ◯ $4\frac{7}{8}$

16. $\frac{82}{12}$ ◯ $6\frac{11}{12}$

17. $\frac{46}{13}$ ◯ $3\frac{7}{13}$

18. $\frac{75}{9}$ ◯ $8\frac{1}{9}$

Day 7 : Quiz on changing improper fractions to mixed numbers, comparing fractions, ordering fractions, expressing fractions with the same denominator.

1. Circle the improper fractions below.

$\frac{3}{8}$ $\frac{5}{3}$ $4\frac{2}{3}$ $\frac{16}{16}$ 6

Change each fraction to a whole or mixed number in simplest form.

2. $\frac{9}{8}$ 3. $\frac{45}{15}$ 4. $\frac{54}{17}$

5. $\frac{38}{6}$ 6. $\frac{0}{9}$ 7. $\frac{49}{14}$

8. $\frac{16}{10}$ 9. $\frac{54}{20}$

Change to like fractions using a common denominator.

10. $\frac{7}{8}$ and $\frac{4}{9}$ $\frac{7}{8} =$ $\frac{4}{9} =$

11. $\frac{5}{6}$ and $\frac{9}{10}$ $\frac{5}{6} =$ $\frac{9}{10} =$

12. $\frac{7}{12}$ and $\frac{3}{16}$ $\frac{7}{12} =$ $\frac{3}{16} =$

13. $\frac{1}{2}$ and $\frac{3}{8}$ $\frac{1}{2} =$ $\frac{3}{8} =$

Use $>$, $<$ or = to compare the following fractions.

14. $\frac{7}{8}$ ___ $\frac{4}{8}$ 15. 1 ___ $\frac{9}{8}$ 16. $2\frac{1}{3}$ ___ $1\frac{4}{5}$

17. $\frac{18}{8}$ ___ $2\frac{1}{4}$ 18. 4 ___ $\frac{16}{4}$ 19. $\frac{24}{30}$ ___ $\frac{4}{5}$

20. $3\frac{1}{3}$ ___ $3\frac{2}{6}$ 21. $\frac{7}{13}$ ___ $\frac{12}{13}$ 22. $\frac{5}{9}$ ___ $\frac{15}{18}$

23. $\frac{1}{2}$ ___ $\frac{3}{4}$ 24. $\frac{3}{8}$ ___ $\frac{5}{12}$ 25. $\frac{6}{15}$ ___ $\frac{2}{3}$

Day 7 : Quiz (continued)

Arrange the fractions in order from largest to smallest.

26. $\frac{1}{2}$, $\frac{3}{4}$, $\frac{6}{10}$

27. $\frac{4}{9}$, $\frac{5}{6}$, $\frac{7}{12}$

Arrange the fractions in order from smallest to largest.

28. $3\frac{2}{3}$, 5 , $4\frac{1}{2}$

29. $\frac{7}{6}$, $\frac{9}{8}$, $\frac{5}{4}$

30. $\frac{2}{3}$, $\frac{17}{30}$, $\frac{1}{2}$, $\frac{3}{5}$

Day 8 : Adding and subtracting fractions with the same denominator.

Objective: Students will be able to add and subtract common fractions with the same denominator and write the sum or difference in simplest form.

Procedure: The teacher will stress that in order to add or subtract fractions, they must have a common denominator.

Examples: When adding or subtracting fractions one must have a common denominator. Then add or subtract numerators and leave denominators the same.

$\frac{3}{5} - \frac{2}{5} = \frac{1}{5}$

$\frac{4}{7} + \frac{5}{7} = \frac{9}{7} = 1\frac{2}{7}$

Change improper fractions to mixed numerals and rename in simplest form.

$\frac{7}{8} + \frac{7}{8} = \frac{14}{8} = 1\frac{6}{8} = 1\frac{3}{4}$

$\frac{1}{4} - \frac{1}{4} = \frac{0}{4} = 0$

$\left(\frac{4}{5} - \frac{3}{5}\right) + \frac{2}{5} = \frac{1}{5} + \frac{2}{5} = \frac{3}{5}$

$\frac{7}{9} - \left(\frac{4}{9} + \frac{2}{9}\right) = \frac{7}{9} - \frac{6}{9} = \frac{1}{9}$

Day 8 : Worksheet on adding and subtracting improper and proper fractions.

Give each result in lowest terms.

1. $\frac{2}{7}+\frac{1}{7}$
2. $\frac{1}{11}+\frac{3}{11}$
3. $\frac{1}{9}+\frac{4}{9}$
4. $\frac{2}{13}+\frac{6}{13}$
5. $\frac{5}{7}-\frac{1}{7}$
6. $\frac{5}{9}-\frac{1}{9}$
7. $\frac{7}{11}-\frac{2}{11}$
8. $\frac{4}{3}-\frac{2}{3}$
9. $\frac{3}{4}-\frac{1}{4}$
10. $\frac{1}{6}-\frac{1}{6}$
11. $\frac{4}{5}+\frac{1}{5}$
12. $\frac{7}{13}+\frac{5}{13}$
13. $\frac{3}{17}+\frac{5}{17}+\frac{1}{17}$
14. $\frac{8}{11}+\frac{2}{11}+\frac{1}{11}$
15. $\left(\frac{3}{13}+\frac{5}{13}\right)-\frac{7}{13}$
16. $\frac{8}{11}-\left(\frac{5}{11}+\frac{3}{11}\right)$

Express each as a proper fraction, whole, or mixed number (simplest form)

17. $\frac{2}{3}+\frac{5}{3}$
18. $\frac{5}{6}+\frac{5}{6}$
19. $\frac{8}{11}-\frac{6}{11}$
20. $\frac{7}{8}-\frac{3}{8}$
21. $\frac{1}{5}+\frac{7}{5}$
22. $\frac{3}{8}+\frac{3}{8}$
23. $\frac{13}{7}-\frac{10}{7}$
24. $\frac{9}{14}-\frac{7}{14}$
25. $\frac{5}{11}+\frac{9}{11}$
26. $\frac{7}{9}+\frac{11}{9}$
27. $\frac{25}{17}-\frac{14}{17}$
28. $\frac{15}{7}-\frac{1}{7}$
29. $\frac{3}{7}+\frac{6}{7}$
30. $\frac{5}{11}+\frac{17}{11}$
31. $\frac{12}{13}-\frac{5}{13}$
32. $\frac{23}{17}-\frac{6}{17}$

Subtract. Write the difference in simplest form.

33. $\frac{5}{8}-\frac{2}{8}$
34. $\frac{9}{10}-\frac{6}{10}$
35. $\frac{10}{11}-\frac{4}{11}$
36. $\frac{7}{9}-\frac{5}{9}$
37. $\frac{12}{15}-\frac{8}{15}$
38. $\frac{11}{12}-\frac{10}{12}$
39. $\frac{13}{16}-\frac{6}{16}$
40. $\frac{27}{32}-\frac{18}{32}$
41. $\frac{3}{4}-\frac{1}{4}$
42. $\frac{5}{6}-\frac{1}{6}$
43. $\frac{9}{10}-\frac{3}{10}$
44. $\frac{4}{9}-\frac{1}{9}$
45. $\frac{7}{8}-\frac{1}{8}$
46. $\frac{9}{16}-\frac{3}{16}$
47. $\frac{11}{12}-\frac{3}{12}$
48. $\frac{9}{10}-\frac{1}{10}$
49. $\frac{8}{9}-\frac{2}{9}$
50. $\frac{10}{12}-\frac{5}{12}$
51. $\frac{13}{16}-\frac{3}{16}$
52. $\frac{11}{14}-\frac{5}{14}$

Add. Write the sum in simplest form.

53. $\frac{4}{5}+\frac{3}{5}$
54. $\frac{5}{7}+\frac{6}{7}$
55. $\frac{4}{5}+\frac{1}{5}$
56. $\frac{5}{7}+\frac{2}{7}$
57. $\frac{7}{9}+\frac{4}{9}$
58. $\frac{2}{3}+\frac{2}{3}$
59. $\frac{7}{10}+\frac{9}{10}$
60. $\frac{3}{8}+\frac{7}{8}$
61. $\frac{5}{6}+\frac{5}{6}$
62. $\frac{11}{12}+\frac{7}{12}$
63. $\frac{11}{16}+\frac{9}{16}$
64. $\frac{15}{32}+\frac{29}{32}$

Day 9 : Adding and subtracting fractions with unlike denominators.

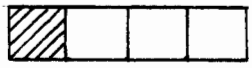
Objective: Students will be able to add or subtract proper fractions with unlike denominators.

Procedure: The teacher will discuss finding a common denominator before adding or subtracting fractions and changing to equivalent fractions before performing the operation.

Examples: First find equivalent fractions with a common denominator and then perform the operation.

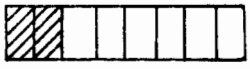
$\frac{1}{4} + \frac{3}{8}$

Diagram 1:



$\frac{1}{4}$

Diagram 2: Change from fourths to eighths

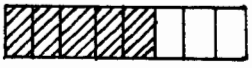


$\frac{1}{4} = \frac{2}{8}$

$$\begin{array}{r} \frac{1}{4} = \frac{2}{8} \\ + \\ \frac{3}{8} = \frac{3}{8} \\ \hline \frac{5}{8} \end{array}$$

Diagram 3:

Add $\frac{3}{8}$



$\frac{2}{8} + \frac{3}{8} = \frac{5}{8}$

$$\begin{array}{r} \frac{5}{6} = \frac{35}{42} \\ + \\ \frac{4}{7} = \frac{24}{42} \\ \hline \frac{59}{42} = 1\frac{17}{42} \end{array}$$

$$\begin{array}{r} \frac{3}{8} = \frac{9}{24} \\ - \\ \frac{1}{3} = \frac{8}{24} \\ \hline \frac{1}{24} \end{array}$$

$$\begin{array}{r} \frac{7}{16} = \frac{21}{48} \\ + \\ \frac{3}{6} = \frac{24}{48} \\ \hline \frac{7}{12} = \frac{28}{48} \\ \hline \frac{73}{48} = 1\frac{25}{48} \end{array}$$

Day 9: Worksheet on adding and subtracting fraction with unlike denominators.

Add. Write the sum in simplest form.

1. $\frac{1}{4} + \frac{1}{8}$
2. $\frac{1}{9} + \frac{2}{3}$
3. $\frac{1}{2} + \frac{1}{3}$
4. $\frac{1}{4} + \frac{2}{7}$
5. $\frac{1}{4} + \frac{1}{6}$
6. $\frac{1}{6} + \frac{3}{8}$
7. $\frac{2}{3} + \frac{5}{6}$
8. $\frac{3}{4} + \frac{2}{3}$
9. $\frac{1}{3} + \frac{1}{6}$
10. $\frac{2}{5} + \frac{3}{10}$
11. $\frac{1}{3} + \frac{1}{4}$
12. $\frac{2}{3} + \frac{2}{11}$
13. $\frac{1}{4} + \frac{1}{10}$
14. $\frac{2}{4} + \frac{2}{6}$
15. $\frac{3}{4} + \frac{1}{2}$
16. $\frac{7}{10} + \frac{2}{4}$
17. $\frac{3}{8} + \frac{1}{4}$
18. $\frac{1}{2} + \frac{3}{10}$
19. $\frac{3}{8} + \frac{1}{3}$
20. $\frac{5}{8} + \frac{2}{9}$
21. $\frac{2}{9} + \frac{1}{6}$
22. $\frac{7}{10} + \frac{2}{12}$
23. $\frac{4}{9} + \frac{3}{4}$
24. $\frac{7}{8} + \frac{9}{12}$

Part II

Subtract. Write the difference in simplest form.

1. $\frac{1}{2} - \frac{1}{3}$
2. $\frac{4}{7} - \frac{1}{3}$
3. $\frac{2}{3} - \frac{1}{9}$
4. $\frac{19}{24} - \frac{1}{4}$
5. $\frac{2}{3} - \frac{2}{5}$
6. $\frac{5}{6} - \frac{3}{4}$
7. $\frac{9}{10} - \frac{7}{30}$
8. $\frac{2}{5} - \frac{1}{3}$
9. $\frac{11}{12} - \frac{4}{5}$
10. $\frac{3}{4} - \frac{5}{8}$
11. $\frac{8}{9} - \frac{2}{3}$
12. $\frac{7}{8} - \frac{2}{3}$
13. $\frac{5}{6} - \frac{7}{9}$
14. $\frac{5}{12} - \frac{4}{24}$
15. $\frac{3}{4} - \frac{2}{3}$
16. $\frac{3}{8} - \frac{1}{4}$
17. $\frac{5}{8} - \frac{3}{16}$
18. $\frac{5}{8} - \frac{9}{64}$
19. $\frac{5}{6} - \frac{3}{8}$
20. $\frac{7}{12} - \frac{2}{9}$
21. $\frac{17}{22} - \frac{5}{11}$

Complete these addition boxes.

22.

$\frac{1}{4}$	$\frac{1}{2}$	
$\frac{1}{3}$	$\frac{1}{6}$	

23.

$\frac{5}{9}$	$\frac{1}{3}$	
	$\frac{5}{12}$	$\frac{5}{6}$

Day 10 : Quiz on adding and subtracting fractions

Give each result as a whole number, mixed number , or proper fraction in simplest form.

1. $\frac{5}{8} + \frac{3}{8} =$

2. $\frac{1}{9} + \frac{5}{9} =$

3. $\frac{7}{13} + \frac{5}{13} =$

4. $\frac{9}{20} + \frac{7}{20} =$

5. $\frac{11}{12} + \frac{5}{12}$

6. $\frac{4}{15} + \frac{1}{15} =$

7. $\frac{17}{18} - \frac{0}{18} =$

8. $\frac{11}{12} - \frac{1}{12} =$

9. $\frac{3}{5} - \frac{1}{5} =$

10. $\frac{9}{20} - \frac{7}{20} =$

11. $\left(\frac{2}{3} + \frac{2}{3}\right) - \frac{1}{3} =$

12. $\left(\frac{17}{18} - \frac{5}{18}\right) + \frac{3}{18} =$

13. $\left(\frac{27}{32} - \frac{18}{32}\right) + \frac{1}{32} =$

14. $\frac{5}{8} + \left(\frac{4}{8} - \frac{3}{8}\right) =$

15. $\frac{0}{7} + \left(\frac{3}{7} - \frac{2}{7}\right) =$

16. $\frac{5}{6} + \frac{9}{10} =$

17. $\frac{4}{5} + \frac{5}{6} =$

18. $\frac{3}{8} + \frac{1}{2} =$

19. $\frac{1}{3} + \frac{1}{4} =$

20. $\frac{4}{15} + \frac{13}{30} =$

21. $\frac{2}{5} + \frac{3}{4} + \frac{1}{4}$

22. $\frac{3}{8} + \frac{9}{16} + \frac{1}{4} =$

23. $\frac{24}{25} - \frac{3}{5} =$

24. $\frac{1}{2} - \frac{1}{3} =$

Day 10 : Quiz (continued)

25. $\frac{15}{18} - \frac{7}{12} =$

26. $\frac{35}{36} - \frac{2}{9} =$

27. $\frac{49}{50} - \frac{3}{10} =$

28. $\frac{5}{12} - \frac{4}{27} =$

29. $\frac{5}{6} - \frac{3}{8} - \frac{1}{4} =$

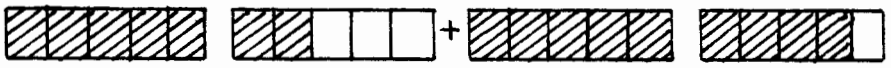
30. $\frac{2}{3} - \frac{4}{9} - \frac{1}{12} =$

Day 11: Adding mixed numbers

Objective: Students will be able to add mixed numbers with like or unlike denominators.

Procedure: The teacher will demonstrate how to add mixed numbers.

Examples: Let us add $1\frac{2}{3}$ candy bars and $1\frac{4}{5}$ candy bars.



= 2 candy bars and six-fifths = three and one-fifth

To add mixed numbers, add the fractions, add the whole numbers, and change the form if possible.

$$\begin{array}{r} 1\frac{2}{5} \\ + \\ 1\frac{4}{5} \\ \hline 2\frac{6}{5} \end{array} = 2 + 1\frac{1}{5} = 3\frac{1}{5}$$

Make sure the denominators are the same.

$$4\frac{5}{6} + 2\frac{1}{3}$$

$$\begin{array}{r} 4\frac{5}{6} = 4\frac{5}{6} \\ + \\ 2\frac{1}{3} = 2\frac{2}{6} \\ \hline 6\frac{7}{6} \end{array} = 6 + 1\frac{1}{6} = 7\frac{1}{6}$$

Day 11: (Continued)

$$\begin{array}{r} 27\frac{9}{16} = 27\frac{18}{32} \\ +\ 8\frac{3}{32} = 8\frac{3}{32} \\ \hline 35\frac{21}{32} \end{array} \qquad \begin{array}{r} 4\frac{3}{4} = 4\frac{9}{12} \\ +\ 5\frac{1}{6} = 5\frac{2}{12} \\ \hline 9\frac{11}{12} \end{array}$$

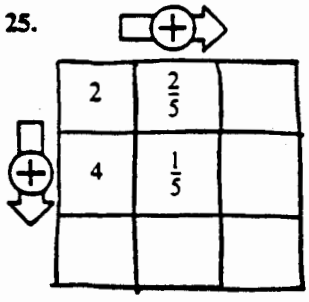
Day 11 ; Worksheet on adding mixed numbers

Add. Rename each in simplest form.

1. $3\frac{1}{4}$ $+4\frac{1}{4}$	2. $8\frac{1}{7}$ $+3\frac{4}{7}$	3. $5\frac{1}{2}$ $+6\frac{1}{2}$	4. $9\frac{3}{8}$ $+6\frac{1}{8}$	5. $10\frac{1}{6}$ $+6\frac{5}{6}$	6. $8\frac{3}{8}$ $+7\frac{3}{8}$
7. $4\frac{1}{4}$ $+3\frac{1}{2}$	8. $3\frac{5}{6}$ $+3\frac{1}{3}$	9. $12\frac{1}{3}$ $+5\frac{2}{3}$	10. $6\frac{1}{2}$ $+7\frac{2}{3}$	11. $6\frac{3}{4}$ $+8\frac{1}{8}$	12. $13\frac{2}{5}$ $+6$
13. $6\frac{1}{2}$ $+4\frac{5}{6}$	14. $4\frac{5}{8}$ $+3\frac{1}{2}$	15. $2\frac{1}{2}$ $+\frac{5}{8}$	16. $16\frac{3}{7}$ $+4\frac{1}{3}$	17. $12\frac{3}{4}$ $+5\frac{3}{8}$	18. $17\frac{2}{5}$ $+11\frac{3}{4}$
19. $2\frac{3}{4}$ $+6\frac{1}{4}$	20. $18\frac{3}{7}$ $+12$	21. $9\frac{3}{5}$ $+6\frac{3}{10}$	22. $9\frac{5}{8}$ $+13\frac{3}{8}$	23. $19\frac{1}{2}$ $+23\frac{1}{2}$	24. $18\frac{7}{8}$ $+\frac{3}{4}$

Copy and complete these addition boxes.

25.



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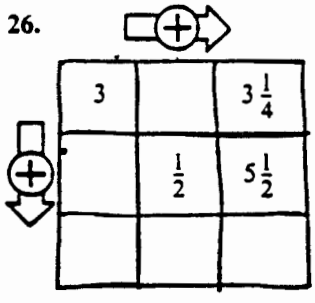

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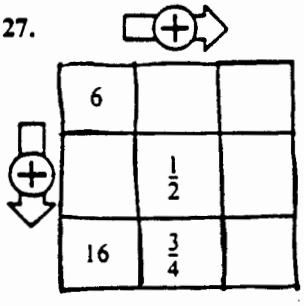


28. $13\frac{1}{6} + 9\frac{5}{8}$

29. $7\frac{3}{10} + 17\frac{5}{12}$

30. $14\frac{1}{6} + 10\frac{7}{10}$

31. $7\frac{1}{4} + 12\frac{5}{6}$

32. $19\frac{5}{6} + 15\frac{3}{10}$

Day 12: Subtracting mixed numbers where renaming may be necessary.

Objective: Students will be able to subtract mixed numbers with like or unlike denominators and rename if necessary.

Procedure: The teacher must show how to rename a whole number in order to subtract mixed numbers.

Examples:

$$\begin{array}{rl} 5 &= 4\frac{3}{3} \\ -\ 4\frac{2}{3} &= 4\frac{2}{3} \\ \hline & \frac{1}{3} \end{array}$$

Rename the five as 4+1, where the one whole is equivalent to $\frac{3}{3}$. The denominator thirds was used because the other fraction had thirds in the denominator and common denominator is a must!

$$\begin{array}{rl} 6\frac{3}{8} = 5\frac{8}{8} + \frac{3}{8} &= 5\frac{11}{8} \\ -\ 4\frac{7}{8} = & 4\frac{7}{8} \\ \hline & 1\frac{4}{8} = 1\frac{1}{2} \end{array}$$

Rename six as 5+1 or 5 and eight eights. Add $\frac{8}{8}$ to the existing $\frac{3}{8}$ which gives eleven eights. Now go ahead and subtract.

$$\begin{array}{rl} 7\frac{1}{12} = 7\frac{1}{12} = 6\frac{12}{12} + \frac{1}{12} &= 7\frac{13}{12} \\ -\ 4\frac{5}{6} = 4\frac{10}{12} &= 4\frac{10}{12} \\ \hline & 3\frac{3}{12} = 3\frac{1}{4} \end{array}$$

First get a common denominator. Then rename if necessary.

$$\begin{array}{lll} 5\frac{3}{8} & 4\frac{1}{4} = \overset{3}{\cancel{4}}\frac{1}{4} + \frac{4}{4} &= 3\frac{5}{4} \\ -\ 2 & -\ 3\frac{1}{2} = 3\frac{2}{4} = & 3\frac{2}{4} \\ \hline 3\frac{3}{8} & & \frac{3}{4} \end{array}$$

Day 12 : Worksheet on subtracting mixed numbers with renaming

EXERCISES

Subtract. Rename each in simplest form.

1. $8\frac{3}{4} - 2\frac{1}{4}$

2. $11\frac{3}{4} - 2\frac{1}{3}$

3. $8\frac{5}{6} - 2\frac{1}{6}$

4. $6\frac{1}{2} - 3\frac{1}{6}$

5. $12 - 3\frac{1}{4}$

6. $16\frac{3}{8} - 5$

7. $8\frac{5}{9} - 1\frac{1}{3}$

8. $8 - 3\frac{2}{3}$

9. $6\frac{3}{8} - 2\frac{3}{4}$

10. $3 - 1\frac{2}{5}$

11. $7 - 2\frac{1}{4}$

12. $10 - 6\frac{5}{8}$

13. $25 - 11\frac{4}{7}$

14. $15\frac{5}{8} - 11\frac{7}{8}$

15. $13\frac{3}{10} - 10\frac{9}{10}$

16. $16\frac{2}{9} - 15\frac{5}{9}$

17. $18\frac{13}{16} - 16\frac{15}{16}$

18. $9\frac{1}{3} - 3\frac{1}{5}$

19. $4\frac{7}{12} - 1\frac{3}{8}$

20. $27\frac{13}{16} - 19\frac{2}{3}$

21. $11\frac{9}{10} - 8\frac{3}{4}$

22. $31\frac{3}{5} - 13\frac{2}{9}$

23. $34\frac{11}{12} - 15\frac{7}{9}$

Copy and complete these addition-subtraction boxes.

24.

3	$\frac{5}{9}$	
1	$\frac{1}{9}$	

25.

9	$\frac{2}{3}$	
4	$\frac{1}{2}$	

26.

12	$\frac{5}{6}$	
7	$\frac{3}{4}$	

Day 13 :Adding and subtracting mixed numbers. Review.

1. $2\frac{1}{2} + 1\frac{3}{8}$

2. $6\frac{1}{4} + 3\frac{1}{6}$

3. $2\frac{1}{3} + 3\frac{5}{6}$

4. $8\frac{11}{14} + \frac{5}{7}$

5. $5\frac{2}{3} + 4\frac{7}{12}$

6. $9\frac{2}{7} + 5\frac{2}{3}$

7. $3\frac{27}{40} + 5\frac{9}{16}$

8. $28\frac{7}{9} + 24\frac{1}{2} + 8\frac{11}{15}$

9. $12\frac{19}{25} + 8\frac{7}{10}$

10. $10\frac{3}{4} - 7\frac{4}{5}$

11. $3\frac{1}{7} - 1\frac{2}{3}$

12. $7\frac{1}{5} - 2\frac{1}{3}$

13. $2\frac{1}{5} - 1\frac{1}{2}$

14. $4\frac{1}{7} - 2\frac{5}{6}$

15. $6\frac{5}{6} - 4\frac{1}{4}$

16. $30\frac{3}{5} - 1\frac{11}{12}$

17. $6\frac{7}{12} - 2$

18. $13 - 4\frac{2}{9}$

Day 14: Quiz on adding and subtracting mixed numbers.

Find the sum as a whole number or mixed number in simplest form.

1. $3\frac{1}{4} + 5\frac{1}{4}$ _____

2. $10\frac{1}{6} + 6\frac{5}{6}$ _____

3. $5 + 3\frac{1}{2}$ _____

4. $1\frac{3}{10} + 2\frac{3}{10}$ _____

5. $9\frac{3}{5} + \frac{1}{5}$ _____

6. $5\frac{3}{8} + 6$ _____

7. $8\frac{3}{8} + 6\frac{4}{5}$ _____

8. $15\frac{1}{4} + 12\frac{5}{6}$ _____

9. $11\frac{5}{9} + 10\frac{8}{15}$ _____

10. $6\frac{1}{4} + 8\frac{1}{2}$ _____

11. $2\frac{3}{4} + 7\frac{5}{16}$ _____

12. $7\frac{5}{12} + \frac{3}{16}$ _____

13. $3\frac{17}{100} + 5\frac{19}{20}$ _____

14. $25\frac{4}{7} + 10\frac{7}{8}$ _____

15. $7\frac{6}{9} + 19\frac{1}{3}$ _____

Day 14 : Quiz (continued)

Find the difference as a whole , mixed number, or proper fraction in lowest terms.

16. $8\frac{3}{4} - 4\frac{1}{4}$

17. $15\frac{1}{2} - 14$

18. $16\frac{3}{8} - 7\frac{5}{8}$

19. $78 - 22\frac{3}{5}$

20. $16\frac{4}{9} - \frac{1}{9}$

21. $3 - 1\frac{5}{16}$

22. $34\frac{11}{12} - 6\frac{7}{9}$

23. $9\frac{1}{3} - 3\frac{1}{5}$

24. $7\frac{3}{8} - 5\frac{1}{4}$

25. $11\frac{9}{10} - 7\frac{3}{4}$

26. $4\frac{7}{12} - 3\frac{7}{8}$

27. $5 - 3\frac{1}{9}$

28. $19\frac{1}{6} - 4\frac{2}{3}$

29. $9\frac{3}{4} - 8\frac{6}{7}$

30. $27\frac{5}{12} - 23\frac{11}{16}$

Day 15 : Review of fractional concepts, equivalent fractions, ordering fractions, improper to mixed numbers, and adding and subtracting fractions and mixed numbers.

Complete.

1. $\frac{1}{5} = \frac{\blacksquare}{10}$ 2. $\frac{2}{3} = \frac{\blacksquare}{9}$ 3. $\frac{3}{5} = \frac{\blacksquare}{25}$ 4. $\frac{4}{7} = \frac{\blacksquare}{21}$

Change each fraction to simplest form.

5. $\frac{3}{9}$ 6. $\frac{8}{10}$ 7. $\frac{9}{12}$ 8. $\frac{14}{21}$ 9. $\frac{25}{30}$

Change each fraction to a mixed numeral in simplest form.

10. $\frac{7}{4}$ 11. $\frac{11}{3}$ 12. $\frac{10}{6}$ 13. $\frac{18}{7}$ 14. $\frac{16}{10}$

Add or subtract. Write the sum or difference in simplest form.

15. $\frac{1}{5} + \frac{2}{5}$ 16. $\frac{1}{6} + \frac{1}{6}$ 17. $\frac{3}{10} + \frac{9}{10}$ 18. $\frac{5}{8} + \frac{7}{8}$

19. $3\frac{1}{3} + 4\frac{1}{3}$ 20. $5\frac{3}{8} + 4\frac{1}{8}$ 21. $6\frac{5}{7} + 9\frac{4}{7}$ 22. $10\frac{7}{9} + 5\frac{5}{9}$

23. $\frac{8}{9} - \frac{2}{9}$ 24. $\frac{5}{8} - \frac{3}{8}$ 25. $\frac{11}{12} - \frac{5}{12}$ 26. $\frac{7}{10} - \frac{3}{10}$

27. $9\frac{4}{5} - 3\frac{2}{5}$ 28. $7 - 3\frac{2}{3}$ 29. $13\frac{1}{3} - 9\frac{2}{3}$ 30. $9\frac{3}{10} - 7\frac{9}{10}$

31. $\frac{1}{5} + \frac{1}{3}$ 32. $\frac{1}{5} + \frac{3}{10}$ 33. $\frac{5}{6} + \frac{4}{9}$ 34. $\frac{3}{4} + \frac{7}{16}$

35. $4\frac{1}{2} + 3\frac{1}{3}$ 36. $9\frac{2}{5} + 5\frac{1}{10}$ 37. $11\frac{5}{8} + 15\frac{5}{12}$ 38. $8\frac{5}{6} + 4\frac{7}{8}$

39. $\frac{1}{3} - \frac{1}{4}$ 40. $\frac{5}{6} - \frac{7}{12}$ 41. $\frac{5}{8} - \frac{3}{10}$ 42. $\frac{7}{9} - \frac{4}{18}$

43. $12\frac{3}{4} - 7\frac{3}{8}$ 44. $7\frac{2}{3} - 3\frac{3}{5}$ 45. $18\frac{1}{6} - 13\frac{4}{9}$ 46. $14\frac{1}{10} - 6\frac{4}{5}$

Copy. Replace each ▪ *with* $<$, $>$, *or* $=$.

47. $\frac{3}{7} \blacksquare \frac{5}{7}$ 48. $\frac{1}{3} \blacksquare \frac{1}{5}$ 49. $\frac{3}{4} \blacksquare \frac{12}{16}$ 50. $\frac{7}{9} \blacksquare \frac{3}{6}$

Write in order greatest to least:

51. $\frac{7}{8}, \frac{3}{4}, \frac{19}{24}$ 52. $\frac{3}{6}, \frac{7}{8}, \frac{9}{16}$

Write word names for the following :

53. $6\frac{1}{12}$ _____ 54. $\frac{13}{16}$ _____

55. What fraction is designated by the letters? W. _____ Z _____

Day 16 : Test

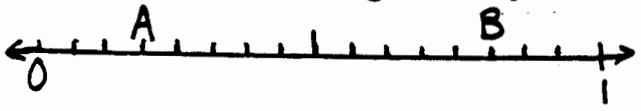
1. Name the fraction with numerator of eight and denominator of seventeen.

_____

2. What fractional part of the diagram is shaded?

_____

What fraction is designated by the letters?



3. A _____
4. B _____

Complete:

5. $\frac{12}{32} = \frac{\square}{8}$

6. $\frac{9}{81} = \frac{1}{\square}$

7. $\frac{16}{25} = \frac{\square}{125}$

8. $\frac{\square}{51} = \frac{2}{3}$

9. $\frac{75}{\square} = \frac{3}{4}$

10. $\frac{3}{7} = \frac{\square}{63}$

Change each to a fraction in simplest form.

11. $\frac{8}{16} =$ ___

12. $\frac{21}{105} =$ ___

13. $\frac{45}{60} =$ ___

14. $\frac{13}{26} =$ ___

Change each to a whole or mixed number in simplest form.

15. $\frac{17}{3} =$

16. $\frac{20}{2} =$

17. $\frac{39}{11} =$

18. $\frac{46}{10} =$

Use $>$, $<$, or $=$ to compare the following fractions.

19. $\frac{9}{8}$ ___ 1

20. $2\frac{3}{4}$ ___ $2\frac{6}{8}$

21. $\frac{5}{9}$ ___ $\frac{1}{2}$

22. $\frac{7}{8}$ ___ $\frac{9}{10}$

23. 2 ___ $1\frac{3}{3}$

24. $\frac{1}{4}$ ___ $\frac{3}{4}$

Test (continued)

Write word names for these fractions.

25. $8\frac{1}{3}$ _____

26. $\frac{16}{25}$ _____

27. $\frac{5}{40}$ _____

Put the following in order from largest to smallest.

28. $\frac{5}{7}$, $\frac{7}{8}$, $\frac{3}{4}$ _____

29. $4\frac{1}{3}$, $4\frac{3}{10}$, $4\frac{1}{5}$ _____

30. $\frac{2}{5}$, $\frac{1}{3}$, $\frac{4}{15}$, $\frac{3}{10}$ _____

Add or subtract. Write the sum or difference as a whole, mixed number, or proper fraction in simplest form.

31. $\frac{3}{7} + \frac{3}{7}$

32. $\frac{4}{8} + \frac{4}{8}$

33. $\left(\frac{3}{9} + \frac{7}{9}\right) + \frac{2}{9}$

34. $\frac{6}{15} + \frac{6}{15}$

35. $\frac{2}{7} + \frac{3}{8}$

36. $\frac{5}{8} + \frac{7}{10}$

37. $\frac{1}{2} + \frac{3}{4} + \frac{1}{6}$

Test (continued)

38. $\frac{1}{6} + \frac{4}{18}$

39. $1\frac{3}{10} + 2\frac{3}{10}$

40. $9\frac{2}{3} + \frac{1}{3}$

41. $28\frac{6}{9} + 4\frac{5}{8}$

42. $6 + 5\frac{3}{8}$

43. $7\frac{5}{12} + 6\frac{4}{12}$

44. $35\frac{3}{9} + 6\frac{4}{12}$

45. $9\frac{13}{16} + 6\frac{5}{8}$

46. $\frac{4}{8} - \frac{2}{8}$

47. $\frac{83}{100} - \frac{21}{100}$

48. $\frac{7}{8} - \left(\frac{6}{8} - \frac{1}{8}\right)$

49. $\frac{3}{8} - \frac{1}{12}$

50. $\frac{13}{15} - \frac{7}{10}$

51. $\frac{3}{4} - \frac{1}{2}$

52. $12\frac{3}{8} - 6\frac{1}{8}$

53. $3\frac{1}{10} - 2$

54. $14 - 5\frac{5}{16}$

55. $4\frac{4}{9} - \frac{1}{8}$

56. $9\frac{1}{9} - 7\frac{1}{3}$

57. $21\frac{3}{8} - 6\frac{5}{12}$

58. $24\frac{5}{6} - 3\frac{7}{8}$

59. $8 - 4\frac{4}{16}$

60. $4\frac{3}{7} - 3\frac{12}{21}$

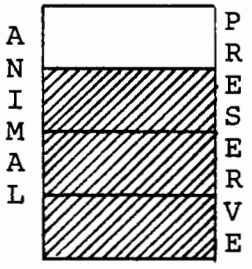
Day 17: Multiplying proper fractions.

Objective: Students will be able to multiply proper fractions.

Procedure: The teacher demonstrates multiplying fractions using a real life situation.

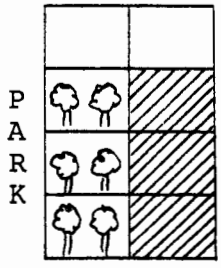
Example: An animal preserve is three-fourths of a park. The wooded area is one half of the animal preserve. How much of the park is wooded?

Diagram 1



$\frac{1}{2}$ of $\frac{3}{4}$ is $\frac{3}{8}$

Diagram 2



$\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$

$\frac{3}{4}$ of $\frac{1}{4}$ is $\frac{3}{4} \times \frac{1}{4} = \frac{3}{16}$

Diagram 1

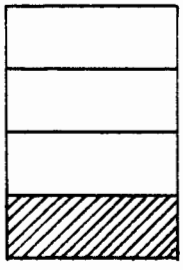
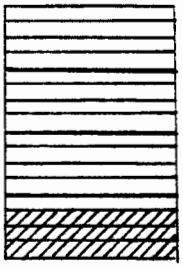


Diagram 2



Day 17: (Continued)

When multiplying fractions, multiply numerators, multiply denominators.

$\frac{3}{7} \times \frac{1}{5} = \frac{3}{35}$

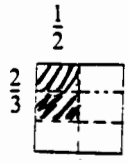
$\frac{1}{2} \times \frac{4}{9} = \frac{4}{18} = \frac{2}{9}$ Rename in simplest form.

$\frac{7}{15} \times \frac{5}{6} = \frac{35}{90} = \frac{7}{18}$

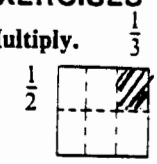
Day 17: Worksheet on multiplying proper fractions

EXERCISES

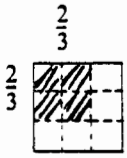
Multiply.



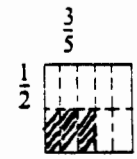
1. $\frac{2}{3} \times \frac{1}{2}$



2. $\frac{1}{2} \times \frac{1}{3}$



3. $\frac{2}{3} \times \frac{2}{3}$



4. $\frac{1}{2} \times \frac{3}{5}$

Multiply. Write the product in simplest form.

1. $\frac{3}{8} \times \frac{1}{5} = \frac{3 \times 1}{8 \times 5} =$ 

2. $\frac{2}{7} \times \frac{2}{3} = \frac{2 \times 2}{7 \times 3} =$ 

3. $\frac{4}{9} \times \frac{2}{5} = \frac{4 \times 2}{9 \times 5} =$ 

4. $\frac{1}{3} \times \frac{1}{6}$
5. $\frac{1}{4} \times \frac{1}{2}$
6. $\frac{1}{7} \times \frac{1}{8}$
7. $\frac{1}{10} \times \frac{1}{10}$
8. $\frac{1}{4} \times \frac{3}{5}$
9. $\frac{2}{3} \times \frac{1}{7}$
10. $\frac{3}{7} \times \frac{1}{8}$
11. $\frac{1}{3} \times \frac{4}{5}$
12. $\frac{2}{3} \times \frac{2}{5}$
13. $\frac{7}{10} \times \frac{3}{8}$
14. $\frac{3}{4} \times \frac{3}{5}$
15. $\frac{4}{7} \times \frac{2}{9}$
16. $\frac{5}{6} \times \frac{7}{8}$
17. $\frac{9}{10} \times \frac{3}{8}$
18. $\frac{5}{8} \times \frac{3}{4}$
19. $\frac{7}{16} \times \frac{3}{4}$
20. $\frac{1}{2} \times \frac{2}{5}$
21. $\frac{1}{3} \times \frac{3}{4}$
22. $\frac{2}{5} \times \frac{5}{7}$
23. $\frac{6}{11} \times \frac{5}{6}$
24. $\frac{7}{10} \times \frac{3}{7}$
25. $\frac{4}{5} \times \frac{5}{9}$
26. $\frac{4}{11} \times \frac{3}{4}$
27. $\frac{7}{8} \times \frac{5}{7}$

28. $\frac{2}{3} \times \frac{1}{5}$ $\frac{2}{15}$
29. $\frac{3}{8} \times \frac{3}{5}$
30. $\frac{7}{9} \times \frac{2}{5} \times \frac{4}{7}$
31. $\frac{1}{4} \times \frac{2}{3}$
32. $\frac{7}{5} \times \frac{3}{8} \times \frac{1}{6}$
33. $\frac{3}{1} \times \frac{1}{3}$
34. $\frac{2}{7} \times \frac{3}{5} \times \frac{6}{7}$
35. $\frac{1}{6} \times \frac{6}{1}$
36. $\frac{7}{10} \times \frac{9}{100}$
37. $\frac{5}{8} \times \frac{3}{4} \times \frac{2}{3}$
38. $\frac{5}{10} \times \frac{7}{10}$
39. $\frac{4}{9} \times \frac{5}{11}$
40. $\frac{9}{12} \times \frac{3}{8} \times \frac{1}{2}$
41. $\frac{1}{2} \times \frac{3}{4} \times \frac{5}{7}$
42. $\frac{7}{9} \times \frac{1}{3} \times \frac{5}{8}$

Day 18: Multiplying a whole number by a proper fraction. Changing a mixed number into an improper fraction.

Objectives:

1) Students will multiply a whole number by a proper fraction and change the product to mixed form if possible.
2) Students will change mixed numbers into improper fractions.

Procedure: The teacher will go through various examples of a whole number times a proper fraction.

Examples:

$2 \times \frac{1}{2}$ is the same as $\frac{1}{2} + \frac{1}{2}$ which is one whole.

2 is also written $\frac{2}{1}$. $\frac{2}{1} \times \frac{1}{2} = \frac{2}{2} = 1$

All whole numbers can be written as an improper fraction with 1 in the denominator.

$6 = \frac{6}{1}$ $\quad 10 = \frac{10}{1}$

$\frac{3}{5} \times 8 = \frac{3}{5} \times \frac{8}{1} = \frac{24}{5} = 4\frac{4}{5}$

$\frac{4}{9} \times 11 = \frac{4}{9} \times \frac{11}{1} = \frac{44}{9} = 4\frac{8}{9}$

We also need to learn to change a mixed number into an improper fraction.

$2\frac{3}{8}$ can be written as $2 + \frac{3}{8} = \frac{16}{8} + \frac{3}{8} = \frac{19}{8}$

Day 18: (Continued)

To do this another way, multiply the whole number by the denominator. Add the numerator to this product. Then write the sum as the numerator and leave the denominator as it was before.

$$2\frac{3}{8} = \frac{(2 \times 8) + 3}{8} = \frac{16 + 3}{8} = \frac{19}{8}$$

$$3\frac{5}{8} = \frac{(3 \times 8) + 5}{8} = \frac{24 + 5}{8} = \frac{29}{8}$$

Day 18 : Worksheet on multiplying a whole times a proper fraction

Express each answer as a whole number, mixed number, or proper fraction in simplest form.

1. $7 \times \frac{3}{8} =$

2. $4 \times \frac{1}{4} =$

3. $16 \times \frac{2}{3} =$

4. $16 \times \frac{1}{4} =$

5. $\frac{1}{3} \times 9 =$

6. $\frac{3}{7} \times 20 =$

7. $16 \times \frac{1}{8} =$

8. $\frac{1}{16} \times 30 =$

9. $100 \times \frac{3}{10} =$

10. $\frac{7}{8} \times 0 =$

11. $\frac{0}{5} \times 4 =$

12. $\frac{3}{4} \times 14 =$

13. $67 \times \frac{1}{2} =$

14. $\frac{3}{10} \times 7 =$

15. $\frac{12}{13} \times 20 =$

Day 18 : Worksheet on changing a mixed number to an improper fraction

A quick way to rename a mixed numeral as a fraction is as follows. Multiply the whole number by the denominator. Add the numerator to this product. Write the sum over the denominator.

$$2\frac{3}{8} = \frac{(2 \times 8) + 3}{8}$$
$$= \frac{16 + 3}{8}$$
$$= \frac{19}{8}$$

Copy and complete.

1. $1\frac{3}{8} = \frac{(1 \times 8) + 3}{8} = \frac{\square}{8}$
2. $1\frac{2}{5} = \frac{(1 \times 5) + 2}{5} = \frac{\square}{5}$
3. $1\frac{8}{9} = \frac{(1 \times 9) + 8}{9} = \frac{\square}{9}$
4. $2\frac{1}{3} = \frac{(2 \times 3) + 1}{3} = \frac{\square}{3}$
5. $2\frac{3}{4} = \frac{(2 \times 4) + 3}{4} = \frac{\square}{4}$
6. $3\frac{5}{8} = \frac{(3 \times 8) + 5}{8} = \frac{\square}{8}$

Rename each mixed numeral as a fraction.

7. $1\frac{7}{8}$
8. $1\frac{7}{12}$
9. $2\frac{1}{2}$
10. $2\frac{4}{5}$
11. $2\frac{9}{10}$
12. $3\frac{5}{8}$
13. $3\frac{2}{3}$
14. $3\frac{5}{9}$
15. $4\frac{3}{4}$
16. $5\frac{2}{3}$
17. $6\frac{7}{8}$
18. $11\frac{2}{3}$
19. $7\frac{1}{8}$
20. $12\frac{1}{2}$
21. $4\frac{1}{4}$
22. $9\frac{1}{2}$
23. $4\frac{13}{16}$
24. $5\frac{7}{16}$
25. $10\frac{7}{10}$
26. $15\frac{2}{3}$

Day 19: Quiz on changing mixed numbers to improper fractions, multiplying fractions and whole numbers.

Write each as an improper fraction in simplest form.

1. $3\frac{3}{8} =$

2. $6\frac{1}{4} =$

3. $8\frac{2}{7} =$

4. $10\frac{8}{24} =$

5. $2\frac{7}{10} =$

6. $4\frac{7}{9} =$

7. $16\frac{5}{6} =$

8. $7\frac{1}{20} =$

9. $4\frac{3}{9} =$

10. $9\frac{5}{10} =$

Give answers as a whole number, mixed number, or proper fraction in simplest form.

11. $\frac{1}{4} \times \frac{3}{5} =$

12. $\frac{3}{5} \times \frac{7}{8} =$

13. $\frac{10}{11} \times \frac{7}{10} =$

14. $\frac{3}{8} \times \frac{8}{9} =$

15. $\frac{4}{9} \times \frac{5}{11} =$

16. $\frac{1}{4} \times \frac{2}{3} \times \frac{8}{5} =$

17. $\frac{7}{8} \times \frac{1}{6} \times \frac{2}{3} =$

18. $\frac{7}{10} \times \frac{3}{7} =$

19. $\frac{1}{15} \times \frac{1}{19} =$

20. $6 \times \frac{2}{15} =$

21. $30 \times \frac{3}{10} =$

22. $\frac{4}{7} \times 7 =$

23. $\frac{1}{8} \times 5 =$

24. $3 \times \frac{4}{5} =$

25. $12 \times \frac{1}{4} =$

26. $0 \times \frac{3}{16} =$

27. $\frac{1}{2} \times \frac{5}{7} \times 14 =$

28. $\frac{3}{8} \times \frac{1}{3} \times 16 =$

29. $\frac{7}{9} \times \frac{1}{2} =$

30. $\frac{1}{51} \times 17 =$

Day 20: Multiplying mixed numbers, whole numbers, and proper fractions in various combinations.

Objectives:

1) Students will be able to multiply mixed numbers, whole numbers, and proper fractions in any combinations.
2) Students will be able to use cross-factoring for a shortcut in multiplying fractions.

Procedure: The teacher will demonstrate how to multiply mixed numbers by changing them into improper fractions.

Examples: $2 \times 3\frac{1}{2} = \frac{2}{1} \times \frac{7}{2} = \frac{14}{2} = 7$

Change whole numbers and mixed numbers into improper fractions and then multiply numerators and denominators.

$2\frac{1}{4} \times 2\frac{2}{3} = \frac{9}{4} \times \frac{8}{3} = \frac{72}{12} = 6$

You can also use a shortcut when multiplying fractions. It gives the product in simplest form. The shortcut is called cross-factoring and is done by dividing both numerator and denominator by a common factor before multiplying. Here is an example using the same improper fractions above.

$\frac{9}{4} \times \frac{8}{3} = ?$ divide by 3 $\frac{\overset{3}{\cancel{9}}}{4} \times \frac{8}{\underset{1}{\cancel{3}}} = ?$

divide by 4 $\frac{\overset{3}{\cancel{9}}}{\underset{1}{\cancel{4}}} \times \frac{\overset{2}{\cancel{8}}}{\underset{1}{\cancel{3}}} = ?$

multiply $\frac{3}{1} \times \frac{2}{1} = \frac{6}{1} = 6$

Day 20: (Continued)

Try these:

$$4\frac{3}{8} \times \frac{12}{20} = \overset{7}{\cancel{35}}\,\cancel{8} \times \cancel{12}\,\overset{3}{\cancel{20}}_{4} = \frac{21}{8} = 2\frac{5}{8}$$

$$1\frac{7}{9} \times 1\frac{1}{8} = \overset{2}{\cancel{16}}\,\cancel{9} \times \cancel{9}\,\overset{1}{\cancel{8}}_{1} = \frac{2}{1} = 2$$

Day 20 : Worksheet on multiplying mixed numbers

Multiplying Mixed Numbers

Step 1	Step 2	Step 3
Change the mixed numbers to fractions.	Divide out the common factors.	Multiply.
$3\frac{1}{3}\times1\frac{1}{2}=\frac{10}{3}\times\frac{3}{2}$	$\frac{\overset{5}{\cancel{10}}}{\underset{1}{\cancel{3}}}\times\frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{2}}}$	$\frac{\overset{5}{\cancel{10}}}{\underset{1}{\cancel{3}}}\times\frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{2}}}=\frac{5}{1}$, or 5

Multiply. Write the answers in simplest form. Show work below.

1. $2\frac{1}{3}\times\frac{5}{7}$
2. $\frac{7}{8}\times2\frac{2}{3}$
3. $3\frac{1}{4}\times\frac{8}{9}$
4. $4\frac{1}{2}\times8$
5. $6\frac{4}{9}\times3$
6. $1\frac{1}{7}\times2\frac{2}{5}$
7. $2\frac{2}{3}\times4\frac{1}{2}$
8. $3\frac{3}{4}\times\frac{14}{15}$
9. $15\times4\frac{1}{3}$
10. $2\frac{2}{3}\times1\frac{7}{8}$
11. $1\frac{4}{5}\times\frac{7}{9}\times\frac{1}{3}$
12. $\frac{2}{3}\times1\frac{1}{2}\times\frac{7}{11}$
13. $1\frac{2}{3}\times\frac{7}{8}\times3\frac{1}{3}$
14. $1\frac{4}{7}\times\frac{3}{5}\times2\frac{1}{2}$
15. $2\frac{1}{4}\times\frac{3}{5}\times1\frac{2}{10}$
16. $\frac{5}{6}\times2\frac{1}{3}\times\frac{8}{9}$
17. $4\frac{1}{3}\times3\times\frac{7}{12}$
18. $5\frac{2}{3}\times\frac{4}{11}\times\frac{5}{8}$

Day 21 : Worksheet on multiplying all types fractions

EXERCISES

Multiply. Divide out common factors (cross-factor)

1. $\frac{3}{5} \times \frac{10}{3}$
2. $\frac{4}{7} \times \frac{14}{12}$
3. $\frac{5}{9} \times \frac{3}{15}$
4. $\frac{7}{5} \times \frac{6}{14}$
5. $\frac{6}{4} \times \frac{8}{9}$
6. $\frac{4}{9} \times \frac{18}{12}$
7. $8 \times \frac{1}{12}$
8. $\frac{16}{9} \times \frac{3}{20}$
9. $12 \times \frac{3}{16}$
10. $\frac{15}{21} \times \frac{14}{10}$
11. $\frac{16}{24} \times \frac{18}{14}$
12. $\frac{15}{32} \times \frac{24}{20}$
13. $\frac{35}{8} \times \frac{12}{20}$
14. $\frac{16}{42} \times \frac{36}{24}$
15. $\frac{16}{7} \times 35$
16. $\frac{45}{14} \times \frac{28}{35}$

Multiply. Replace ◯ with <, >, or =.

17. $\frac{1}{3} \times \frac{1}{4} \bigcirc \frac{3}{7} \times \frac{1}{2}$
18. $\frac{5}{7} \times \frac{2}{3} \bigcirc \frac{1}{9} \times \frac{7}{11}$
19. $\frac{5}{7} \times \frac{6}{1} \bigcirc \frac{1}{2} \times \frac{3}{1}$
20. $\frac{2}{5} \times \frac{4}{1} \bigcirc \frac{5}{7} \times \frac{4}{5}$
21. $\frac{7}{8} \times \frac{3}{10} \bigcirc \frac{3}{2} \times \frac{2}{3}$
22. $\frac{3}{3} \times \frac{3}{8} \bigcirc \frac{4}{6} \times \frac{3}{7}$

Multiply. Write the product in simplest form.

23. $1\frac{1}{4} \times 1\frac{3}{5}$
24. $2\frac{5}{8} \times 1\frac{5}{7}$
25. $2\frac{1}{8} \times 1\frac{1}{3}$
26. $3\frac{3}{4} \times 1\frac{1}{5}$
27. $5\frac{1}{3} \times 4\frac{1}{2}$
28. $2\frac{2}{3} \times 3\frac{3}{8}$
29. $3\frac{3}{4} \times 2\frac{2}{3}$
30. $2\frac{5}{6} \times 1\frac{7}{8}$
31. $1\frac{5}{16} \times 10\frac{2}{3}$
32. $9\frac{1}{3} \times 2\frac{5}{8}$
33. $8\frac{1}{3} \times 2\frac{1}{10}$
34. $2\frac{3}{16} \times 3\frac{3}{7}$

Day 22 : Quiz on multiplying fractions and mixed numbers.

Express answers as a whole number, mixed number , or proper fraction in simplest form.

1. $\frac{1}{2} \times \frac{1}{3} =$

2. $\frac{2}{3} \times \frac{1}{5} =$

3. $\frac{1}{8} \times 3 =$

4. $\frac{4}{9} \times 2 =$

5. $\frac{2}{3} \times \frac{3}{4} =$

6. $\frac{5}{6} \times \frac{4}{7} =$

7. $1\frac{1}{2} \times \frac{1}{5} =$

8. $\frac{3}{8} \times 1\frac{1}{3} =$

9. $\frac{7}{10} \times 2\frac{3}{14} =$

10. $8 \times 6\frac{2}{3} =$

11. $1\frac{1}{8} \times 6\frac{1}{3} =$

12. $\frac{5}{9} \times 4\frac{4}{5} =$

13. $6\frac{3}{4} \times 2\frac{2}{9} =$

14. $5\frac{5}{7} \times \frac{3}{4} =$

15. $4\frac{2}{3} \times 1\frac{5}{7} =$

Day 22 : Quiz (continued)

16. $5\frac{4}{12} \times 1\frac{7}{8} =$

17. $3\frac{4}{15} \times 2\frac{6}{7} =$

18. $8\frac{5}{9} \times 4\frac{1}{11} =$

19. $6\frac{3}{10} \times 10\frac{5}{7} =$

20. $2\frac{4}{25} \times 4\frac{4}{9} =$

21. $7\frac{1}{7} \times 6\frac{3}{10} =$

22. $4\frac{3}{8} \times 6\frac{5}{9} =$

23. $6\frac{4}{7} \times 5\frac{5}{12} =$

24. $1\frac{5}{28} \times 5\frac{1}{11} =$

25. $7\frac{1}{5} \times 4\frac{4}{9} =$

26. $10\frac{2}{3} \times 7\frac{1}{8} =$

27. $12\frac{1}{4} \times 2\frac{5}{14} =$

28. $15\frac{1}{3} \times 4\frac{1}{8} =$

29. $10\frac{5}{9} \times 7\frac{1}{5} =$

30. $1\frac{1}{5} \times 3\frac{2}{7} =$

Day 23: Reciprocals and division of whole numbers and proper fractions.

Objectives:

1) Students will define the term "reciprocal" and be able to find the reciprocal of a whole number, mixed number, and proper fraction.
2) Students will be able to divide fractions by whole numbers and proper fractions.

Procedure: The teacher will explain that two fractions whose product is one are called reciprocals. Then the teacher will have an example with division of whole numbers and have the students change it to a multiplication problem dealing with fractions.

Examples: What do you multiply these fractions by to get one?

$\frac{2}{3} \times \square = 1$ $\frac{3}{2}$

$5 \times \square = 1$ $\frac{1}{5}$

$\frac{4}{3} \times \square = 1$ $\frac{3}{4}$

Two fractions whose product is one are called reciprocals.

These are reciprocals of each other: $\frac{2}{3}$, $\frac{3}{2}$

5 , $\frac{1}{5}$

$\frac{4}{3}$, $\frac{3}{4}$

Day 23: (Continued)

Zero has no reciprocal. Zero cannot be the denominator of any fraction since we cannot divide by zero.

$\frac{0}{5}$, $\frac{0}{7}$, 0 Fractions similar to these have no reciprocal.

Find the reciprocals of these fractions.

$\frac{8}{9} \rightarrow \frac{9}{8}$ $4\frac{1}{2} \rightarrow \frac{2}{9}$

$\frac{5}{6} \rightarrow \frac{6}{5}$ $8\frac{3}{4} \rightarrow \frac{4}{35}$

An easy way to find reciprocals is to exchange numerator with denominator. If it is a whole number, change it to an improper fraction with one as the denominator, and then exchange numerator with denominator. Use this same process for mixed numbers.

$7 = \frac{7}{1}$ reciprocal: $\frac{1}{7}$

$6\frac{5}{8} = \frac{53}{8}$ reciprocal: $\frac{8}{53}$

Look at this easy division problem. $6 \div 2 = 3$

Can you change this to a multiplication problem using fractions?

Hint: $6 \times \square = 3$

Answer: $6 \times \frac{1}{2} = 3$

Day 23: (Continued)

What is the relationship between the divisor 2 and $\frac{1}{2}$?

Yes, they are reciprocals.

Try this problem: $8 \div \frac{1}{2}$

This is the same as 8 x 2 which is 16. Is it true there are sixteen halves in eight ones?

To divide by a fraction, multiply by the reciprocal of the divisor. Do not change the first number, the dividend.

$$\frac{4}{5} \div \frac{1}{3} = \frac{4}{5} \times \frac{3}{1} = \frac{12}{5} = 2\frac{2}{5}$$

$$3 \div \frac{8}{9} = \frac{3}{1} \times \frac{9}{8} = \frac{27}{8} = 3\frac{3}{8}$$

$$\frac{7}{8} \div 8 = \frac{7}{8} \times \frac{1}{8} = \frac{7}{64}$$

You may cross-factor <u>after</u> the problem has been changed to multiplication.

$$\frac{5}{14} \div \frac{1}{7} = \frac{5}{14} \times \frac{7}{1} = \frac{5}{2} = 2\frac{1}{2}$$

$$16 \div \frac{2}{3} = \frac{\overset{8}{\cancel{16}}}{1} \times \frac{3}{\cancel{2}_{1}} = \frac{24}{1} = 24$$

Day 23: Worksheet on reciprocals , division of wholes and proper fractions

Write the reciprocals. They may be left as improper fractions (simplest form)

1. $\frac{2}{3}$ $\frac{3}{2}$ 2. $\frac{7}{5}$ 3. $\frac{6}{1}$ 4. $\frac{1}{8}$ 5. $\frac{9}{4}$ 6. $\frac{10}{100}$ 7. $\frac{15}{23}$

8. $\frac{3}{11}$ 9. $\frac{8}{3}$ 10. $\frac{4}{7}$ 11. $\frac{115}{25}$ 12. $\frac{51}{62}$ 13. $\frac{5}{6}$ 14. $\frac{11}{1}$

15. $\frac{12}{15}$ 16. $\frac{71}{25}$ 17. $\frac{117}{201}$ 18. 17 19. $1\frac{2}{3}$ 20. 9 21. $4\frac{1}{5}$

22. $1\frac{7}{8}$ 23. $15\frac{7}{8}$ 24. $3\frac{1}{6}$ 25. $8\frac{1}{2}$ 26. $2\frac{1}{4}$ 27. 12 28. $1\frac{9}{11}$

Divide. Leave the quotient in simplest form.

29. $\frac{2}{3} \div 2$ 30. $\frac{1}{2} \div \frac{1}{4}$ 31. $\frac{3}{4} \div \frac{1}{4}$ 32. $\frac{3}{8} \div \frac{1}{8}$

33. $\frac{3}{4} \div \frac{2}{3}$ 34. $\frac{5}{8} \div 3$ 35. $\frac{4}{5} \div \frac{2}{2}$ 36. $8 \div \frac{3}{5}$

37. $5 \div \frac{2}{5}$ 38. $\frac{5}{6} \div \frac{3}{8}$ 39. $\frac{3}{5} \div 4$ 40. $\frac{0}{4} \div \frac{1}{2}$

41. $\frac{5}{9} \div \frac{1}{3}$ 42. $6 \div \frac{1}{2}$ 43. $\frac{6}{5} \div \frac{3}{3}$ 44. $\frac{7}{4} \div \frac{7}{4}$

45. $\frac{3}{8} \div \frac{3}{4}$ 46. $\frac{3}{4} \div \frac{3}{8}$ 47. $\frac{5}{9} \div \frac{2}{3}$ 48. $\frac{2}{3} \div \frac{5}{9}$

True or false?

49. $\frac{2}{3} \times \frac{3}{4} < \frac{2}{3}$ 50. $\frac{2}{3} \times 1 = \frac{2}{3}$ 51. $\frac{2}{3} \times \frac{5}{4} > \frac{2}{3}$

52. $\frac{5}{8} \div \frac{2}{3} > \frac{5}{8}$ 53. $\frac{5}{8} \div 1 = \frac{5}{8}$ 54. $\frac{5}{8} \div \frac{4}{3} < \frac{5}{8}$

Divide. Write the quotient in simplest form.

55. $3 \div \frac{1}{4}$ 59. $6 \div \frac{1}{2}$

56. $6 \div \frac{2}{3}$ 60. $8 \div \frac{2}{7}$

57. $\frac{1}{2} \div 3$ 61. $\frac{1}{5} \div 4$

58. $\frac{4}{5} \div 2$ 62. $\frac{9}{10} \div 6$

Day 24: Dividing mixed numbers, wholes, and proper fractions.

Objective: Students will change division problems involving mixed numbers, wholes, and proper fractions to an equivalent multiplication problem and solve.

Procedure: The teacher will explain how to divide mixed numbers generalizing from division of proper fractions.

Examples: When dividing fractions multiply by the reciprocal of the divisor or second fraction.

$$5\frac{1}{3} \div 6 = \frac{16}{3} \div \frac{6}{1} = \frac{\overset{8}{\cancel{16}}}{3} \times \frac{1}{\cancel{6}_{3}} = \frac{8}{9}$$

$$7\frac{3}{4} \div 3\frac{1}{4} = \frac{31}{4} \times \frac{13}{4} = \frac{31}{\cancel{4}_{1}} \times \frac{\overset{1}{\cancel{4}}}{13} = \frac{31}{13} = 2\frac{5}{13}$$

$$5 \div 2\frac{3}{8} = \frac{5}{1} \div \frac{19}{8} = \frac{5}{1} \times \frac{8}{19} = \frac{40}{19} = 2\frac{2}{19}$$

Try these on your own:

$1\frac{1}{8} \div 2\frac{1}{4}$ Answer: $\frac{1}{2}$

$10\frac{5}{8} \div 3\frac{2}{5}$ Answer: $3\frac{1}{8}$

$5 \div 6\frac{2}{3}$ Answer: $\frac{3}{4}$

Day 24 : Worksheet on division of mixed numbers, wholes, and proper fractions.

Complete.

1. $1\frac{1}{2} \div 3 = \frac{3}{2} \div 3 = \frac{3}{2} \times \frac{\square}{\square} = \frac{\square}{\square}$

2. $5\frac{3}{5} \div 7 = \frac{28}{5} \div 7 = \frac{28}{5} \times \frac{\square}{\square} = \frac{\square}{\square}$

3. $2 \div 4\frac{4}{5} = \frac{2}{1} \div \frac{24}{5} = \frac{2}{1} \times \frac{\square}{\square} = \frac{\square}{\square}$

4. $3 \div 6\frac{3}{4} = \frac{3}{1} \div \frac{27}{4} = \frac{3}{1} \times \frac{\square}{\square} = \frac{\square}{\square}$

5. $2\frac{1}{4} \div 3\frac{3}{8} = \frac{9}{4} \div \frac{27}{8} = \frac{\square}{\square} \times \frac{\square}{\square} = \frac{\square}{\square}$

6. $1\frac{3}{5} \div 3\frac{1}{5} = \frac{8}{5} \div \frac{16}{5} = \frac{\square}{\square} \times \frac{\square}{\square} = \frac{\square}{\square}$

Divide. Write the quotient in simplest form.

7. $1\frac{3}{4} \div 3$

8. $8\frac{2}{5} \div 6$

9. $5\frac{3}{4} \div 5$

10. $5 \div 6\frac{2}{3}$

11. $1\frac{3}{5} \div \frac{5}{8}$

12. $\frac{8}{15} \div 3\frac{1}{5}$

13. $1\frac{2}{5} \div 2\frac{2}{3}$

14. $8\frac{5}{8} \div 4\frac{3}{5}$

15. $9\frac{3}{4} \div 1\frac{5}{8}$

16. $6\frac{2}{3} \div 1\frac{5}{6}$

17. $4\frac{2}{3} \div 1\frac{3}{5}$

18. $7\frac{1}{2} \div 2\frac{3}{16}$

19. $3\frac{3}{4} \div 3$

20. $2\frac{1}{4} \div 4$

21. $6 \div 2\frac{1}{4}$

22. $1\frac{5}{8} \div \frac{1}{2}$

23. $\frac{3}{4} \div 1\frac{1}{2}$

24. $2\frac{3}{4} \div 1\frac{3}{8}$

25. $7\frac{1}{8} \div 3\frac{4}{5}$

26. $4\frac{2}{3} \div 4\frac{2}{3}$

27. $9\frac{3}{5} \div 4\frac{1}{5}$

28. $5\frac{7}{9} \div 2\frac{2}{3}$

29. $6\frac{1}{2} \div 4\frac{1}{2}$

30. $7\frac{1}{2} \div 1\frac{3}{4}$

Day 25: Changing a fraction to a decimal.

Objective: Students will be able to change a proper, improper, or mixed fraction to a decimal.

Procedure: The teacher will show how a fraction is related to a decimal and how to change a fraction to a decimal.

Examples: The decimal .5 is equivalent to what fraction? $\frac{5}{10}$

$\frac{5}{10}$ may be renamed as $\frac{1}{2}$. In order to change $\frac{1}{2}$ to .5 divide 1 by 2. $2\overline{)1.00}$ .5

To change any fraction to a decimal divide numerator by denominator. Place a decimal to the right of the dividend and annex zeros until the quotient terminates (ends) or repeats in a pattern.

$\frac{3}{8}$ $8\overline{)3.000}$ .375

$\frac{1}{3}$ $3\overline{)1.000}$ .333... = $.\overline{33}$ or $.\overline{3}$

$\frac{1}{7}$ $7\overline{)1.000000}$ .142857 1... = $.\overline{142857}$

Day 25: (Continued)

To change a mixed number to a decimal, you can change it to improper form first and then follow the same procedure. The whole number will remain the same.

$3\frac{1}{4} = \frac{13}{4}$ $\quad 4\overline{)13.00}\ 3.25$ $\quad 1\frac{1}{6} = \frac{7}{6}$ $\quad 6\overline{)7.000}\ 1.166\ldots = 1.1\overline{6}$

The repeating bar is used only over the digits that repeat. They are never used over whole numbers.

Day 25 : Worksheet on changing a fraction to a decimal.

Change each fraction to a repeating or terminating decimal.

1. $\frac{1}{4}$ =

2. $\frac{5}{16}$ =

3. $\frac{2}{3}$ =

4. $\frac{4}{5}$ =

5. $10\frac{1}{2}$ =

6. $2\frac{5}{8}$ =

7. $4\frac{9}{10}$ =

8. $\frac{11}{20}$ =

9. $\frac{5}{9}$ =

10. $\frac{7}{50}$ =

Day 25 : Changing a fraction to a decimal(continued)

11. $\frac{5}{6}$ =

12. $\frac{3}{16}$ =

13. $\frac{3}{11}$ =

14. $3\frac{1}{9}$ =

15. $\frac{8}{25}$ =

16. $\frac{3}{7}$ =

17. $\frac{1}{18}$ =

18. $7\frac{3}{4}$ =

Day 26 : Quiz on reciprocals, division of fractions, and changing a fraction to a decimal.

Express all answers as a whole number, mixed number, or proper fraction in simplest form.

1. $\frac{1}{5} \times$ _____ $= 1$

2. What is the reciprocal of $\frac{3}{4}$? _____

3. $\frac{2}{3} \times$ _____ $= 1$

4. What is the reciprocal of $\frac{2}{5}$? _____

5. What is the reciprocal of $\frac{31}{50}$? _____

6. $\frac{2}{3} \div \frac{1}{3} =$

7. $\frac{8}{9} \div \frac{2}{3} =$

8. $\frac{3}{4} \div \frac{5}{8} =$

9. $3\frac{1}{9} \div \frac{7}{15} =$

10. $4\frac{4}{5} \div 1\frac{11}{25} =$

11. $7\frac{2}{3} \div 5\frac{1}{9} =$

12. $8\frac{2}{9} \div 3\frac{1}{12} =$

13. $4\frac{2}{7} \div 1\frac{4}{21} =$

14. $4\frac{1}{6} \div 3\frac{8}{9} =$

15. $3\frac{7}{10} \div 4\frac{5}{8} =$

16. $2\frac{11}{12} \div 4\frac{1}{6} =$

17. $10\frac{2}{3} \div 1\frac{1}{15} =$

18. $7\frac{1}{6} \div 4\frac{7}{9} =$

19. $2\frac{7}{10} \div 5\frac{2}{5} =$

Day 26 : Quiz (continued)

Express as a decimal:

20. $\frac{7}{10} =$

21. $\frac{3}{5} =$

22. $2\frac{1}{4} =$

23. $\frac{1}{3} =$

24. $4\frac{2}{9} =$

25. $3\frac{1}{6} =$

26. $\frac{7}{15} =$

27. $2\frac{3}{8} =$

28. $5\frac{9}{16} =$

29. $\frac{5}{11} =$

30. $1\frac{17}{20} =$

Day 27 : Review on multiplication, division of fractions and changing a fraction to a decimal

Copy and complete.

Fraction	$\frac{3}{2}$	$\frac{5}{3}$	$\frac{11}{4}$	$\frac{9}{5}$	$\frac{15}{6}$				
Mixed numeral						$2\frac{1}{2}$	$3\frac{1}{4}$	$4\frac{2}{3}$	$1\frac{3}{5}$

Change to decimals.

(1.) $\frac{1}{4}$ (2.) $\frac{2}{5}$ (3.) $\frac{3}{8}$ (4.) $\frac{5}{4}$ (5.) $\frac{2}{3}$ (6.) $\frac{5}{6}$ (7.) $\frac{1}{9}$ (8.) $\frac{13}{8}$

Find the product. Rename in simplest form.

9. $\frac{3}{5} \times \frac{1}{2}$ 10. $\frac{2}{5} \times \frac{3}{4}$ 11. $\frac{5}{2} \times 2$ 12. $\frac{5}{9} \times \frac{3}{2}$

13. $2\frac{1}{2} \times \frac{5}{3}$ 14. $\frac{6}{7} \times 1\frac{1}{4}$ 15. $3\frac{1}{4} \times 1\frac{1}{3}$ 16. $5\frac{3}{4} \times 2\frac{2}{3}$

Find the quotient. Rename in simplest form.

17. $\frac{3}{5} \div \frac{1}{2}$ 18. $\frac{7}{8} \div \frac{3}{2}$ 19. $\frac{5}{9} \div \frac{2}{3}$ 20. $\frac{6}{7} \div \frac{2}{5}$

21. $\frac{4}{5} \div 2\frac{1}{2}$ 22. $5\frac{3}{4} \div 2$ 23. $4\frac{1}{3} \div 1\frac{1}{3}$ 24. $8\frac{2}{5} \div 2\frac{3}{4}$

Complete.

25. To divide by $\frac{3}{5}$, you can multiply by the reciprocal of ____.

26. Dividing by $\frac{4}{7}$ is the same as multiplying by ____.

27. Dividing by ____ is the same as multiplying by $\frac{5}{6}$.

28. To divide by ____, you can multiply by the reciprocal of $\frac{5}{8}$.

Find the reciprocal of each of the following rational numbers.

(29.) $\frac{1}{2}$ (30.) $\frac{4}{3}$ (31.) 11 (32.) $\frac{22}{7}$ (33.) 1 (34.) $\frac{2}{7}$ (35.) $\frac{2}{5}$ (36.) $2\frac{1}{2}$ (37.) $1\frac{3}{4}$ (38.) $\frac{1}{10}$

39. Choose any fraction. Write its reciprocal. Multiply the reciprocal times itself. Multiply this product times the original fraction. What do you get?

Day 28 : Test

Change each mixed number to improper fractions in simplest form.

1. $2\frac{1}{2}$ =

2. $8\frac{2}{3}$ =

3. $25\frac{1}{4}$ =

4. $17\frac{5}{30}$ =

5. $4\frac{4}{8}$ =

6. $7\frac{3}{27}$ =

Change these fractions to decimals.

7. $\frac{1}{8}$

8. $\frac{9}{10}$

9. $\frac{2}{3}$

10. $\frac{13}{6}$

11. $1\frac{2}{7}$

12. $3\frac{4}{5}$

Find the reciprocals of the following:
(You may leave them as improper fractions)

13. $\frac{1}{5}$ _____

14. $\frac{3}{8}$ _____

15. $\frac{0}{8}$ _____

16. 7 _____

17. $8\frac{9}{16}$ _____

18. 1 _____

19. The product of a fraction and its reciprocal is _____.

20. Dividing by $2\frac{3}{8}$ is the same as multiplying by _____.

Test (continued)

Write true or false in the blank.

21. $\frac{1}{5} \times 5 = 5 \div 1$ _____

22. $\frac{7}{8} \times \frac{8}{7} < 1 \times 1\frac{1}{7}$ _____

23. $\frac{5}{18} \times 2 > \frac{1}{6} \times 3$ _____

24. $\frac{4}{7} \div 7 = 7 \div \frac{4}{7}$ _____

25. $\frac{3}{8} \times \frac{8}{3} = \frac{8}{3} \div \frac{3}{8}$ _____

Give each product or quotient as a whole number, mixed number, or proper fraction in

26. $\frac{2}{3} \times \frac{1}{3} =$

27. $\frac{4}{9} \times \frac{3}{8} =$

28. $\frac{7}{15} \times 20 =$

29. $3 \times \frac{7}{9} =$

30. $\frac{4}{5} \times 1\frac{9}{16} =$

31. $\frac{3}{13} \times 3\frac{1}{39} =$

32. $16\frac{1}{8} \times 2\frac{1}{2} =$

33. $8 \times 4\frac{3}{4} =$

34. $\frac{3}{4} \times \frac{6}{9} \times \frac{1}{2} =$

35. $\frac{7}{9} \times 6 =$

36. $\frac{8}{36} \times \frac{12}{15} \times \frac{5}{8} =$

37. $2\frac{1}{4} \times 4\frac{3}{8} =$

38. $10\frac{4}{5} \times 6\frac{1}{9} =$

39. $0 \times 3\frac{1}{3} =$

(continue on to next page)

Test (continued)

40. $\frac{5}{7} \div \frac{3}{4} =$

41. $1 \div \frac{1}{3} =$

42. $\frac{2}{5} \div 4 =$

43. $\frac{16}{20} \div \frac{2}{3} =$

44. $\frac{5}{8} \div 3\frac{1}{2} =$

45. $40 \div 2\frac{1}{7} =$

46. $3\frac{1}{3} \div 2\frac{2}{3} =$

47. $\frac{3}{8} \div \left(\frac{1}{2} \div \frac{3}{7}\right) =$

48. $4\frac{1}{5} \div 6\frac{1}{3} =$

49. $3\frac{3}{4} \div 1\frac{1}{11} =$

50. $4\frac{2}{7} \div 20 =$

Answers to Exercises

Day 1 (Part 1)

1. $\frac{2}{6}$
2. $\frac{4}{12}$
3. $\frac{3}{5}$
4. $\frac{3}{8}$
5. $\frac{9}{25}$
6. $\frac{5}{7}$
7. $\frac{1}{3}$
8. $\frac{4}{6}$
9. $\frac{2}{7}$
10. $\frac{4}{9}$
11. X = $\frac{2}{5}$, Y = $1\frac{1}{5}$, W = $3\frac{4}{5}$, Z = $2\frac{3}{5}$
12. R = $\frac{2}{8}$ or $\frac{1}{4}$, S = $\frac{5}{8}$, T = $\frac{7}{8}$, U = $\frac{4}{8}$ or $\frac{1}{2}$

(Part 2)

1. 2
2. 4
3. 9
4. 10
5. 3
6. 4
7. 12

(Part 2 - Continued)

8. 2

9. 5

10. 10

11. $\frac{3}{3}$

12. $\frac{2}{2}$

13. $\frac{4}{4}$

14. 24

15. 15

16. 21

17. 7

18. 4

19. 8

20. 15

21. 10

22. 35

23. 18

24. 45

25. 84

26. $\frac{5}{20}, \frac{6}{24}, \frac{7}{28}, \frac{8}{32}$

27. $\frac{10}{15}, \frac{12}{18}, \frac{14}{21}, \frac{16}{24}$

28. $\frac{15}{25}, \frac{18}{30}, \frac{21}{35}, \frac{24}{40}$

29. $\frac{20}{35}, \frac{24}{42}, \frac{28}{49}, \frac{32}{56}$

30. $\frac{45}{40}, \frac{54}{48}, \frac{63}{56}, \frac{72}{64}$

31. $\frac{25}{20}, \frac{30}{24}, \frac{35}{28}, \frac{40}{32}$

32. $\frac{10}{5}, \frac{12}{6}, \frac{14}{7}, \frac{16}{8}$

33. $\frac{5}{9}$

34. $\frac{7}{11}$

35. $\frac{9}{11}$

Day 2

1. 2, $\frac{4}{5}$
2. 4, $\frac{2}{3}$
3. 7, $\frac{3}{4}$
4. 3, $\frac{2}{3}$
5. 7, $\frac{6}{7}$
6. 2, $\frac{5}{7}$
7. 3, $\frac{8}{9}$
8. 2, $\frac{4}{5}$
9. 12, $\frac{2}{3}$
10. 12, $\frac{3}{5}$
11. 2, $\frac{16}{120}$
12. 3, $\frac{4}{7}$
13. 4, $\frac{28}{20}$
14. 6, $\frac{3}{4}$
15. 4, $\frac{24}{28}$
16. $\frac{1}{2}$
17. $\frac{1}{4}$
18. $\frac{3}{5}$
19. $\frac{3}{4}$
20. $\frac{1}{4}$
21. $\frac{7}{9}$
22. $\frac{2}{5}$
23. $\frac{3}{8}$
24. $\frac{3}{8}$
25. $\frac{2}{3}$
26. $\frac{5}{8}$
27. $\frac{1}{8}$
28. $\frac{7}{8}$
29. $\frac{2}{3}$
30. $\frac{5}{6}$
31. $\frac{3}{4}$
32. $\frac{5}{6}$
33. $\frac{6}{7}$
34. $\frac{2}{3}$
35. $\frac{3}{4}$
36. five eighths
37. nine tenths
38. four sevenths
39. seven sixteenths
40. fourteen fifteenths
41. eleven twentieths

Day 2 (continued)

42. six and one fourth

43. nine and three fifths

44. one and eleven twelfths

45. four and one half

46. $\frac{5}{12}, \frac{25}{60}$

47. $\frac{30}{54}, \frac{15}{27}$

48. $\frac{12}{36}, \frac{1}{3}$

49. $\frac{5}{10}, \frac{25}{50}$

50. $\frac{12}{42}, \frac{2}{7}$

51. $\frac{42}{98}, \frac{21}{49}$

Day 3

1. $\frac{5}{12}$
2. $\frac{3}{8}$
3. $\frac{3}{4}$, $\frac{6}{8}$
4. $\frac{1}{3}$, $\frac{2}{6}$
5. $\frac{1}{8}$
6. $\frac{4}{8}$ or $\frac{1}{2}$
7. $1\frac{1}{4}$
8. $\frac{1}{4}$
9. numerator
10. 52
11. 35
12. 88
13. 15
14. $\frac{6}{10}$, $\frac{9}{15}$, $\frac{12}{20}$, $\frac{15}{25}$
15. 2
16. 20
17. 28
18. 4
19. 1
20. 250
21. $\frac{1}{8}$
22. $\frac{1}{3}$
23. $\frac{3}{4}$
24. $\frac{2}{11}$
25. $\frac{4}{5}$
26. eleven twelfths
27. five and three eights
28. seven sixteenths
29. $\frac{14}{16}$, $\frac{21}{24}$
30. $\frac{21}{49}$, $\frac{42}{98}$

Day 4

1. $1\frac{2}{5}$
2. $1\frac{5}{8}$
3. $1\frac{9}{16}$
4. $1\frac{7}{12}$
5. $1\frac{3}{10}$
6. $1\frac{7}{8}$
7. $4\frac{1}{2}$
8. $3\frac{1}{4}$
9. $3\frac{1}{7}$
10. $3\frac{5}{9}$
11. $4\frac{5}{6}$
12. $5\frac{7}{12}$
13. $1\frac{1}{2}$
14. $1\frac{3}{4}$
15. $1\frac{1}{2}$
16. $1\frac{2}{5}$
17. $1\frac{3}{4}$
18. $1\frac{2}{3}$
19. $2\frac{1}{3}$
20. $2\frac{1}{4}$
21. $2\frac{1}{2}$
22. $3\frac{1}{2}$
23. $2\frac{1}{2}$
24. $2\frac{1}{4}$
25. $5\frac{2}{3}$
26. $3\frac{2}{3}$
27. $3\frac{1}{3}$
28. $2\frac{1}{4}$
29. $2\frac{1}{2}$
30. $4\frac{1}{3}$
31. $30\frac{5}{8}$ mpg
32. $14\frac{7}{10}$ mpg
33. $24\frac{11}{12}$ mpg
34. $20\frac{6}{11}$ mpg
35. $22\frac{3}{7}$ mpg
36. $13\frac{9}{17}$ mpg
37. $1\frac{2}{3}$
38. $3\frac{1}{2}$

(Continued)

39. $1\frac{1}{4}$

40. $2\frac{1}{2}$

41. $2\frac{3}{4}$

42. $1\frac{3}{5}$

43. $1\frac{1}{8}$

44. 1

45. $1\frac{4}{5}$

46. 3

47. $1\frac{1}{6}$

48. $3\frac{2}{3}$

49. $2\frac{1}{4}$

50. $1\frac{3}{8}$

51. $2\frac{1}{3}$

52. $4\frac{1}{2}$

53. $2\frac{2}{3}$

54. $1\frac{5}{8}$

55. $4\frac{1}{6}$

56. 7

57. 5

58. $3\frac{1}{3}$

59. 0

60. $9\frac{1}{2}$

Day 5

1. $\frac{8}{12}, \frac{3}{12}$
2. $\frac{20}{36}, \frac{21}{36}$
3. $\frac{15}{36}, \frac{14}{36}$
4. $\frac{2}{18}, \frac{15}{18}$
5. $\frac{63}{72}, \frac{40}{72}$
6. $\frac{10}{15}, \frac{3}{15}$
7. $\frac{5}{8}, \frac{4}{8}$
8. $\frac{3}{12}, \frac{5}{12}$
9. $\frac{25}{30}, \frac{21}{30}$
10. $\frac{6}{10}, \frac{7}{10}$
11. $\frac{7}{100}, \frac{45}{100}$
12. $\frac{40}{56}, \frac{7}{56}$
13. $>$
14. $>$
15. $<$
16. $<$
17. $>$
18. $>$
19. $<$
20. $>$
21. $<$
22. $<$
23. $<$
24. $<$
25. $>$
26. $>$
27. $<$
28. $<$
29. $>$
30. $<$
31. $<$
32. $>$
33. $<$
34. $>$
35. $<$
36. $>$
37. $>$
38. $=$
39. $<$
40. $<$
41. $<$
42. $=$
43. $>$
44. $>$

Day 6

1. $\frac{2}{5}, \frac{3}{7}, \frac{1}{2}$
2. $\frac{1}{4}, \frac{3}{8}, \frac{6}{7}$
3. $\frac{7}{11}, \frac{5}{7}, \frac{63}{77}$
4. $\frac{2}{3}, \frac{4}{5}, \frac{5}{6}, \frac{27}{30}$
5. $\frac{6}{5}, \frac{4}{3}, \frac{3}{2}$
6. $\frac{1}{6}, \frac{5}{12}, \frac{4}{9}$
7. $\frac{4}{5}, \frac{2}{3}, \frac{1}{2}$
8. $\frac{5}{12}, \frac{3}{16}, \frac{1}{8}$
9. $3\frac{4}{5}, 3\frac{2}{3}, 1\frac{3}{20}$
10. $1\frac{11}{12}, 1\frac{3}{8}, 1\frac{1}{18}$
11. $<$
12. $<$
13. $<$
14. $<$
15. $<$
16. $<$
17. $=$
18. $>$

Day 7

1. $\frac{5}{3}$, $\frac{16}{16}$
2. $1\frac{1}{8}$
3. 3
4. $3\frac{3}{17}$
5. $6\frac{1}{3}$
6. 0
7. $3\frac{1}{2}$
8. $1\frac{3}{5}$
9. $2\frac{7}{10}$
10. $\frac{63}{72}$, $\frac{32}{72}$
11. $\frac{25}{30}$, $\frac{27}{30}$
12. $\frac{28}{48}$, $\frac{9}{48}$
13. $\frac{4}{8}$, $\frac{3}{8}$
14. >
15. <
16. >
17. =
18. =
19. =
20. =
21. <
22. <
23. <
24. <
25. <
26. $\frac{3}{4}$, $\frac{6}{10}$, $\frac{1}{2}$
27. $\frac{5}{6}$, $\frac{7}{12}$, $\frac{4}{9}$
28. $3\frac{2}{3}$, $4\frac{1}{2}$, 5
29. $\frac{9}{8}$, $\frac{7}{6}$, $\frac{5}{4}$
30. $\frac{1}{2}$, $\frac{17}{30}$, $\frac{3}{5}$, $\frac{2}{3}$

Day 8

1. $\frac{3}{7}$
2. $\frac{4}{11}$
3. $\frac{5}{9}$
4. $\frac{8}{13}$
5. $\frac{4}{7}$
6. $\frac{4}{9}$
7. $\frac{5}{11}$
8. $\frac{2}{3}$
9. $\frac{1}{2}$
10. 0
11. 1
12. $\frac{12}{13}$
13. $\frac{9}{17}$
14. 1
15. $\frac{1}{13}$
16. 0
17. $2\frac{1}{3}$
18. $1\frac{2}{3}$
19. $\frac{2}{11}$
20. $\frac{1}{2}$
21. $1\frac{3}{5}$
22. $\frac{3}{4}$
23. $\frac{3}{7}$
24. $\frac{1}{7}$
25. $1\frac{3}{11}$
26. 2
27. $\frac{11}{17}$
28. 2
29. $1\frac{2}{7}$
30. 2
31. $\frac{7}{13}$
32. 1
33. $\frac{3}{8}$
34. $\frac{3}{10}$
35. $\frac{6}{11}$
36. $\frac{2}{9}$
37. $\frac{4}{15}$
38. $\frac{1}{12}$
39. $\frac{7}{16}$
40. $\frac{9}{32}$
41. $\frac{1}{2}$
42. $\frac{2}{3}$
43. $\frac{3}{5}$
44. $\frac{1}{3}$
45. $\frac{3}{4}$
46. $\frac{3}{8}$
47. $\frac{2}{3}$
48. $\frac{4}{5}$
49. $\frac{2}{3}$
50. $\frac{5}{12}$
51. $\frac{5}{8}$
52. $\frac{3}{7}$
53. $1\frac{2}{5}$
54. $1\frac{4}{7}$
55. 1
56. 1
57. $1\frac{2}{9}$
58. $1\frac{1}{3}$
59. $1\frac{3}{5}$
60. $1\frac{1}{4}$
61. $1\frac{2}{3}$
62. $1\frac{1}{2}$
63. $1\frac{1}{4}$
64. $1\frac{3}{8}$

Day 9 (Part 1)

1. $\frac{3}{8}$
2. $\frac{7}{9}$
3. $\frac{5}{6}$
4. $\frac{15}{28}$
5. $\frac{5}{12}$
6. $\frac{13}{24}$
7. $1\frac{1}{2}$
8. $1\frac{5}{12}$
9. $\frac{1}{2}$
10. $\frac{7}{10}$
11. $\frac{7}{12}$
12. $\frac{28}{33}$
13. $\frac{7}{20}$
14. $\frac{5}{6}$
15. $1\frac{1}{4}$
16. $1\frac{1}{5}$
17. $\frac{5}{8}$
18. $\frac{4}{5}$
19. $\frac{17}{24}$
20. $\frac{61}{72}$
21. $\frac{7}{18}$
22. $\frac{13}{15}$
23. $1\frac{7}{36}$
24. $1\frac{5}{8}$

Part 2

1. $\frac{1}{6}$
2. $\frac{5}{21}$
3. $\frac{5}{9}$
4. $\frac{13}{24}$
5. $\frac{4}{15}$
6. $\frac{1}{12}$
7. $\frac{2}{3}$
8. $\frac{1}{15}$
9. $\frac{7}{60}$
10. $\frac{1}{8}$
11. $\frac{2}{9}$
12. $\frac{5}{24}$
13. $\frac{1}{18}$
14. $\frac{1}{4}$
15. $\frac{1}{12}$
16. $\frac{1}{8}$
17. $\frac{7}{16}$
18. $\frac{31}{64}$
19. $\frac{11}{24}$
20. $\frac{13}{36}$
21. $\frac{7}{22}$
22.

$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$
$\frac{1}{3}$	$\frac{1}{6}$	$\frac{1}{2}$
$\frac{7}{12}$	$\frac{2}{3}$	$1\frac{1}{4}$

23.

$\frac{5}{9}$	$\frac{1}{3}$	$\frac{8}{9}$
$\frac{5}{12}$	$\frac{5}{12}$	$\frac{5}{6}$
$\frac{35}{36}$	$\frac{3}{4}$	$1\frac{13}{18}$

Day 10

1. 1
2. $\frac{2}{3}$
3. $\frac{12}{13}$
4. $\frac{4}{5}$
5. $1\frac{1}{3}$
6. $\frac{1}{3}$
7. $\frac{17}{18}$
8. $\frac{5}{6}$
9. $\frac{2}{5}$
10. $\frac{1}{10}$
11. 1
12. $\frac{5}{6}$
13. $\frac{5}{16}$
14. $\frac{3}{4}$
15. $\frac{1}{7}$
16. $1\frac{11}{15}$
17. $1\frac{19}{30}$
18. $\frac{7}{8}$
19. $\frac{7}{12}$
20. $\frac{7}{10}$
21. $1\frac{2}{5}$
22. $1\frac{3}{16}$
23. $\frac{9}{25}$
24. $\frac{1}{6}$
25. $\frac{1}{4}$
26. $\frac{3}{4}$
27. $\frac{17}{25}$
28. $\frac{29}{108}$
29. $\frac{5}{24}$
30. $\frac{5}{36}$

Day 11

1. $7\frac{1}{2}$
2. $11\frac{5}{7}$
3. 12
4. $15\frac{1}{2}$
5. 17
6. $15\frac{3}{4}$
7. $7\frac{3}{4}$
8. $7\frac{1}{6}$
9. 18
10. $14\frac{1}{6}$
11. $14\frac{7}{8}$
12. $19\frac{2}{5}$
13. $11\frac{1}{3}$
14. $8\frac{1}{8}$
15. $3\frac{1}{8}$
16. $20\frac{16}{21}$
17. $18\frac{1}{8}$
18. $29\frac{3}{20}$
19. 9
20. $30\frac{3}{7}$
21. $15\frac{9}{10}$
22. 23
23. 43
24. $19\frac{5}{8}$
25.

2	$\frac{2}{5}$	$2\frac{2}{5}$
4	$\frac{1}{5}$	$4\frac{1}{5}$
6	$\frac{3}{5}$	$6\frac{3}{5}$

26.

3	$\frac{1}{4}$	$3\frac{1}{4}$
5	$\frac{1}{2}$	$5\frac{1}{2}$
8	$\frac{3}{4}$	$8\frac{3}{4}$

27.

6	$\frac{1}{4}$	$6\frac{1}{4}$
10	$\frac{1}{2}$	$10\frac{1}{2}$
16	$\frac{3}{4}$	$16\frac{3}{4}$

28. $22\frac{19}{24}$
29. $24\frac{43}{60}$
30. $24\frac{13}{15}$
31. $20\frac{1}{12}$
32. $35\frac{2}{15}$

Day 12

1. $6\frac{1}{2}$
2. $9\frac{5}{12}$
3. $6\frac{2}{3}$
4. $3\frac{1}{3}$
5. $8\frac{3}{4}$
6. $11\frac{3}{8}$
7. $7\frac{2}{9}$
8. $4\frac{1}{3}$
9. $3\frac{5}{8}$
10. $1\frac{3}{5}$
11. $4\frac{3}{4}$
12. $3\frac{3}{8}$
13. $13\frac{3}{7}$
14. $3\frac{3}{4}$
15. $2\frac{2}{5}$
16. $\frac{2}{3}$
17. $1\frac{7}{8}$
18. $6\frac{2}{15}$
19. $3\frac{5}{24}$
20. $8\frac{7}{48}$
21. $3\frac{3}{20}$
22. $18\frac{17}{45}$
23. $19\frac{5}{36}$

24.

3	$\frac{5}{9}$	$3\frac{5}{9}$
1	$\frac{1}{9}$	$1\frac{1}{9}$
2	$\frac{4}{9}$	$2\frac{4}{9}$

25.

9	$\frac{2}{3}$	$9\frac{2}{3}$
4	$\frac{1}{2}$	$4\frac{1}{2}$
5	$\frac{1}{6}$	$5\frac{1}{6}$

26.

12	$\frac{5}{6}$	$12\frac{5}{6}$
7	$\frac{3}{4}$	$7\frac{3}{4}$
5	$\frac{1}{12}$	$5\frac{1}{12}$

Day 13

1. $3\frac{7}{8}$
2. $9\frac{5}{12}$
3. $6\frac{1}{6}$
4. $9\frac{1}{2}$
5. $10\frac{1}{4}$
6. $14\frac{20}{21}$
7. $9\frac{19}{80}$
8. $62\frac{1}{90}$
9. $21\frac{23}{50}$
10. $2\frac{19}{20}$
11. $1\frac{10}{21}$
12. $4\frac{13}{15}$
13. $\frac{7}{10}$
14. $3\frac{13}{42}$
15. $2\frac{7}{12}$
16. $28\frac{41}{60}$
17. $4\frac{7}{12}$
18. $8\frac{7}{9}$

Day 14

1. $8\frac{1}{2}$
2. 17
3. $8\frac{1}{2}$
4. $3\frac{3}{5}$
5. $9\frac{4}{5}$
6. $11\frac{3}{8}$
7. $15\frac{7}{40}$
8. $28\frac{1}{12}$
9. $22\frac{4}{45}$
10. $14\frac{3}{4}$
11. $10\frac{1}{16}$
12. $7\frac{29}{48}$
13. $9\frac{3}{25}$
14. $36\frac{25}{56}$
15. 27
16. $4\frac{1}{2}$
17. $1\frac{1}{2}$
18. $8\frac{3}{4}$
19. $55\frac{2}{5}$
20. $16\frac{1}{3}$
21. $1\frac{11}{16}$
22. $28\frac{5}{36}$
23. $6\frac{2}{15}$
24. $2\frac{1}{8}$
25. $4\frac{3}{20}$
26. $\frac{17}{24}$
27. $1\frac{8}{9}$
28. $14\frac{1}{2}$
29. $\frac{25}{28}$
30. $3\frac{35}{48}$

Day 15

1. 2
2. 6
3. 15
4. 12
5. $\frac{1}{3}$
6. $\frac{4}{5}$
7. $\frac{3}{4}$
8. $\frac{2}{3}$
9. $\frac{5}{6}$
10. $1\frac{3}{4}$
11. $3\frac{2}{3}$
12. $1\frac{2}{3}$
13. $2\frac{4}{7}$
14. $1\frac{3}{5}$
15. $\frac{3}{5}$
16. $\frac{1}{3}$
17. $1\frac{1}{5}$
18. $1\frac{1}{2}$
19. $7\frac{2}{3}$
20. $9\frac{1}{2}$
21. $16\frac{2}{7}$
22. $16\frac{1}{3}$
23. $\frac{2}{3}$
24. $\frac{1}{4}$
25. $\frac{1}{2}$
26. $\frac{2}{5}$
27. $6\frac{2}{5}$
28. $3\frac{1}{3}$
29. $3\frac{2}{3}$
30. $1\frac{2}{5}$
31. $\frac{8}{15}$
32. $\frac{1}{2}$
33. $1\frac{5}{18}$
34. $1\frac{3}{16}$
35. $7\frac{5}{6}$
36. $14\frac{1}{2}$
37. $27\frac{1}{24}$
38. $13\frac{17}{24}$
39. $\frac{1}{12}$
40. $\frac{1}{4}$
41. $\frac{13}{40}$
42. $\frac{5}{9}$
43. $5\frac{3}{8}$
44. $4\frac{1}{15}$
45. $4\frac{13}{18}$
46. $7\frac{3}{10}$
47. <
48. >
49. =
50. >
51. $\frac{7}{8}$, $\frac{19}{24}$, $\frac{3}{4}$
52. $\frac{7}{8}$, $\frac{9}{16}$, $\frac{3}{6}$
53. six and one twelfth
54. thirteen sixteenths
55. W $\frac{3}{10}$
    Z $\frac{8}{10}$ or $\frac{4}{5}$

Day 16

1. $\frac{8}{17}$
2. $\frac{7}{12}$
3. $\frac{3}{16}$
4. $\frac{13}{16}$
5. 3
6. 9
7. 80
8. 34
9. 100
10. 27
11. $\frac{4}{9}$
12. $\frac{1}{5}$
13. $\frac{3}{4}$
14. $\frac{1}{2}$
15. $5\frac{2}{3}$
16. 10
17. $3\frac{6}{11}$
18. $4\frac{3}{5}$
19. >
20. =
21. >
22. <
23. =
24. <
25. eight and one third
26. sixteen twenty fifths
27. five fortieths
28. $\frac{7}{8}, \frac{3}{4}, \frac{5}{7}$
29. $4\frac{1}{3}, 4\frac{3}{10}, 4\frac{1}{5}$
30. $\frac{2}{5}, \frac{1}{3}, \frac{3}{10}, \frac{4}{15}$
31. $\frac{6}{7}$
32. 1
33. $1\frac{2}{9}$
34. $\frac{4}{5}$
35. $\frac{37}{56}$
36. $1\frac{13}{40}$
37. $1\frac{5}{12}$
38. $\frac{7}{18}$
39. $3\frac{3}{5}$
40. 10
41. $29\frac{7}{24}$
42. $11\frac{3}{8}$
43. $10\frac{3}{4}$
44. $41\frac{2}{3}$
45. $16\frac{7}{16}$
46. $\frac{1}{4}$
47. $\frac{31}{50}$
48. $\frac{3}{8}$
49. $\frac{7}{24}$
50. $\frac{1}{6}$
51. $\frac{1}{4}$
52. $6\frac{1}{4}$
53. $1\frac{1}{10}$
54. $8\frac{11}{16}$
55. $4\frac{23}{72}$
56. $1\frac{7}{9}$
57. $14\frac{23}{24}$
58. $20\frac{23}{24}$
59. $3\frac{3}{4}$
60. $\frac{6}{7}$

Day 17

1. $\frac{1}{3}$
2. $\frac{1}{6}$
3. $\frac{4}{9}$
4. $\frac{3}{10}$

1. $\frac{3}{40}$
2. $\frac{4}{21}$
3. $\frac{8}{45}$
4. $\frac{1}{18}$
5. $\frac{1}{8}$
6. $\frac{1}{56}$
7. $\frac{1}{100}$
8. $\frac{3}{20}$
9. $\frac{2}{21}$
10. $\frac{3}{56}$
11. $\frac{4}{15}$
12. $\frac{4}{15}$
13. $\frac{21}{80}$
14. $\frac{9}{20}$
15. $\frac{8}{63}$
16. $\frac{35}{48}$
17. $\frac{27}{80}$
18. $\frac{15}{32}$
19. $\frac{21}{64}$
20. $\frac{1}{5}$
21. $\frac{1}{4}$
22. $\frac{2}{7}$
23. $\frac{5}{11}$
24. $\frac{3}{10}$
25. $\frac{4}{9}$
26. $\frac{3}{11}$
27. $\frac{5}{8}$
28. $\frac{2}{15}$
29. $\frac{9}{40}$
30. $\frac{8}{45}$
31. $\frac{1}{6}$
32. $\frac{7}{80}$
33. 1
34. $\frac{36}{245}$
35. 1
36. $\frac{63}{1000}$
37. $\frac{5}{16}$
38. $\frac{7}{20}$
39. $\frac{20}{99}$
40. $\frac{9}{64}$
41. $\frac{15}{56}$
42. $\frac{35}{216}$

Day 18 (Part 1)

1. $2\frac{5}{8}$
2. 1
3. 0
4. 4
5. 3
6. $8\frac{4}{7}$
7. 2
8. $1\frac{7}{8}$
9. 30
10. 0
11. 0
12. $10\frac{1}{2}$
13. $33\frac{1}{2}$
14. $2\frac{1}{10}$
15. $18\frac{6}{13}$

(Part 2)

1. 11
2. 7
3. 17
4. 7
5. 11
6. 29
7. $\frac{15}{8}$
8. $\frac{19}{12}$
9. $\frac{5}{2}$
10. $\frac{14}{5}$
11. $\frac{29}{10}$
12. $\frac{29}{8}$
13. $\frac{11}{3}$
14. $\frac{32}{9}$
15. $\frac{19}{4}$
16. $\frac{17}{3}$
17. $\frac{55}{8}$
18. $\frac{35}{3}$
19. $\frac{57}{8}$
20. $\frac{25}{2}$
21. $\frac{17}{4}$
22. $\frac{19}{2}$
23. $\frac{77}{16}$
24. $\frac{87}{16}$
25. $\frac{107}{10}$
26. $\frac{47}{3}$

Day 19

1. $\frac{27}{8}$
2. $\frac{25}{4}$
3. $\frac{58}{7}$
4. $\frac{31}{3}$
5. $\frac{27}{10}$
6. $\frac{43}{9}$
7. $\frac{101}{6}$
8. $\frac{141}{20}$
9. $\frac{13}{3}$
10. $\frac{19}{2}$
11. $\frac{3}{20}$
12. $\frac{21}{40}$
13. $\frac{7}{11}$
14. $\frac{1}{3}$
15. $\frac{20}{99}$
16. $\frac{4}{15}$
17. $\frac{7}{72}$
18. $\frac{3}{10}$
19. $\frac{1}{285}$
20. $\frac{4}{5}$
21. 9
22. 4
23. $\frac{5}{8}$
24. $2\frac{2}{5}$
25. 3
26. 0
27. 5
28. 2
29. $\frac{7}{18}$
30. $\frac{1}{3}$

Day 20

1. $1\frac{2}{3}$
2. $2\frac{1}{3}$
3. $2\frac{8}{9}$
4. 36
5. $19\frac{1}{3}$
6. $2\frac{26}{35}$
7. 12
8. $3\frac{1}{2}$
9. 65
10. 5
11. $\frac{7}{15}$
12. $\frac{7}{11}$
13. $4\frac{31}{36}$
14. $2\frac{5}{14}$
15. $1\frac{31}{50}$
16. $1\frac{59}{81}$
17. $7\frac{7}{12}$
18. $1\frac{19}{66}$

Day 21

1. 2
2. $\frac{2}{3}$
3. $\frac{1}{9}$
4. $\frac{3}{5}$
5. $1\frac{1}{3}$
6. $\frac{2}{3}$
7. $\frac{2}{3}$
8. $\frac{4}{15}$
9. $2\frac{1}{4}$
10. 1
11. $\frac{6}{7}$
12. $\frac{9}{16}$
13. $2\frac{5}{8}$
14. $\frac{4}{7}$
15. 80
16. $2\frac{4}{7}$
17. <
18. >
19. >
20. >
21. <
22. >
23. 2
24. $4\frac{1}{2}$
25. $2\frac{5}{6}$
26. $4\frac{1}{2}$
27. 24
28. 9
29. 10
30. $5\frac{5}{16}$
31. 14
32. $24\frac{1}{2}$
33. $17\frac{1}{2}$
34. $7\frac{1}{2}$

Day 22

1. $\frac{1}{6}$
2. $\frac{2}{15}$
3. $\frac{3}{8}$
4. $\frac{8}{9}$
5. $\frac{1}{2}$
6. $\frac{10}{21}$
7. $\frac{3}{10}$
8. $\frac{1}{2}$
9. $1\frac{11}{20}$
10. $53\frac{1}{3}$
11. $7\frac{1}{8}$
12. $2\frac{2}{3}$
13. 15
14. $4\frac{2}{7}$
15. 8
16. 10
17. $9\frac{1}{3}$
18. 35
19. $67\frac{1}{2}$
20. $9\frac{3}{5}$
21. 45
22. $28\frac{49}{72}$
23. $35\frac{25}{42}$
24. 6
25. 32
26. 76
27. $28\frac{7}{8}$
28. $63\frac{1}{4}$
29. 76
30. $3\frac{33}{35}$

Day 23

1. $\frac{3}{2}$
2. $\frac{5}{7}$
3. $\frac{1}{6}$
4. 8
5. $\frac{4}{9}$
6. 10
7. $\frac{23}{15}$
8. $\frac{11}{3}$
9. $\frac{3}{8}$
10. $\frac{7}{4}$
11. $\frac{5}{23}$
12. $\frac{62}{51}$
13. $\frac{6}{5}$
14. $\frac{1}{11}$
15. $\frac{5}{4}$
16. $\frac{25}{71}$
17. $\frac{67}{39}$
18. $\frac{1}{17}$
19. $\frac{3}{5}$
20. $\frac{1}{9}$
21. $\frac{5}{21}$
22. $\frac{8}{15}$
23. $\frac{8}{127}$
24. $\frac{6}{19}$
25. $\frac{2}{17}$
26. $\frac{4}{9}$
27. $\frac{1}{12}$
28. $\frac{11}{20}$
29. $\frac{1}{3}$
30. 2
31. 3
32. 3
33. $1\frac{1}{8}$
34. $\frac{5}{24}$
35. $\frac{4}{5}$
36. $13\frac{1}{3}$
37. $12\frac{1}{2}$
38. $2\frac{2}{9}$
39. $\frac{3}{20}$
40. 0
41. $1\frac{2}{3}$
42. 12
43. $1\frac{1}{5}$
44. 1
45. $\frac{1}{2}$
46. 2
47. $\frac{5}{6}$
48. $1\frac{1}{5}$
49. true
50. true
51. true
52. true
53. true
54. true
55. 12
56. 9
57. $\frac{1}{6}$
58. $\frac{2}{5}$
59. 12
60. 28
61. $\frac{1}{20}$
62. $\frac{3}{20}$

Day 24

1. $\frac{1}{2}$
2. $\frac{4}{5}$
3. $\frac{5}{12}$
4. $\frac{4}{9}$
5. $\frac{2}{3}$
6. $\frac{1}{2}$
7. $\frac{7}{12}$
8. $1\frac{2}{5}$
9. $1\frac{3}{20}$
10. $\frac{3}{4}$
11. $2\frac{14}{25}$
12. $\frac{1}{6}$
13. $\frac{21}{40}$
14. $1\frac{7}{8}$
15. 6
16. $3\frac{7}{11}$
17. $2\frac{11}{12}$
18. $3\frac{3}{7}$
19. $1\frac{1}{4}$
20. $\frac{9}{16}$
21. $2\frac{2}{3}$
22. $3\frac{1}{4}$
23. $\frac{1}{2}$
24. 2
25. $1\frac{7}{8}$
26. 1
27. $2\frac{2}{7}$
28. $2\frac{1}{6}$
29. $1\frac{4}{9}$
30. $4\frac{2}{7}$

Day 25

1. .25
2. .3125
3. $.\overline{6}$
4. .8
5. 10.5
6. 2.625
7. 4.9
8. .55
9. $.\overline{5}$
10. .14
11. $.8\overline{3}$
12. .1875
13. $.\overline{27}$
14. $3.\overline{1}$
15. .32
16. $.\overline{428571}$
17. $.0\overline{5}$
18. 7.75

Day 26

1. 5 or $\frac{5}{1}$
2. $1\frac{1}{3}$ or $\frac{4}{3}$
3. $1\frac{1}{2}$ or $\frac{3}{2}$
4. $2\frac{1}{2}$ or $\frac{5}{2}$
5. $1\frac{19}{50}$ or $\frac{50}{31}$
6. 2
7. $1\frac{1}{3}$
8. $1\frac{1}{5}$
9. $6\frac{2}{3}$
10. $3\frac{1}{3}$
11. $1\frac{1}{2}$
12. $2\frac{2}{3}$
13. $3\frac{3}{5}$
14. $1\frac{1}{14}$
15. $\frac{4}{5}$
16. $\frac{7}{10}$
17. 10
18. $1\frac{1}{2}$
19. $\frac{1}{2}$
20. .7
21. .6
22. 2.25
23. $.\overline{3}$
24. $4.\overline{2}$
25. $3.1\overline{6}$
26. $.4\overline{6}$
27. 2.375
28. 5.5625
29. $.\overline{45}$
30. 1.85

Day 27

1. .25
2. .4
3. .375
4. 1.25
5. $.\overline{6}$
6. $.8\overline{3}$
7. $.\overline{1}$
8. 1.625
9. $\frac{3}{10}$
10. $\frac{3}{10}$
11. 5
12. $\frac{5}{6}$
13. $4\frac{1}{6}$
14. $1\frac{1}{14}$
15. $4\frac{1}{3}$
16. $15\frac{1}{3}$
17. $1\frac{1}{5}$
18. $\frac{7}{12}$
19. $\frac{5}{6}$
20. $2\frac{1}{7}$
21. $\frac{8}{25}$
22. $2\frac{7}{8}$
23. $3\frac{1}{4}$
24. $3\frac{3}{55}$
25. $\frac{3}{5}$
26. $\frac{7}{4}$
27. $\frac{6}{5}$
28. $\frac{5}{8}$
29. 2
30. $\frac{3}{4}$
31. $\frac{1}{11}$
32. $\frac{7}{22}$
33. 1
34. $\frac{7}{2}$
35. $\frac{5}{2}$
36. $\frac{2}{5}$
37. $\frac{4}{7}$
38. 10
39. The reciprocal of the original fraction

Day 28

1. $\frac{5}{2}$
2. $\frac{26}{3}$
3. $\frac{101}{4}$
4. $\frac{103}{6}$
5. $\frac{9}{2}$
6. $\frac{64}{9}$
7. .125
8. .9
9. $.\overline{6}$
10. $2.1\overline{6}$
11. $1.\overline{285714}$
12. 3.8
13. 5
14. $\frac{8}{3}$ or $2\frac{2}{3}$
15. none
16. $\frac{1}{7}$
17. $\frac{16}{137}$
18. 1
19. 1
20. $\frac{8}{19}$
21. false
22. true
23. true
24. false
25. false
26. $\frac{2}{9}$
27. $\frac{1}{6}$
28. $9\frac{1}{3}$
29. $2\frac{1}{3}$
30. $1\frac{1}{4}$
31. $\frac{1}{169}$
32. $40\frac{5}{16}$
33. 38
34. $\frac{1}{4}$
35. $4\frac{2}{3}$
36. $\frac{1}{9}$
37. $9\frac{27}{32}$
38. 66
39. 0
40. $\frac{20}{21}$
41. 3
42. $\frac{1}{10}$
43. $1\frac{1}{5}$
44. $\frac{5}{28}$
45. $18\frac{2}{3}$
46. $1\frac{1}{4}$
47. $\frac{9}{28}$
48. $\frac{63}{95}$
49. $3\frac{7}{16}$
50. $\frac{3}{14}$

APPENDIX B

STAD Materials

Math Scoreboard

Team Summary Sheet

Chart for Base Scores

M A T H SCOREBOARD

Mr. Renner's 2nd Class
Neveln Jr. High

Date: Jan. 16,1984

The results of the first quiz found Def Cat ... with an early lead with 35 points followed by a tough challenge from Def Leppard and Superfriends.

The second quiz was a struggle for some groups but Superfriends put forth a tremendous effort and scored a maximum 40 points! The Fraggles , only 5 points behind the Superfriends on this quiz, had a good comeback to push them from last place to third in overall competition. At present , there is a deadlock for third place with Def Cat ..., The Flower Children, and Fraggles. This should turn out to be an interesting race in the future. SCDM stands alone and must have a supreme cooperative week to score high on the next quizzes and get back in the thick of competition.

Remember: The person who helps others will help himself and the team score.

Results After 2 exams:

Teams	Points
Superfriends	73
Def Leppard	67
Fraggles	64
Flower Children	64
Def Cat ...	64
SCDM	60

High Scorers for teams (9 or 10 points):

Ted Zimmerly
Steve Lister (twice) — Flower Children
Mindie Williams

Rusty Kern (twice)
Leann Swanson — Fraggles

Missy Whitmore
Jenni Carter (twice) — Def Cat
Troy Thorson

Dawn Jepsen(twice)
Marcelo Goldsberry — SCDM
Chris Whitmore

Mike Saner (twice) — Def
Mike Brandenburg (twice) — Leppard

Scott Jones (twice)
Amy Elliot — Superfriends
Angie Aunspach
Dwane Scott (twice)

Team Summary Sheet

Team Name _____

Team Members	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total Team Score														
Transformed Team Score														
Team Standing This Week														
Cumulative Score														
Cumulative Standing														

Quiz Score Sheet

	Date:			Date:			Date:		
	Quiz:			Quiz:			Quiz:		
Student	Base	Quiz Score	Points	Base	Quiz Score	Points	Base	Quiz Score	Points

Quiz Score Sheet

	Date:			Date:			Date:			Date:		
	Quiz:			Quiz:			Quiz:			Quiz:		
Base	Quiz Score	Points	Base	Quiz Score	Points	Base	Quiz Score	Points	Base	Quiz Score	Points

Calculating New Base Scores

To find new base, add student's two quiz scores together and find the total in the column to the left. Find the student's old base score at the top. Follow row and column until they intersect. This number is the new base.

Total of Quiz Scores	Old Base Scores										
	3	4	5	6	7	8	9	10	11	12	13
16	3	3	4	4	4	5	5	5	6	6	6
17	3	4	4	4	5	5	5	6	6	6	7
18	4	4	4	5	5	5	6	6	6	7	7
19	4	4	5	5	5	6	6	6	7	7	7
20	4	5	5	5	6	6	6	7	7	7	8
21	5	5	5	6	6	6	7	7	7	8	8
22	5	5	6	6	6	7	7	7	8	8	8
23	5	6	6	6	7	7	7	8	8	8	9
24	6	6	6	7	7	7	8	8	8	9	9
25	6	6	7	7	7	8	8	8	9	9	9
26	6	7	7	7	8	8	8	9	9	9	10
27	7	7	7	8	8	8	9	9	9	10	10
28	7	7	8	8	8	9	9	9	10	10	10
29	7	8	8	8	9	9	9	10	10	10	11
30	8	8	8	9	9	9	10	10	10	11	11
31	8	8	9	9	9	10	10	10	11	11	11
32	8	9	9	9	10	10	10	11	11	11	12
33	9	9	9	10	10	10	11	11	11	12	12
34	9	9	10	10	10	11	11	11	12	12	12
35	9	10	10	10	11	11	11	12	12	12	13
36	10	10	10	11	11	11	12	12	12	13	13
37	10	10	11	11	11	12	12	12	13	13	13
38	10	11	11	11	12	12	12	13	13	13	14
39	11	11	11	12	12	12	13	13	13	14	14
40	11	11	12	12	12	13	13	13	14	14	14
41	11	12	12	12	13	13	13	14	14	14	15
42	12	12	12	13	13	13	14	14	14	15	15
43	12	12	13	13	13	14	14	14	15	15	15
44	12	13	13	13	14	14	14	15	15	15	16
45	13	13	13	14	14	14	15	15	15	16	16
46	13	13	14	14	14	15	15	15	16	16	16
47	13	14	14	14	15	15	15	16	16	16	17
48	14	14	14	15	15	15	16	16	16	17	17
49	14	14	15	15	15	16	16	16	17	17	17
50	14	15	15	15	16	16	16	17	17	17	18
51	15	15	15	16	16	16	17	17	17	18	18
52	15	15	16	16	16	17	17	17	18	18	18
53	15	16	16	16	17	17	17	18	18	18	19
54	16	16	16	17	17	17	18	18	18	19	19
55	16	16	17	17	17	18	18	18	19	19	19
56	16	17	17	17	18	18	18	19	19	19	20
57	17	17	17	18	18	18	19	19	19	20	20
58	17	17	18	18	18	19	19	19	20	20	20
59	17	18	18	18	19	19	19	20	20	20	21
60	18	18	18	19	19	19	20	20	20	21	21

Old Base Scores

Total of Quiz Scores	14	15	16	17	18	19	20	21	22	23	24	25
16	7	7	7	8	8	8	9	9	9	10	10	10
17	7	7	8	8	8	9	9	9	10	10	10	11
18	7	8	8	8	9	9	9	10	10	10	11	11
19	8	8	8	9	9	9	10	10	10	11	11	11
20	8	8	9	9	9	10	10	10	11	11	11	12
21	8	9	9	9	10	10	10	11	11	11	12	12
22	9	9	9	10	10	10	11	11	11	12	12	12
23	9	9	10	10	10	11	11	11	12	12	12	13
24	9	10	10	10	11	11	11	12	12	12	13	13
25	10	10	10	11	11	11	12	12	12	13	13	13
26	10	10	11	11	11	12	12	12	13	13	13	14
27	10	11	11	11	12	12	12	13	13	13	14	14
28	11	11	11	12	12	12	13	13	13	14	14	14
29	11	11	12	12	12	13	13	13	14	14	14	15
30	11	12	12	12	13	13	13	14	14	14	15	15
31	12	12	12	13	13	13	14	14	14	15	15	15
32	12	12	13	13	13	14	14	14	15	15	15	16
33	12	13	13	13	14	14	14	15	15	15	16	16
34	13	13	13	14	14	14	15	15	15	16	16	16
35	13	13	14	14	14	15	15	15	16	16	16	17
36	13	14	14	14	15	15	15	16	16	16	17	17
37	14	14	14	15	15	15	16	16	16	17	17	17
38	14	14	15	15	15	16	16	16	17	17	17	18
39	14	15	15	15	16	16	16	17	17	17	18	18
40	15	15	15	16	16	16	17	17	17	18	18	18
41	15	15	16	16	16	17	17	17	18	18	18	19
42	15	16	16	16	17	17	17	18	18	18	19	19
43	16	16	16	17	17	17	18	18	18	19	19	19
44	16	16	17	17	17	18	18	18	19	19	19	20
45	16	17	17	17	18	18	18	19	19	19	20	20
46	17	17	17	18	18	18	19	19	19	20	20	20
47	17	17	18	18	18	19	19	19	20	20	20	21
48	17	18	18	18	19	19	19	20	20	20	21	21
49	18	18	18	19	19	19	20	20	20	21	21	21
50	18	18	19	19	19	20	20	20	21	21	21	22
51	18	19	19	19	20	20	20	21	21	21	22	22
52	19	19	19	20	20	20	21	21	21	22	22	22
53	19	19	20	20	20	21	21	21	22	22	22	23
54	19	20	20	20	21	21	21	22	22	22	23	23
55	20	20	20	21	21	21	22	22	22	23	23	23
56	20	20	21	21	21	22	22	22	23	23	23	24
57	20	21	21	21	22	22	22	23	23	23	24	24
58	21	21	21	22	22	22	23	23	23	24	24	24
59	21	21	22	22	22	23	23	23	24	24	24	25
60	21	22	22	22	23	23	23	24	24	24	25	25

APPENDIX C

Fraction Concept Test

Fraction Pretest

Fraction Posttest

Answers to Tests

Item Analysis

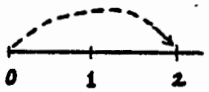
Fraction Concept Test

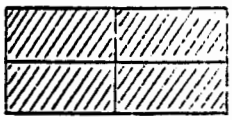
WHICH PICTURES SHOW A WHOLE UNIT MARKED? CIRCLE THEM.

① 

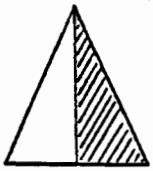
② 

③ 

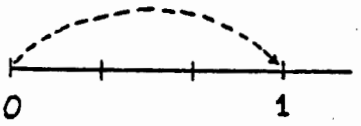
④ 

⑤ 

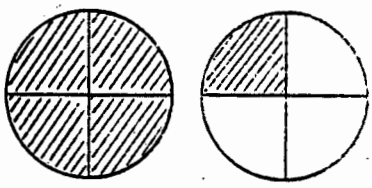
HOW MUCH IS MARKED? WRITE WORD NAMES.

⑥ 

_____

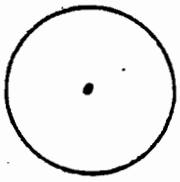
⑦ 

_____

⑧ 

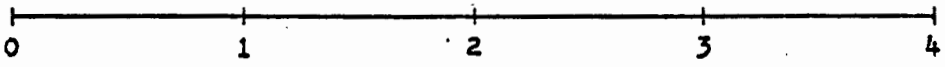
_____

⑨ USE THE CIRCLE UNIT. SHADE IT TO SHOW $\frac{4}{4}$.



⑩ SHADE THIS UNIT TO SHOW $\frac{7}{10}$.

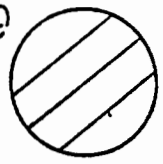
⑪ FIND THE POINTS



(a) PUT A DOT AT $\frac{3}{4}$. MARK IT A.

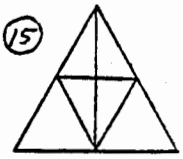
(b) PUT A DOT AT $3\frac{1}{2}$ MARK IT B.

WHICH FIGURES SHOW EQUAL-SIZE PARTS? CIRCLE THEM.

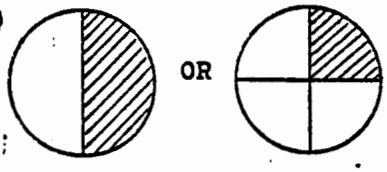
(12) 

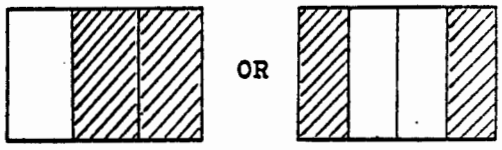
(13) 

(14) 

(15) 

WHICH IS MORE? CIRCLE IT.

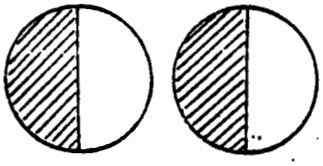
(16) 

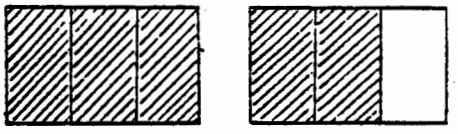
(17) 

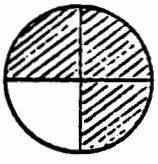
WRITE FRACTIONS FOR WORD NAMES.

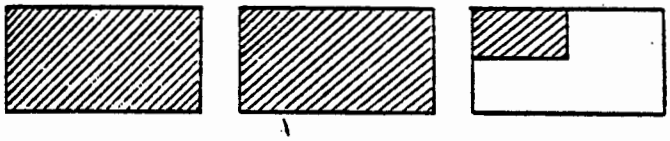
(18) 5 SIXTHS _____ (19) 2 THIRDS _____ (20) 5 HALVES _____ (21) 1 AND 3 FOURTHS _____

HOW MUCH IS MARKED? WRITE THE ANSWER.

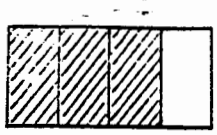
(22)  _____

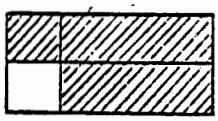
(23)  _____

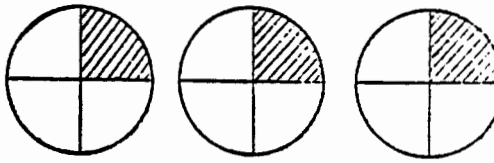
(24)  _____

(25)  _____

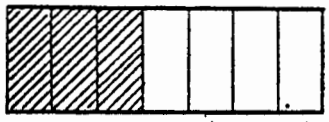
WHICH FIGURES SHOW $\frac{3}{4}$? CIRCLE THEM.

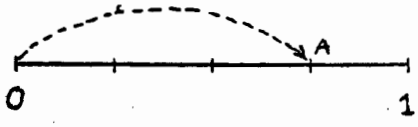
26 

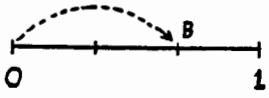
27 

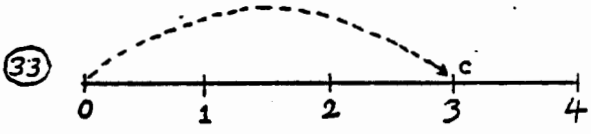
28 

29 

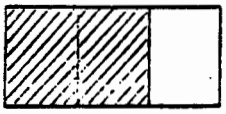
30 

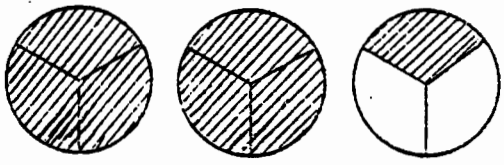
31 

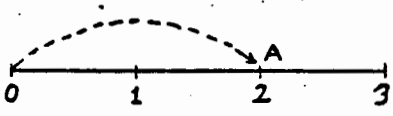
32 

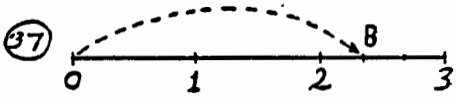
33 

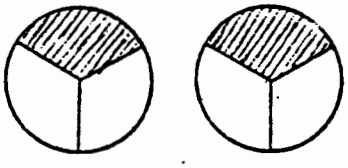
WHICH FIGURES SHOW $2\frac{1}{3}$? CIRCLE THEM.

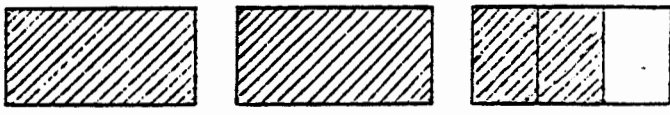
34 

35 

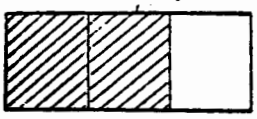
36 

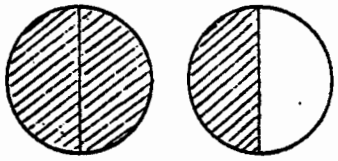
37 

38 

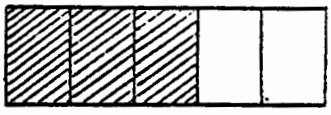
39 

WHICH FIGURES SHOW $\frac{3}{2}$? CIRCLE THEM.

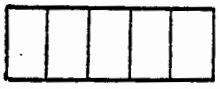
(40) 

(41) 

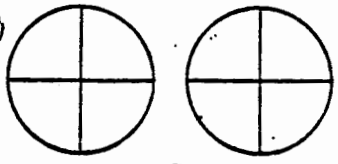
(42) 

(43) 

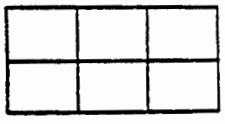
MAKE MARKS ON EACH FIGURE TO SHOW THE NUMBER.

(44) 

$\frac{3}{5}$

(45) 

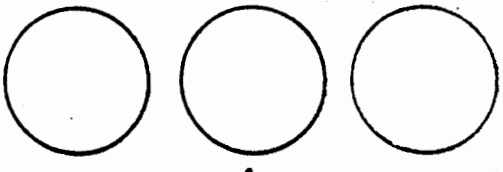
$\frac{5}{4}$

(46) 

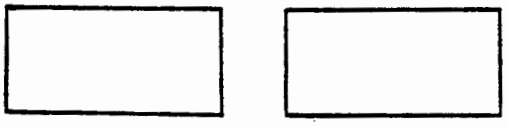
2 SIXTHS

(47) 

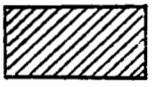
$\frac{2}{2}$

(48) 

$2\frac{1}{2}$

(49) 

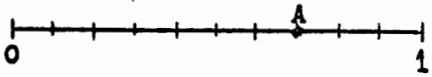
1 UNIT AND 3 FOURTHS OF A UNIT

(50) USE  AS 1 UNIT. DRAW UNITS OR PARTS OF UNIT TO SHOW

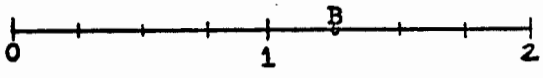
(a) $\frac{3}{3}$ (b) $\frac{5}{3}$

HOW FAR IS IT

(51) FROM 0 TO A? _____



(52) FROM 0 TO B? _____



WRITE WORD NAMES FOR FRACTIONS

(53) $\frac{1}{2}$ _____ (54) $\frac{5}{6}$ _____ (55) $2\frac{1}{2}$ _____

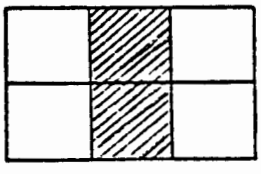
WHICH IS MORE? CIRCLE IT.

(56) $\frac{1}{2}$ or $\frac{1}{4}$ (57) $\frac{3}{5}$ or $\frac{4}{4}$ (58) $\frac{5}{6}$ or $\frac{6}{5}$ (59) $\frac{9}{8}$ or 1

(60) $\frac{4}{3}$ or $\frac{3}{6}$ (61) $\frac{7}{5}$ or $\frac{6}{5}$ (62) $2\frac{1}{4}$ or $2\frac{3}{4}$

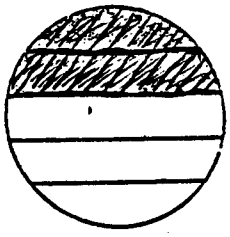
(63) THE FIGURE SHOWS THAT $\frac{1}{3}$ SHOWS THE SAME AMOUNT OF SHADING AS

(a) $\frac{2}{4}$ (b) $\frac{2}{6}$ (c) $\frac{2}{3}$ (d) $\frac{4}{6}$



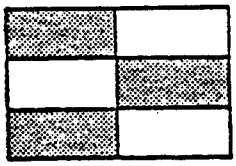
WHAT PART IS SHADED ? CIRCLE THE ANSWER.

(64)



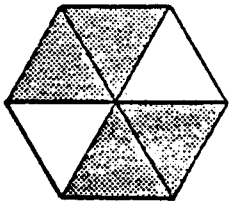
(A) $\frac{1}{5}$
(B) $\frac{2}{5}$
(C) $\frac{3}{5}$
(D) $\frac{4}{5}$
(E) None of these

(65)



(A) $\frac{1}{2}$
(B) $\frac{2}{3}$
(C) $\frac{1}{3}$
(D) $\frac{3}{4}$
(E) None of these

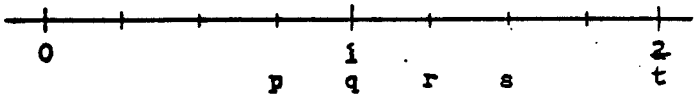
(66)



(A) $\frac{1}{6}$
(B) $\frac{2}{6}$
(C) $\frac{3}{4}$
(D) $\frac{4}{6}$
(E) None of these

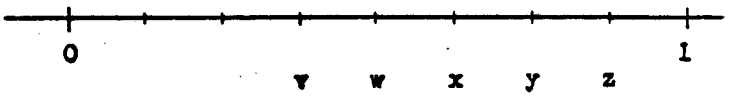
USING THE NUMBER LINE WITH FRACTIONS. CIRCLE THE ANSWER.

(67) WHICH IS $\frac{5}{4}$?



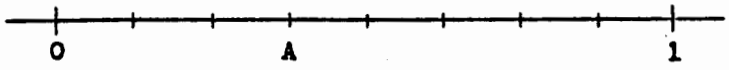
(a) p (b) q (c) r (d) s (e) t

(68) WHICH IS $\frac{3}{4}$?



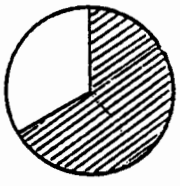
(a) v (b) w (c) x (d) y (e) z

(69) A IS



(a) $\frac{1}{2}$ (b) $\frac{1}{4}$ (c) $\frac{3}{8}$ (d) $\frac{1}{3}$ (e) $\frac{5}{8}$

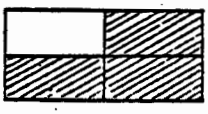
(70)



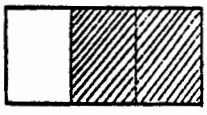
THE SHADED PART OF THIS FIGURE REPRESENTS THE SAME FRACTION AS:

CIRCLE THE ANSWER

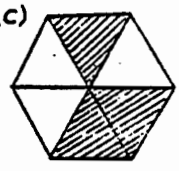
(a)



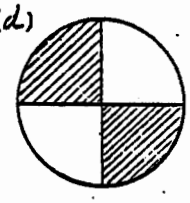
(b)



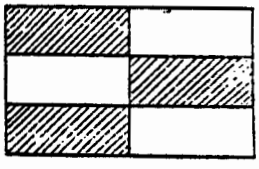
(c)



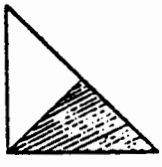
(d)

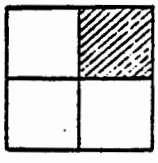


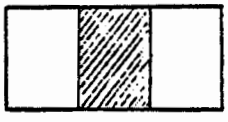
(e)

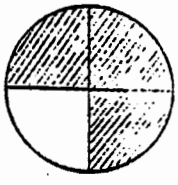


(71) WHICH OF THE FIGURES BELOW IS ONE-THIRD SHADED ? CIRCLE IT.

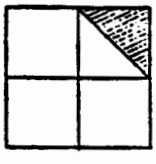








(72) WHAT PART OF THE PICTURE BELOW IS SHADED ?



(73) WHICH ARE MORE THAN 3 FOURTHS ? CIRCLE THE ANSWERS.

(a) 3 fifths (b) 3 halves (c) $\frac{3}{3}$ (d) $\frac{2}{5}$

(74) 4 PEOPLE SHARE 1 CANDY BAR EQUALLY. HOW MUCH DOES EACH ONE GET?

(75) 3 PEOPLE SHARE 2 CANDY BARS EQUALLY. HOW MUCH DOES EACH ONE GET ?

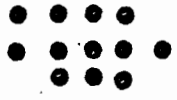
FIND THE SUMS:

(76) $\frac{1}{4} + \frac{1}{4} =$ _____

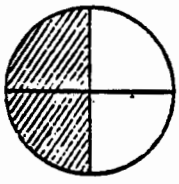
(77) $\frac{3}{5} + \frac{4}{5} =$ _____

(78) $\frac{1}{2} + \frac{1}{4} =$ _____

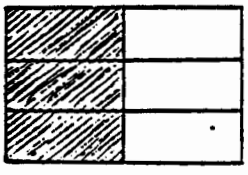
(79) CIRCLE $\frac{1}{4}$



(80) HOW MUCH IS $\frac{1}{2}$ OF THE SHADED PART ? WRITE THE FRACTION.



(81) HOW MUCH IS $\frac{2}{3}$ OF THE SHADED PART ? WRITE THE FRACTION.



Fraction Pretest

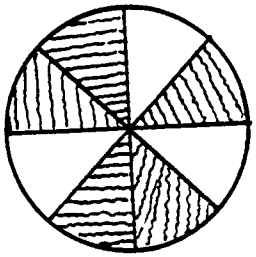
DIRECTIONS:

For each multiple choice problem,

Circle the letter of the "best" answer.

It is helpful and also suggested that computational work be done on the test next to each problem.

1. What fraction describes the shaded portion of this display?



A. $\frac{3}{8}$

B. $\frac{5}{8}$

C. $\frac{3}{5}$

D. $\frac{5}{3}$

2. Written in word form, $7\frac{5}{8}$ is:

A. Seventy-five eighths

B. Seven and five eighths

C. Five seventy eighths

D. Seven and eight fifths

3. Which letter identifies the fraction $1\frac{7}{8}$?

A. P

B. N

C. T

D. M

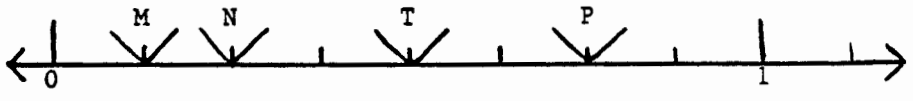
4. Which letter identifies $\frac{3}{4}$?

A. M

B. N

C. T

D. P



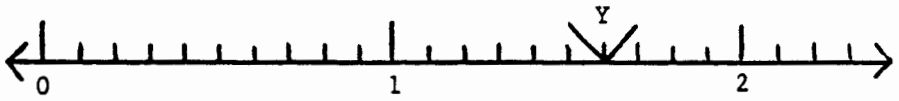
5. The letter Y identifies what fraction?

A. $\frac{3}{5}$

B. $1\ \frac{7}{10}$

C. $\frac{4}{10}$

D. $1\ \frac{6}{10}$



6. Another way to write $\frac{25}{8}$ is:

A. $3\ \frac{1}{8}$

B. $2\ \frac{5}{8}$

C. $2\ \frac{7}{8}$

D. $5\ \frac{2}{8}$

7. Another way to write $3\ \frac{3}{4}$ is:

A. $\frac{15}{4}$

B. $\frac{10}{4}$

C. $\frac{9}{4}$

D. $\frac{12}{4}$

8. Another way to write 7 is:

   A. $\frac{12}{2}$

   B. $\frac{21}{7}$

   C. $\frac{28}{4}$

   D. $\frac{35}{7}$

9. Written in simplest terms, $\frac{12}{18}$ is:

   A. $1\ \frac{6}{18}$

   B. $\frac{4}{5}$

   C. $\frac{2}{3}$

   D. $\frac{3}{8}$

10. Which fraction below is larger than $\frac{3}{4}$ and smaller than $\frac{7}{8}$?

   A. $\frac{2}{3}$

   B. $\frac{13}{16}$

   C. $\frac{11}{12}$

   D. $\frac{22}{32}$

11. Renamed as a decimal fraction, $4\ \frac{1}{4}$ is:

   A. 4.41

   B. 4.25

   C. 4.5

   D. 4.14

12. Renamed as a decimal fraction, $\frac{3}{5}$ is:

A. 0.6

B. 3.5

C. 6.0

D. 0.3

13. Of the following four fractions, which <u>is</u>/<u>are</u> equal to $1\frac{6}{8}$?

(I) $1\frac{12}{16}$ (II) $1\frac{60}{80}$ (III) $1\frac{18}{24}$ (IV) $1\frac{24}{32}$

A. Only I

B. All of them

C. Only I, II, III

D. Only I, II, IV

14. Which set below lists the fractions $\frac{3}{5}$; $\frac{1}{2}$; $\frac{7}{10}$ in order from least to greatest?

A. $\frac{7}{10}$; $\frac{1}{2}$; $\frac{3}{5}$

B. $\frac{3}{5}$; $\frac{1}{2}$; $\frac{7}{10}$

C. $\frac{1}{2}$; $\frac{3}{5}$; $\frac{7}{10}$

D. $\frac{3}{5}$; $\frac{7}{10}$; $\frac{1}{2}$

15. Which set below lists the fractions $3\frac{5}{8}$; $3\frac{1}{2}$; $3\frac{12}{16}$ in order from least to greatest?

A. $3\frac{12}{16}$; $3\frac{5}{8}$; $3\frac{1}{2}$

B. $3\frac{12}{16}$; $3\frac{1}{2}$; $3\frac{5}{8}$

C. $3\frac{1}{2}$; $3\frac{5}{8}$; $3\frac{12}{16}$

D. $3\frac{5}{8}$; $3\frac{1}{2}$; $3\frac{12}{16}$

SHOW ALL OF YOUR WORK
simplify (reduce) answers

16. Add: $\begin{array}{r} \frac{3}{10} \\ +\ \frac{5}{10} \\ \hline \end{array}$

_____
Answer

17. Add: $\frac{5}{6} + \frac{3}{4} =$ __?__

_____
Answer

SHOW ALL OF YOUR WORK
simplify (reduce) answers

18. Add:
$$\begin{array}{r} 1\frac{2}{5} \\ \frac{3}{5} \\ +\ 3\frac{4}{5} \\ \hline \end{array}$$

Answer

19. Add: $1\frac{11}{16} + \frac{7}{8} + 2\frac{3}{4} = \underline{\quad ? \quad}$

Answer

20. Subtract: $\frac{11}{16} - \frac{7}{16} = \underline{\quad ? \quad}$

Answer

21. Subtract:
$$\begin{array}{r} \frac{1}{2} \\ -\ \frac{3}{10} \\ \hline \end{array}$$

Answer

22. Subtract: $7\frac{5}{8} - \frac{3}{16} = \underline{\quad ? \quad}$

Answer

SHOW ALL OF YOUR WORK
simplify (reduce) answers

23. Subtract: $4\frac{1}{5} - 1\frac{7}{10} = \underline{?}$

Answer

24. Subtract: $3\frac{1}{3} - \frac{3}{4}$

Answer

25. Subtract: $6 - \frac{3}{5}$

Answer

26. Subtract: $3\frac{3}{5} - 2\frac{1}{10}$

Answer

27. Subtract: $9 - 3\frac{3}{8} = \underline{?}$

Answer

28. Multiply: $\frac{3}{4} \times \frac{7}{10} = \underline{?}$

Answer

SHOW ALL OF YOUR WORK
simplify (reduce) answers

29. Multiply: $\frac{2}{3} \times 20\frac{1}{4} = \underline{?}$

Answer

30. Divide: $8 \div 2\frac{1}{2} = \underline{?}$

Answer

31. Divide: $15 \div \frac{3}{5} = \underline{?}$

Answer

32. Divide: $\frac{4}{5} \div 5 = \underline{?}$

Answer

33. Divide: $2\frac{1}{2} \div 12 = \underline{?}$

Answer

Fraction Posttest

DIRECTIONS:

For each multiple choice problem,

Circle the letter of the "best" answer.

It is helpful and also suggested that computational work be done on the test next to each problem.

1. What fraction describes the shaded portion of this display?

A. $\frac{4}{8}$

B. $\frac{4}{5}$

C. $\frac{6}{10}$

D. $\frac{4}{10}$

2. Written in word form, $1\frac{3}{4}$ is:

A. One point three fourths

B. One and four thirds

C. Thirteen fourths

D. One and three fourths

3. Written in word form, $\frac{7}{16}$ is:

A. Sixteen sevenths

B. Seven sixteenths

C. Seven sixteens

D. Seven and sixteenths

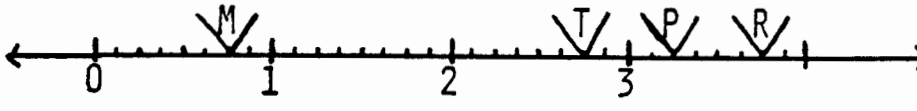
4. Which letter identifies the fraction $2\frac{3}{4}$?

A. T

B. P

C. R

D. M



5. Which letter identifies $\frac{1}{4}$?

A. M

B. N

C. T

D. P

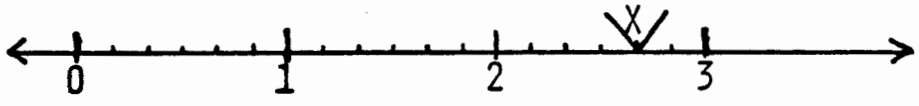
6. The letter X identifies what fraction?

A. $2\frac{2}{3}$

B. $2\frac{2}{6}$

C. $2\frac{4}{4}$

D. $1\frac{4}{6}$



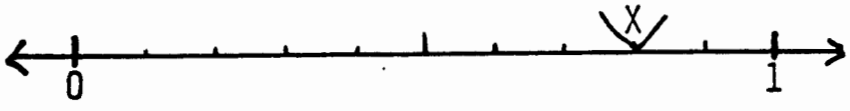
7. The letter X identifies what fraction?

A. $\frac{8}{9}$

B. $\frac{3}{4}$

C. $\frac{8}{10}$

D. $\frac{2}{10}$



8. Another way to write $\frac{23}{4}$ is:

   A. $6\frac{3}{4}$

   B. $5\frac{4}{3}$

   C. $\frac{19}{4}$

   D. $5\frac{3}{4}$

9. Another way to write $2\frac{3}{5}$ is:

   A. $\frac{5}{5}$

   B. $\frac{6}{5}$

   C. $\frac{13}{5}$

   D. $\frac{10}{5}$

10. Another way to write 6 is:

   A. $\frac{12}{2}$

   B. $\frac{18}{12}$

   C. $\frac{10}{4}$

   D. $\frac{4}{10}$

11. Written in simplest terms, $\frac{12}{16}$ is:

A. $1\ \frac{4}{16}$

B. $\frac{4}{5}$

C. $\frac{3}{4}$

D. $\frac{3}{8}$

12. Which fraction below is between the fractions $\frac{2}{4}$ and $\frac{7}{8}$?

A. $\frac{15}{16}$

B. $\frac{3}{8}$

C. $\frac{3}{4}$

D. $\frac{4}{8}$

13. Which fraction below is between the fractions $\frac{2}{5}$ and $\frac{3}{5}$?

A. $\frac{6}{10}$

B. $\frac{1}{5}$

C. $\frac{5}{10}$

D. $\frac{4}{10}$

14. Renamed as a decimal fraction, $2\frac{3}{4}$ is:

A. 2.75

B. 2.34

C. 2.43

D. 2.68

E. None of the above is correct

15. Renamed as a decimal fraction, $\frac{2}{5}$ is:

A. 0.4

B. 2.5

C. 4

D. 0.2

E. None of the above is correct

16. Of the following four fractions, which is/are equal to $1\frac{8}{16}$?

(I) $1\frac{1}{2}$ (II) $1\frac{4}{8}$ (III) $1\frac{5}{10}$ (IV) $1\frac{3}{4}$

A. All of them

B. Only I, II, III

C. Only II

D. Only I

17. Which set below lists the fractions $\frac{2}{3}$; $\frac{5}{6}$; $\frac{3}{4}$ in order from least to greatest?

A. $\frac{2}{3}, \frac{5}{6}, \frac{3}{4}$

B. $\frac{2}{3}, \frac{3}{4}, \frac{5}{6}$

C. $\frac{5}{6}, \frac{2}{3}, \frac{3}{4}$

D. $\frac{3}{4}, \frac{2}{3}, \frac{5}{6}$

18. Which set below lists the fractions $1\ \frac{4}{5}$; $1\ \frac{1}{2}$; $1\ \frac{7}{10}$ in order from least to greatest?

A. $1\ \frac{1}{2}, 1\ \frac{7}{10}, 1\ \frac{4}{5}$

B. $1\ \frac{7}{10}, 1\ \frac{4}{5}, 1\ \frac{1}{2}$

C. $1\ \frac{1}{2}, 1\ \frac{4}{5}, 1\ \frac{7}{10}$

D. $1\ \frac{4}{5}, 1\ \frac{1}{2}, 1\ \frac{7}{10}$

SHOW ALL OF YOUR WORK
simplify (reduce) answers

19. Add: $\frac{3}{8} + \frac{4}{8} = \underline{\quad ? \quad}$

_____
Answer

SHOW ALL OF YOUR WORK
simplify (reduce) answers

20. Add:
$$\begin{array}{r} \frac{7}{10} \\ +\ \frac{1}{10} \\ \hline \end{array}$$

Answer

21. Add:
$$\begin{array}{r} \frac{3}{5} \\ +\ \frac{1}{2} \\ \hline \end{array}$$

Answer

22. Add: $\frac{2}{3} + \frac{1}{2} = \underline{\quad ? \quad}$

Answer

23. Add:
$$\begin{array}{r} 1\ \frac{2}{5} \\ \frac{4}{5} \\ +\ 3\ \frac{4}{5} \\ \hline \end{array}$$

Answer

24. Add: $2\ \frac{3}{8} + 1\ \frac{7}{8} + \frac{6}{8} = \underline{\quad ? \quad}$

Answer

25. Add: $1\ \frac{2}{3} + \frac{5}{6} + 2\ \frac{1}{2} = \underline{\quad ? \quad}$

Answer

SHOW ALL OF YOUR WORK
simplify (reduce) answers

26. Add: $1\frac{4}{5}$
$+ \quad 2\frac{1}{2}$

Answer

27. Subtract: $\frac{7}{8} - \frac{3}{8} = \underline{?}$

Answer

28. Subtract: $\frac{9}{10}$
$- \frac{3}{10}$

Answer

29. Subtract: $\frac{7}{8} - \frac{5}{16} = \underline{?}$

Answer

30. Subtract: $\frac{1}{2}$
$- \frac{1}{10}$

Answer

31. Subtract: $2\frac{3}{4} - \frac{1}{2} = \underline{?}$

Answer

SHOW ALL OF YOUR WORK
Simplify (reduce) answers

32. Subtract: $3\frac{4}{5} - 2\frac{3}{10}$

Answer

33. Subtract: $3\frac{2}{3} - 1\frac{5}{6} = \underline{?}$

Answer

34. Subtract: $3\frac{1}{3} - 1\frac{3}{4}$

Answer

35. Subtract: $7 - \frac{3}{5}$

Answer

36. Subtract: $6 - 1\frac{5}{8} = \underline{?}$

Answer

37. Multiply: $\frac{2}{3} \times \frac{4}{5} = \underline{?}$

Answer

SHOW ALL OF YOUR WORK
simplify (reduce) answers

38. Multiply: $\frac{4}{5} \times 20\frac{1}{2} =$?

Answer

39. Divide: $4 \div 2\frac{1}{2} =$?

Answer

40. Divide: $6 \div \frac{3}{5} =$?

Answer

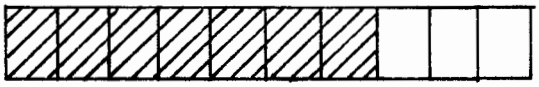
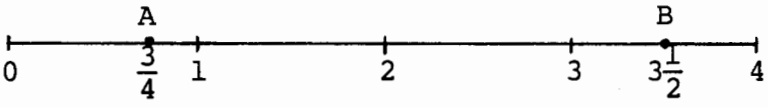
41. Divide: $\frac{1}{3} \div 3 =$?

Answer

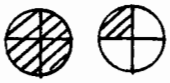
42. Divide: $3\frac{3}{8} \div 18 =$?

Answer

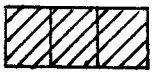
Answers to Fraction Concept Test

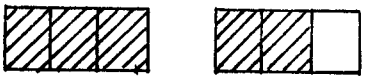
1. circled
2. not circled
3. circled
4. not circled
5. circled
6. one half
7. one
8. one and one fourth
9. 
10. 
11. 

12. not circled
13. circled
14. circled
15. not circled
16. 
17. 
18. $\frac{5}{6}$
19. $\frac{2}{3}$
20. $\frac{5}{2}$
21. $1\frac{3}{4}$
22. 1

23. $1\frac{2}{3}$
24. $\frac{3}{4}$
25. $2\frac{1}{4}$
26. circled
27. not circled
28. circled
29. not circled
30. not circled
31. not circled
32. not circled
33. not circled
34. not circled
35. circled
36. not circled
37. circled
38. not circled
39. not circled
40. not circled
41. circled
42. circled
43. not circled
44. 
45. 
46. 
47. 
48. 

49. 

50. a. 

b. 

51. $\frac{7}{10}$

52. $1\frac{1}{4}$

53. one half

54. five sixths

55. two and one half

56. $\frac{1}{2}$

57. $\frac{4}{4}$

58. $\frac{6}{5}$

59. $\frac{9}{8}$

60. $\frac{4}{3}$

61. $\frac{7}{5}$

62. $2\frac{3}{4}$

63. B

64. E

65. A

66. D

67. C

68. D

69. C

70. B

71. C

72. $\frac{1}{8}$

73. B and C

74. $\frac{1}{4}$

75. $\frac{2}{3}$

76. $\frac{1}{2}$

77. $1\frac{2}{5}$

78. $\frac{3}{4}$

79. 3 dots circled

80. $\frac{1}{4}$

81. $\frac{1}{3}$

Answers to Fraction Pretest

1. B
2. B
3. D
4. D
5. D
6. A
7. A
8. C
9. C
10. B
11. B
12. A
13. B
14. C
15. C
16. $\frac{4}{5}$
17. $1\frac{7}{12}$
18. $5\frac{4}{5}$
19. $5\frac{5}{16}$
20. $\frac{1}{4}$
21. $\frac{1}{5}$
22. $7\frac{7}{16}$
23. $2\frac{1}{2}$
24. $2\frac{7}{12}$
25. $5\frac{2}{5}$
26. $1\frac{1}{2}$
27. $5\frac{5}{8}$
28. $2\frac{1}{10}$
29. $13\frac{1}{2}$
30. $3\frac{1}{5}$
31. 25
32. $\frac{4}{25}$
33. $\frac{5}{24}$

Answers to Fraction Posttest

1. D
2. D
3. B
4. A
5. B
6. A
7. C
8. D
9. C
10. A
11. C
12. C
13. C
14. A
15. A
16. B
17. B
18. A
19. $\frac{7}{8}$
20. $\frac{4}{5}$
21. $1\frac{1}{10}$
22. $1\frac{1}{6}$
23. 6
24. 5
25. 5
26. $4\frac{3}{10}$
27. $\frac{1}{2}$
28. $\frac{3}{5}$
29. $\frac{9}{16}$
30. $\frac{2}{5}$
31. $2\frac{1}{4}$
32. $1\frac{1}{2}$
33. $1\frac{5}{6}$
34. $1\frac{7}{12}$
35. $6\frac{2}{5}$
36. $4\frac{3}{8}$
37. $\frac{8}{15}$
38. $16\frac{2}{5}$
39. $1\frac{3}{5}$
40. 10
41. $\frac{1}{9}$
42. $\frac{3}{16}$

Item Analysis

The Percentage of the Class Which Answered the Item Correctly

	Pretest		Posttest	
	STAD	TCL	STAD	TCL
1. Describing the shaded part of a diagram	79.1	100.0	100.0	100.0
2. Writing a fraction or mixed number in word form	91.7	100.0	100.0	88.6
3. Locate a given mixed number on a number line	70.8	63.7	91.7	90.9
4. Locate a given fraction on a number line	37.5	40.9	25.0	27.3
5. Name a fraction using a point on the number line	91.7	95.5	72.9	75.0
6. Rename an improper fraction as a mixed number	45.8	68.1	91.7	90.9
7. Rename a mixed number as an improper fraction	33.3	36.4	100.0	100.0
8. Rename a whole number as an improper fraction	37.5	45.5	91.7	90.9
9. Rename a fraction in simplest form	58.3	50.0	100.0	100.0
10. Locate a fraction between two given fractions	16.7	18.1	50.0	31.8
11. Rename a mixed number as a mixed decimal	25.0	13.6	50.0	59.1
12. Rename a fraction as a decimal fraction	12.5	9.1	100.0	100.0
13. Select fractions equivalent to a given fraction	83.3	68.1	41.7	50.0
14. Ordering fractions with unlike denominator	37.5	45.5	83.3	77.3
15. Ordering mixed numbers with unlike denominators	37.5	36.4	45.8	68.2

Total percentage correct of all items relating to concepts:

	STAD	TCL
Pretest	50.55	52.73
Posttest	76.25	76.67

Item Analysis (Continued)

	Pretest		Posttest	
	STAD	TCL	STAD	TCL
16. Adding two or three fractions with like denominators	37.5	40.1	81.3	88.6
17. Adding two or three fractions with unlike denominators	20.8	27.2	79.1	70.5
18. Adding mixed numbers and fractions with like denominators	20.8	31.8	72.9	59.1
19. Adding mixed numbers and fractions with unlike denominators	16.7	4.5	72.9	59.1
20. Subtracting fractions with like denominators	45.8	36.4	93.8	95.4
21. Subtracting fractions with unlike denominators	29.1	27.2	77.1	86.4
22. Subtracting a mixed number and a fraction with unlike denominators	25.0	36.4	77.1	84.1
23. Subtracting mixed numbers and fractions with regrouping	8.3	4.5	61.1	63.6
24. Subtracting a fraction from a whole number when regrouping	8.3	9.1	70.8	72.7
25. Subtracting a mixed number from a whole number	20.0	13.6	58.3	54.5
26. Subtracting mixed numbers with unlike denominators	29.1	27.2	75.0	81.1
27. Multiplying two fractions	54.1	27.2	95.8	86.3
28. Multiplying a mixed number by a fraction	0	0	54.2	59.1
29. Dividing a whole number by a mixed number	0	0	75.0	63.6
30. Dividing a whole number by a fraction	0	0	83.3	75.0
31. Dividing a fraction by a whole number	0	0	54.2	54.5
32. Dividing a mixed number by a whole number	0	0	25.0	31.8

Total percentage correct of all items relating to computation:

	STAD	TCL
Pretest	18.56	16.77
Posttest	70.99	70.50

APPENDIX D

Raw Data

Measures of Equivalency--STAD Group

Measures of Equivalency--TCL Group

Fraction Pretest and Posttest--Both Groups

Raw Data: Measures of Equivalency

STAD Group

	Sex	Age in Months	ITBS Reading GE*	ITBS Math Concepts GE	ITBS Math Computation GE	ITBS Math Total GE	Fraction Concept Test (%)
1.	M	146	63	71	57	63	68
2.	F	150	70	43	56	46	63
3.	F	162	55	47	57	54	71
4.	M	151	79	49	62	59	51
5.	F	153	79	76	70	74	85
6.	M	148	75	76	65	69	74
7.	M	153	59	51	57	57	59
8.	M	154	56	60	56	56	68
9.	M	153	62	71	63	73	89
10.	F	150	61	62	63	61	80
11.	M	149	77	83	62	73	80
12.	F	155	72	57	64	61	70
13.	F	148	35	49	68	54	66
14.	F	153	65	71	65	70	86
15.	M	153	46	49	46	49	--
16.	F	155	69	39	51	44	39
17.	M	153	56	83	77	79	84
18.	M	149	39	53	44	55	60
19.	M	150	42	71	49	54	69
20.	M	167	21	45	54	51	56
21.	F	157	42	57	51	52	80
22.	F	145	39	45	52	48	63
23.	M	186	28	45	63	48	44
24.	M	156	56	58	52	59	--

* GE = Grade Equivalent Score

Raw Data: Measures of Equivalency

TCL Group

	Sex	Age in Months	ITBS Reading GE*	ITBS Math Concepts GE	ITBS Math Computation GE	ITBS Math Total GE	Fraction Concept Test (%)
1.	F	157	84	76	62	68	93
2.	F	143	54	43	54	45	59
3.	F	146	51	74	60	57	60
4.	F	155	81	81	60	69	79
5.	M	152	55	60	63	58	68
6.	F	147	61	69	70	67	61
7.	F	156	59	62	53	59	61
8.	M	148	39	71	60	69	88
9.	M	159	54	65	48	57	68
10.	F	152	52	71	62	72	81
11.	M	157	36	71	54	63	--
12.	M	146	58	65	64	65	59
13.	F	156	75	83	72	84	80
14.	F	157	49	69	68	66	60
15.	F	154	70	55	57	59	76
16.	M	160	52	47	49	51	61
17.	M	147	54	55	54	58	66
18.	F	153	51	60	73	64	75
19.	M	153	47	60	43	53	59
20.	F	151	54	53	64	56	59
21.	M	153	58	55	60	55	61
22.	M	158	51	57	51	58	69

* GE = Grade Equivalent Score

Raw Data

	STAD Group		TCL Group	
	Fraction Pretest (%)	Fraction Posttest (%)	Fraction Pretest (%)	Fraction Posttest (%)
1.	27	48	55	88
2.	15	57	24	38
3.	27	69	33	88
4.	18	79	52	88
5.	64	90	39	93
6.	39	90	21	60
7.	12	38	33	67
8.	21	69	42	62
9.	61	90	18	74
10.	55	88	61	93
11.	73	98	33	81
12.	27	71	39	79
13.	21	62	64	93
14.	70	90	27	71
15.	15	33	27	67
16.	6	43	24	74
17.	79	100	24	43
18.	30	71	30	76
19.	33	62	21	43
20.	18	74	21	60
21.	36	79	21	64
22.	18	76	12	71
23.	24	69		
24.	33	64		