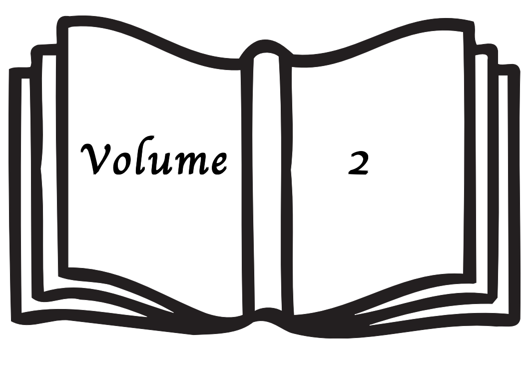
Grade Five

Classroom

Strategies



The learner will understand and compute with non-negative rational numbers.

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Notes and textbook references

1.01 Develop number sense for rational numbers 0.001 through 999,999.

a.) Connect model, number word, and number using a variety of representations.

A. Have the students develop their own number puzzles by describing a number in a variety of ways. Once the puzzles are developed, have the students solve each other's puzzles. You might create a card file with number puzzles written by students or make a place on a bulletin board for the "Puzzle of the Day."

Ask students to write "number riddles" about the number on their index cards. For example:

I have 6 digits and I am even.
The sum of my digits is 18.
Two of my digits are zeros.
All of my digits are even.
I am greater than 850 thousand and less than 870 thousand.

Each day, a different student's number riddle can be featured on the chalkboard, or a special bulletin board. Students work to find the number, or numbers, that fit the description. All of the numbers and their riddles might be combined to create a challenge center or a riddle book.

Notes and textbook references

B. Read the book How Much Is A Million? written by Steven Kellog. Have the class brainstorm ways they could show a million. Be prepared with an example to share with students.

C. Write money in standard, word, and decimal form by filling out checks; see Blackline Masters I - 19 and I - 20. The students could collect ads for products they would like, write checks as they "purchase" the items, and keep their checkbooks up to date. Starting with $2,000 will give the students opportunities for writing amounts in word form and practice in subtraction and regrouping.

D. Give each student a copy of the "**Decimal Hunt**" game board (See Blackline Master I - 21). Have partners sit facing each other with a file folder or book blocking their vision of each other's papers. Each player places 5 counters on his or her board. Players take turns trying to guess each other's decimals. If one of the decimals marked is called out, the player guessing gets a point. If the player names a decimal that is touching one marked, the clue of "close" is given. The first player to locate 3 markers is the winner of that round. At the end of each round, the winner gets an extra 2 points. At the end of 10 rounds, players add their scores.
Note: Decimals must be read correctly in order to earn points (i.e. "two and four tenths, "not" two point four").

E. Consider establishing a short term classroom economy which is handled through the classroom bank. Brainstorm a list of ways for students to "earn money". This list might include classroom chores, completing extra credit work, etc. Assign "wages" to each item on this list using large numbers. Students establish an account through the bank by depositing their wages (checks from their employer) and receiving a checkbook (see Blackline Master I - 19 and I - 20). Then brainstorm a list of items or privileges for sale or rent. Students might need to rent their desks, pay to use the pencil sharpener, or pay to spend time at a special interest center. As students spend their wages, they write checks and keep track of the balance in their accounts. All of this business is transacted using checks rather than getting involved with "play money". Keeping and balancing a bank account is an important real-life skill.

b.) Build understanding of place value (thousandths through hundred thousands).

Notes and textbook references

A. Have the students write a 6-digit number and place a decimal in their number. Ask them to add 0.1, add 0.01, add 0.001. Discuss how the place value of the digits change. Repeat the activity. *Variation:* use the calculator. All students could enter the same number (for example, 47.387) and then add two hundredths. Then they can be asked to read their results aloud.

B. Use newspapers, magazines, etc. to identify place value in numbers. For example, list the numbers which have the digit 5. Tell the value of the 5 in each number.

C. Each person rolls a die five times to create the largest number with the digits rolled. *Variation:* The winner is the person making the smallest number or the largest odd number, etc.

D. Many large numbers are used in fifth grade social studies and science units. As they occur in contexts, ask students to talk about (explain) the numbers in many ways. For example: "The population of a city is 425,000."

1. This number is rounded to the nearest thousand. The population is 424,500 or more and less than 425,499.

2. If the population grows by 75,000 or more, there will be half a million people in the country.

3. The number written in standard form is 425,000.

4. The number written in expanded form is 400,000 + 20,000 + 5,000.

E. Give each student a real estate guide. Students figure out how many homes they could buy that total less than $1,000,000. Ask students to think of ways they could classify the houses.

Notes and textbook references

c. Compare and order rational numbers.

A. Prepare sets of 30 to 40 cards. (See Blackline Masters I - 1 through I - 9 or I - 8 through I - 13) The cards should be labeled with rational numbers, which can be selected in terms of student's capabilities and the number concepts the teacher wishes to reinforce. Students can be paired to play "War" using the following directions.

1. Distribute an equal number of cards to each player.

2. Cards should remain face down in a stack.

3. The first player turns his/her first card over, followed by the other player.

4. The player who has the highest (lowest) value gets to take all the cards for that round.

5. If both of the players have a card with the same value, "War" is declared. Each player puts 3 cards face down and turns over the fourth card. The fourth card determines the player who takes all the cards for that round.

6. The winner of the game is the player with the most cards when the time is up or the one who ends up with all the cards.

B. **The Race Is On** Prepare decks of 30 to 40 cards with rational numbers. Have the students play "The Race Is On." Give the following directions to the students. (See Blackline Masters I - 1 through I - 9 or I - 8 through I - 13)

1. Each player is dealt 10 cards.

2. At the signal, each player begins to place his/her cards in a row so that the numbers are arranged from smallest to largest (largest to smallest).

3. The first player to complete a row of 10 cards correctly is declared the winner.

Notes and textbook references

C. Prepare decks of 30 to 40 cards with rational numbers. Have the students play “In Between.” Two to four students can play with one deck. Give the following directions to the students. (See Blackline Masters I - 1 through I - 9)

1. Each player draws two cards and gives a number between the two numbers on the cards.

2. If the player is correct, he/she keeps the cards. If the player is incorrect, the next player can try to name an appropriate number.

3. If the next player names an appropriate number, then he/she can keep the cards as well as take his/her regular turn. If the player does not name an appropriate number, he/she loses a turn, and the cards are passed on to the next player.

4. Play continues accordingly.

5. If no player can name an appropriate number, the cards are shuffled into the deck.

6. The winner is the player who has the most cards when all the cards in the deck are gone or when time runs out.

Example: cards **0.1** **0.2**

Possible response: 0.11 is between 0.1 and 0.2

D. On one sheet of paper draw several enlarged number lines to show the spaces from 0 to 1 segmented in different ways. (See Blackline Masters I - 24 and I - 25). Ask the students to fill in the blanks on the “ruler.” Discuss the fractions/decimals that are equivalent and why. Make a list of equivalent fractions.

Notes and textbook references

E. Prepare a deck of cards labeled with the numerals from 0 to 9. Also, prepare a set of cards with the place value positions indicated as shown below. (See Blackline Masters I - 14 and I - 15)

__ __ . __

__ . __ __

__ __ __ . __

0 . __ __ __

0 . __ __

Give the following directions to each student.

1. Draw three cards from the deck of numeral cards.
2. Draw a place value card.
3. Use the numeral cards and the place value card to make the largest possible number and the smallest possible number.

Example:

Place Value Card	**Numeral Cards**
0 . __ __	**2** **1** **9**

Response: 0.92 - largest, 0.12 - smallest

F. Visit NCTM's Website and play the Fraction Track Game. (URL: http://standards.nctm.org/document/eexamples/chap5/5.1/index.htm).

Notes and textbook references

G. **Show and Tell** with fractions. Distribute fraction-recording sheets (Blackline Masters I - 16 through I - 18) for these activities. Select a denominator: tenths, twelfths, or hundredths. Distribute the appropriate blackline to students. Have students color or shade the appropriate fractional part of the circle (or square) as you call out the fractions. (ex. 8/12, 4/12, 9/12, 2/12, etc.). After coloring the fractions, have students cut them out and place them in descending order. Have students explain their reasoning and compare their work. Students could also group the pieces by other means. Which are closest to 1/4? to 3/4? Which are between 1/3 and 2/3?

H. Make a set of fraction dominoes for each group of children. (See the Blackline Masters I - 22 and I - 23.) You can save these to use at a later time, especially if they are laminated. Each student gets six dominoes. Remaining dominoes are placed face down in the "bone yard". The first player lays down a domino. The next player must match the domino with a domino that shows an equivalent fraction or lose a turn. The first player to lay down all of her/his dominoes wins.

I. Choose a target number less than ten million. This number might represent a statistic from the newspaper or social studies text. For example, in 1991, the sales of cellular phones reached 3,100,000 according to the data collected by the Electronic Industries Association. Distribute large index cards and ask students to write a number less than this target number on their cards. Ask students to hold up their cards if their number

is less than 3,100,000
has an even digit in the ten thousand's place
is greater than 500,000
is between 100,000 and 1,000,000
has a digit between 2 and 7 in the hundred's place
is less than half of 3,100,000
etc.

Choose a least one of these criteria to discuss by reading aloud those numbers being held up for display and asking, "What do the numbers have in common?" Students could be asked to bring in an "interesting number" and this task could become a weekly event.

Notes and textbook references

J. Integrate measurement studies with fractions by having each student create a fraction bar set. On the paper cutter, cut 28 strips that are 1″ x 6″ for every student. (Note: There is great value in students making their own set; however, pre-made sets are included on Blackline Masters I - 26 through I - 30). Each student will need a sandwich bag to store the set. Have students measure and shade their fraction bars as given below. Allow them to color the bars as they choose, since a bar with 1/3 shaded remains the same fraction whether it is colored red or green.

one unit bar (no division)
three bars divided into thirds (2″)
(shade one bar entirely; 1/3; 2/3)
six bars divided into sixths (1″)
(shade one entirely; 1/6; 2/6
3/6; 4/6; 5/6)

two bars divided into 2 parts (3″)
(shade one bar entirely; 1/2 of other)
four bars divided into fourths (1 1/2″)
(shade one entirely; 1/4; 2/4; 3/4)
twelve bars divided into twelfths (1/2″)
(shade one entirely; 1/12; 2/12; etc.)

Students should write their names on the backs of each fraction bar so that the sets may be used together in activities. Use set to do the following activity:

With a partner mix two sets of fraction bars together. Place them face down. Each student draws a bar and they compare to determine the greater fraction. They must record their comparison (1/3 > 1/4). The person with the larger fraction shaded keeps both bars. If the fractions are equivalent, each student keeps a bar from that turn. Continue until all bars in the original mix have been compared.

Students work in pairs to determine all possible groups of equivalent fractions in one set. Arrange bars together and record this information in symbolic form. (1/3 = 2/6 = 4/12 or 3/3 = 1 = 2/2 = 4/4 = 6/6 = 12/12)

Working in pairs, have students find three bars which are not equivalent. Order the bars from greatest to least then least to greatest and use the appropriate symbols to record each set.
(11/12 > 1/2 > 1/4 and 1/4 < 1/2 < 11/12).

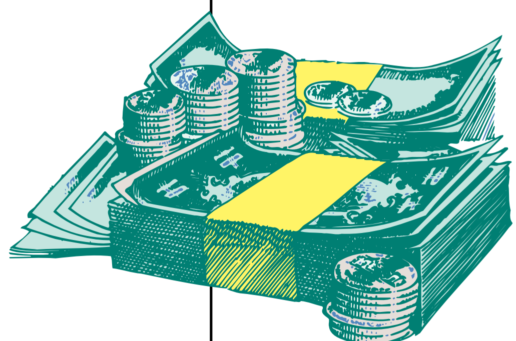
Have the students trace the bar that is divided into halves. Shade 1/2. Now divide each half into two equal parts. Did the shaded area increase or decrease? (neither) What part is shaded? (2/4) Now divide each part into half again. What part is shaded? (4/8) Divide each part again into equal parts. What is shaded? (1/2) Can you predict what fraction you would be illustrating if you divide each of these parts into two equal parts? Repeat the activity with bars that are divided into thirds.

Notes and textbook references

K. Make enough sets of equivalent fraction/decimal cards for each pair of students in the class. (See Blackline Masters I - 8 through I - 13.) Save the cards for repeated use. Give each pair of students a shuffled set of cards. Set a timer, or have a time keeper keep time. Ask the students to begin matching the equivalent fractions/decimals, without speaking to each other at the signal of "go." The first pair to match the fractions/decimals correctly wins. Try again to see whether you can beat the time.

L. Money provides a helpful model for many students when they are working with fractions and decimals. Have students work in small groups to compare U.S. coins to decimals and fractions. They might begin by creating a chart with a column listing coins, a second column listing the decimal equivalent of a dollar, and a third listing the fraction equivalent of one dollar.

Coins	**Decimal**	**Fraction**
1 penny	0.01	1/100
2 pennies	0.02	2/100
•	•	•
•	•	•
•	•	•
1 dime	0.10 = 0.1	10/100=1/10



After students have created a comparison chart based upon actual value of these coins, change the value of the coins. What if a penny is now worth 0.1? What is the value of a nickel, dime, quarter, and half dollar? What other values might be assigned to a penny?

M. Ask the students to bring in data from the newspaper using decimal numbers. Use these data to write problems. Order the numbers where it is appropriate. For example, the value of the share of stock dropped 0.2 in today's trading.

N. List stocks and use >, <, = to compare the values of the shares.

Notes and textbook references

O. **Build-a-Number**; Students work in groups of four. Each student uses his/her own set of number cards numbered 0 through 9. (See Blackline Master I - 14 and I - 31 through I - 36.) Add a card with a decimal point and a second with a line for setting up fractions. Each student receives a direction card instructing her/him to build a number according to a given property. These properties would include directions using a combination of whole numbers, decimals, and fractions. After each student in the group has built his/her own number, the group works together to build a fifth number which fits all four properties. During this final process, students may use any of their number tiles. They are not limited to the tiles already placed while building individually. An added direction might include that this final number must be built as a fraction, a decimal, and written in standard form and words. Students might even be required to build some kind of model showing the number with base ten or pattern blocks.

Here is and example:

Build a number between zero and one-half.
Build a number less than 1/3.
Build a number with the digit 5 in the hundredths place.
Build a number greater than the value of $0.20.

Before students begin be sure they understand all parts of the activity.

(1) Build a number that fits your clue.
(2) Tell your group why you built that number and why it fits the clue.
(3) As a team, write your numbers in ascending order.
(4) Now, as a team, build a 5th number fitting all the clues. Represent the 5th number in at least four different ways. These might include a decimal, a fraction, a model, words, standard or expanded form.

Extension: Have students write their own problems in order to challenge other groups. Stress the need for including enough information to make the solution possible yet not so much that the problem isn't challenging.

P. Ask students to brainstorm a list of every day uses of decimal numbers. This list might include some of the following: location of radio stations on the dial, rise and fall of stock prices, odometer readings, Dewey Decimal catalog numbers, currency exchanges for various countries, prices of items in ads or at fast food restaurants or at grocery stores, etc. As a total group, write several problems that require comparing these decimal numbers.

For example: Sean likes to listen to WKRP on the radio. This station is located at 101.5 on the dial. The radio is currently tuned to 102.9. What does Sean need to do in order to find his station on the radio?

Notes and textbook references

Q. Model and estimate fractions in daily life. Give each student a strip of graph paper that is 1 unit by the number of units equaling the number of students in class. If the class has 29 students, everyone gets a strip 1 square unit by 29 square units. Second, each student gets a piece of construction paper the same size. Students fold the construction paper in half (matching the short ends) and label the fold one - half. Next, students fold this strip to create one-fourth and three-fourths and write appropriate labels.

Further divisions can be added and equivalent fractional names written. This construction strip might be divided into eighths or quarters, etc. Brainstorm a list of survey questions for the class. These questions might be related to something being studied. Using lunch count as an example; ask everyone who brought lunch to raise their hands. Imagine that 5 of the 29 students in class brought lunch. About what fraction of the class is this? Students hold their strip of graph paper under the construction paper to see where 5 units measures on the construction paper. This comparison shows that 5 of 29 students is close to one-sixth of the class. How many students have brown eyes? red hair? are left-handed? have one sibling? This estimation is important especially if the fractions have unusual denominators. Helping students with a method for rounding fractions gives them a powerful estimation technique. This idea is presented in Seeing Fractions, California Department of Education, P.O. Box 271, Sacramento, CA 95812-0271.

R. The sports section of the newspaper lists a large variety of statistics: batting averages, standings, earned run averages, team and individual achievements, times for races, distances thrown and jumped, weights lifted and games won and lost - most of which are computed to three decimal places. These provide a rich source of numbers to compare and contrast.

S. Talk with students about equivalent fractions and naming fractions in lowest terms. When is the appropriate time for a fraction not to be simplified? Example: in writing checks, we write 50/100 rather than writing 1/2.

Notes and textbook references

T. **Play Guess My Number**. On sheets of paper or index cards write a series of fractions, decimals, whole or mixed numbers. Tape these numbers to students' backs. Each student must figure out her/his number by asking questions that can be answered with "yes" or "no". These questions might include the following: "Is my number closer to zero than to one-half?" "Is my number between 9 and 10?" "Is my number greater than one?" Once everyone has guessed her/his number, students organize themselves into a line ordered from smallest to largest. Ask those students holding 0, 1/2, 1, 1 1/2, 2, 2 1/2, etc. to step forward, out of line. All other students must then cluster with whichever of these they are closest to according to their number. For example, anyone wearing 1/3 should cluster with 1/2 while anyone wearing 2.8 should cluster with 3, etc. Repeat this clustering activity by asking only whole numbers to step out of line. Then everyone clusters with the nearest whole number and each cluster takes the name of that whole number. Thus, 4 1/3 would cluster with 4 and become a 4. Discuss the questions and answers as a total group. Which questions provided the most information? What were the fewest number of questions asked? Did everyone answer questions accurately? Students might be asked to arrange these index cards into a "number line" and post it over the chalkboard. Repeat this activity with different numbers. Notice whether students become more proficient with asking questions.

U. Bring small doughnuts or candy bars to class. Ask students: "Would you rather have $\frac{1}{6}$, $\frac{1}{4}$ or $\frac{1}{3}$?"
Students write down choices. Cut the doughnut (or candy bar) into sixths, thirds, and fourths. Write fractional values on board and compare. Enjoy!

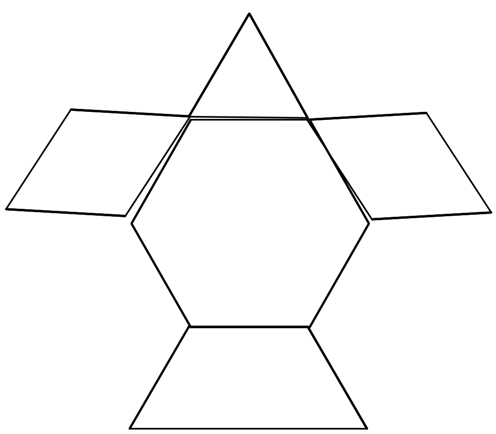
V. Use a ruler to help students discover that fractions with the same denominators increase in size as the numerators increase. Have students compare 1/2, 2/2, 3/2, 4/2,. . . ; repeat with 1/4, 2/4, 3/4, 4/4, . . . ; 1/8, 2/8, 3/8, 4/8, . . .; and 1/16, 2/16, 3/16, 4/16, . . .
Next have them compare and order fractions with the same numerator but with different denominators i.e. 1/2 > 1/4 > 1/8 > 1/16.
Repeat with 2/2 > 2/4 > 2/8 > 2/16, and 3/16 < 3/8 < 3/4 < 3/2 and so forth. Ask students to explain how they should be able to order any two fractions with the same numerators or with the same denominators on sight.

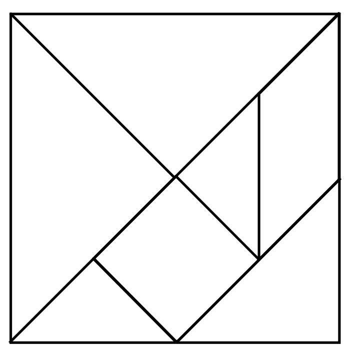
W. Using pattern blocks, assign the yellow hexagon a value of one. What value does the red trapezoid represent?, the green triangle? the blue rhombus? Have students use these shapes to illustrate and prove relationships such as 4/6 < 4/2, 3/6 >1/6, 1/2 < 2/2, etc. Have students compare and order, as well as compute, with fractions using 1, 1/2, 1/6 and 1/3 as the basis for discussion. Example: What does the sum of 2/3 and 1/6 look like? Can you assign a name to this sum? What is the result of 2 - 2/3?

This activity does not involve finding common denominators, but rather has students creating the sums (or differences) with manipulatives and then deciding, based on the shapes, correct name(s) for the result.

Similar activities can be conducted with the tangram shapes. Assign the value one to the complete square. What values do the individual pieces have? Again fractions can be compared, ordered and sums and differences can be computed. An *extension* might assign a price to the smallest triangle and have students compute the value of a figure or shape made from the pieces. Another extension would involve changing the value of the shapes. Ex. rhombus = 1.

If the rhombus in this figure costs $0.75, how much will the whole robot cost?



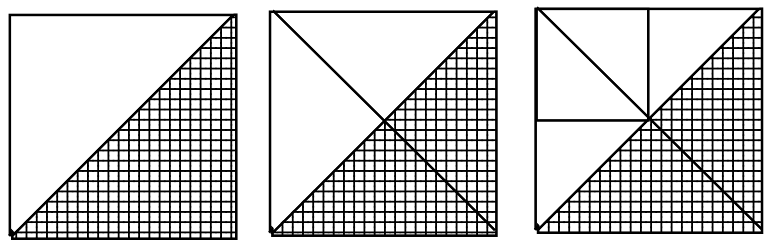


If the <u>small</u> square weighs 12 ounces, how much will the whole shape weigh? How many pounds is that?

Notes and textbook references

Notes and textbook references

X. Give students different models (circles, rectangles, etc.) and have them color a fraction. Further divide the figure to shade and record equivalent fractions. For example:



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

Y. Give the students a sheet of tablet paper. Ask them to write a fraction to show how many pieces of paper they have $\frac{1}{1}$

Fold the paper in half. Tear it along the crease. How many pieces would we have? (2) What fraction of the whole piece of paper would this be? $\frac{1}{2}$

Fold the papers again. How many pieces do we get when we tear along each of the folds? (4) What fraction of the whole sheet would each piece be now? $\frac{1}{4}$

Continue the process and name fractions until you have a piece that is

$\frac{1}{16}$ of the original sheet.

Variation: Use the pieces from your tangram sets to model and write comparisons. For example, four small pieces = $\frac{4}{16} = \frac{1}{4}$.

Z. If you have TI-Math Explorer ™ calculators, ask students to find out what happens when you use the "Simplify Key."

AA. Using strips of colored construction paper cut 3 inches by 18 inches, have students develop models of fractional equivalents. Begin with one strip representing a whole. Then students fold a second strip in half lengthwise and cut, thus creating halves. A third strip is first split in half and then folded over again in the same direction to create fourths. Continue in this same manner up to sixteenths, labeling pieces. Students can then line up equivalent pieces to demonstrate the pattern of $\frac{1}{2}$, $\frac{2}{4}$, $\frac{4}{8}$, $\frac{8}{16}$ and explain what is happening to numerators and denominators. Similar models could be created with other fractional parts such as $\frac{1}{3}$, $\frac{2}{6}$, $\frac{4}{12}$; $\frac{2}{3}$, $\frac{4}{6}$, $\frac{8}{12}$; etc.
Other models, such as circular pieces of paper, might also be used. Students might also be asked to create games using these patterns. A spinner might be created with the fraction names and students could spin this spinner to get fractional pieces - the goal being to gather all the parts of a pattern, i.e. $\frac{1}{2}$, $\frac{2}{4}$, $\frac{4}{8}$, and $\frac{8}{16}$.
Be sure to always start with the same "whole" so that all the parts will be comparable.

Notes and textbook references

Notes and textbook references

d.) Make estimates of rational numbers in appropriate situations.

A. Ask the students to bring in newspaper articles and advertisements using numbers. Discuss with your students how the numbers on the newspaper are used and whether they give reasonable information. How many of these numbers are estimates? How many are exact?

B. Provide students with a number line (Blackline Masters I - 24 and I - 25) and give them two or three rational numbers at least two units apart to graph ex.: one, two and one-fourth , and three and one-half. After graphing, students are then asked to name two rational numbers between each of the numbers on the number line. Students then justify their choices.

C. Discuss when an exact answer is necessary and when an estimate will suffice. Make list of the situations or the conditions when an estimate would be to the nearest dollar, nearest penny, nearest meter, nearest thousand, nearest mile, etc. Also, students should consider when the estimate is “high” or the estimate is “low” and why. Are there advantages and disadvantages to “high” and “low” estimates?

D. Using a stopwatch, have the students, in pairs, estimate and time some of the following activities in seconds to the nearest tenth of a second:

- Stand tiptoe on one foot with your eyes shut for as long as you can.
- Line up 10 centimeter cubes.
- Take apart 10 centimeter cubes.
- Blow a die the length of a ruler.
- Touch your hair, your chin, your elbow, your knees, and your toes and spell each.
- Write your name left-handed and right-handed.
- Draw a two-inch square.
- Name all of your teachers since the first grade.
- Name 10 animals.
- Do 5 sit-ups.

Notes and textbook references

1.02 Develop fluency in adding and subtracting non-negative rational numbers (halves, fourths, eighths; thirds, sixths, twelfths; fifths, tenths, hundredths, thousandths; mixed numbers).

a.) Develop and analyze strategies for adding and subtracting numbers.

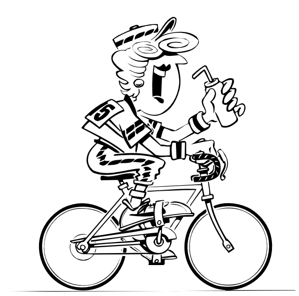
A. Using a hundred grid, make a design using 3 colors to cover half of the grid. See Blackline Master I - 16. Ask students to write an equation to explain how they know that they have shaded half of the grid. Repeat the task with a different amount colored.

B. Students can use a collection of two colored counters as a model. First determine the unit, for example 10 counters. Students put ten counters in a cup and pour them on their desk. Suppose 7 land yellow side up and 3 land red side up. Students record the equation

7/10 + 3/10 = 10/10.

Connect this to subtraction by also asking students to record the equations 10/10 - 7/10 = 3/10 and 10/10 - 3/10 = 7/10. Continue similar activities with a variety of models.

C. Explain to students that the mileage can be shown on a bicycle using an odometer. Have the students, in groups of two or three, write an odometer story about traveling on their bikes. Example: "My bike odometer read 22.2 miles when I started. I rode 0.5 miles to the park, the odometer read _____. I rode 0.9 miles to the snack bar and the odometer read _____. At the end of the trip, I rode a total of _____ miles."

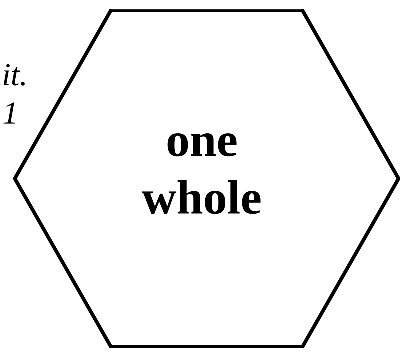


Notes and textbook references

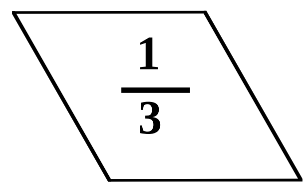
D. Use a variety of models such as pattern blocks, fraction bars, Cuisenaire™ rods, square inch tiles, and collections of objects to provide students with an opportunity to add and subtract fractions. Begin by establishing a unit. For example, when using pattern blocks, the hexagon might have the value of one whole unit. Ask students to determine the value of the triangle (1/6), blue rhombus (1/3), and trapezoid (1/2). Students build and record addition and subtraction problems using one kind of pattern block. For example, students agree to work with the blue rhombuses, or thirds. They roll a number cube twice and get two and three, or roll two cubes and get a two and a three. The numbers they roll become the numerators. They then gather the rhombuses, and write

$$\frac{2}{3} + \frac{3}{3} = \frac{5}{3} \text{ or } 1\frac{2}{3}.$$

Define *a unit.*
Hexagon = 1



Blue rhombus = $\frac{1}{3}$

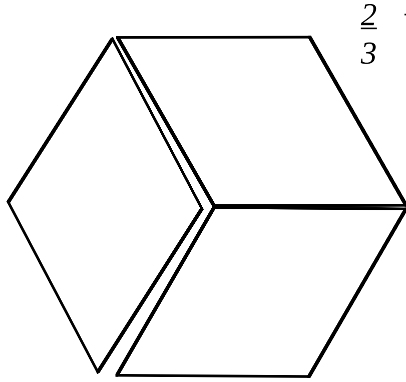


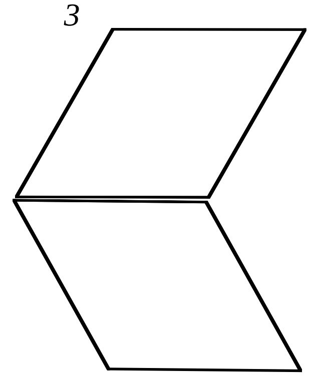
Roll *number cubes to generate numerators. Faces show 2 and 3.*

Collect *2 rhombuses and 3 rhombuses and compare with the unit shape.*

Record *results:*

$$\frac{2}{3} + \frac{3}{3} = \frac{5}{3} \text{ or } 1\frac{2}{3}$$





E. Give each group of four students 20 straws. Each straw will represent one whole. Each student folds and cuts one straw in half. Ask, "How many halves in a whole?" Then have each group model a mixed number using the straws. 2 1/2 could be five halves, two wholes and a half, or a whole and three halves. Next, direct students to fold a half in half and cut it to make fourths. "How many fourths in a whole?" Students could then model 3 and 3/4 using straws. Other possibilities: 15 fourths, one whole and 11 fourths, two wholes and seven fourths, three wholes and three fourths. Repeat with straws cut into eighths.

After students have modeled the mixed numbers, assign each group a mixed number to model. Ask group #1 and group # 2 to add their fractions. Which models are easiest to use? Which sum has the least number of "parts"? Some groups could be asked to subtract their numbers. Again, which models of the addends, minuends or subtrahends are easiest to use? Which model uses the least number of parts to display the sum or difference? These fraction pieces could be stored in Ziplock™ bags and referenced at another time. Another set of straws might be made with thirds and sixths. Giving students the opportunity to model the exchanges helps them to see the regrouping in fraction computation in a manner similar to the regrouping they experienced in the primary grades.

F. Most supermarkets carry their own brand of products sold under their own name. These "store brands" are almost always less expensive than the "name brands." Reproduce the Comparison Shopping Record Sheet (see Blackline Master I - 37) and review directions.

Directions: Take the shopping list to the supermarket. Write the price of the store brand and the name brand item in the table. Add four more items of your choice. Compute the difference in the prices of the two brands and record in the last column. Note: Be sure "store brand" and "name brand" items are in the same size containers or packages.

When students return to class, make a master chart with data collected by students. Discuss the data. Note whether any store brands are more expensive than the name brands and the variations in costs of different name brands and different store brands. Talk about why store brands may cost less and why some people still choose the more expensive brands. If you bought 10 items from the class's master chart, how much would you save by comparison shopping? In their journals or as an open-ended assessment, ask students to respond to the following writing prompt *"It is (or is not)always a good idea to buy store brands."* The creation of a list of six items from the class's master chart will help support their arguments.

Notes and textbook references

Notes and textbook references

G. Students can use pattern blocks to model addition and subtraction of fractions and mixed numbers with unlike denominators. If the hexagon represents one, then let students determine the fractional values of the trapezoid, blue rhombus and triangle. They should practice modeling equivalent fractions; $\frac{1}{2} = \frac{3}{6}$ (trapezoid = 3 triangles); $\frac{1}{3} = \frac{2}{6}$ (rhombus = 2 triangles) etc.
Have students model sums and differences with 2, 3 and 6 as denominators by trading the shapes until they have a single fraction representation as the result.

Example:

$$\begin{array}{r} 3\frac{1}{3} \\ +\ 2\frac{1}{2} \end{array}$$

Three hexagons and a rhombus will model the first addend; two hexagons and a trapezoid will model the second. The sum is now five hexagons, a rhombus and a trapezoid. The latter shapes can be traded for 5 triangles or a sum of $5\frac{5}{6}$. An example with regrouping:

$$\begin{array}{r} 2\frac{5}{6} \\ +1\frac{1}{2} \end{array}$$

To model the first addend, two hexagons and a variety of smaller shapes can be used (5 triangles; a trapezoid and a rhombus; 2 triangles and a trapezoid; etc.) The second addend :one hexagon and a trapezoid. After trading shapes the resulting sum can be represented by four hexagons and a triangle ($4\frac{1}{3}$).
After many examples, students can be encouraged to represent sums and differences with the <u>least</u> number of shapes. The pattern blocks limit the possibilities to denominators of 2, 3 and 6. Other manipulatives can be used to represent denominators of 4, 8 and 16, the tangram shapes. On another occasion a square measuring 5″ by 5″ can be divided to represent 5, 10 and 20 as denominators. See Blackline Master I - 38.

H. Have students work in pairs using a deck of cards where the kings, queens, and jacks have been removed. The value of the number cards 2 - 9 will be the same, ace = 1, and 10 = 0. Player One turns over three cards and makes a three-digit number, with red cards as whole numbers and black cards as decimal numbers. Player One repeats the process and adds the second number to the first.

Player One:	red 7, black ace, black 2	7.12
	red 4, red 10, black 8	+ 40.8

Player Two follows the same process. Players add their numbers. The greater sum wins the round. Variation: Each player keeps adding her/his numbers until one player has a total that is closest to 300 without going over.

I. Use the activity described in 1.02 a) H but ask the students to subtract the two numbers. The player with the greatest difference wins the round. Play for 15 rounds. Activities 1.02 a) H and J could be played in groups of three or four.

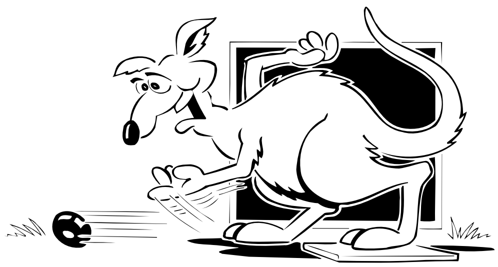
Notes and textbook references

Notes and textbook references

b.) Estimate sums and differences.

A. Read word names for decimal numbers in addition and subtraction problems. Have students record the addition or subtraction problems. Have them estimate the solution and then solve.
Example: Three and four tenths minus two tenths equals?

B. Students need a calculator with a constant function and the worksheet "Hit the Target!" (see Blackline Master I - 39). They estimate which of two given targets they will hit by following a certain rule, then check using the constant function on their calculators.
Copies of student-generated problems could be put in a center or made into a class calculator problem book.



C. Set up an arrangement of empty boxes with a target number determined by the spinner. See Blackline Masters I - 14, I - 40, and I - 41. Roll a decahedron die with numbers 0 through 9 to generate the numbers to be placed or use the digit cards. This activity can be varied by using different arrangements of the boxes, changing the operation from addition to subtraction and changing the targets.

c.) Judge the reasonableness of solutions.

Notes and textbook references

A. Make up a sheet of problems from the students' errors. Have the students find the errors and discuss why the errors were made. Validate answers by logical reasoning or by using inverse operations. (See Blackline Master I - 47 for an error pattern sheet, Dizzy Division.)

Note: This objective should be taught in conjunction with 1.02a) and 1.02b). It should not be taught in isolation. Some strategies are included to show ways to meet this objective while teaching 1.02a) and 1.02b).

B. For every problem you ask the students to work, focus on verifying results. Give the students ample opportunities to use different strategies to solve a problem. Look for different strategies to solve problems. Ask questions such as these: *"How many whole number digits will be in the answer when you multiply 63.4 x 4.5?"* or *"Why would a survey of only 10 fifth graders not be a good way to determine students' favorite pastimes?"*

C. Develop a group of problems that have unreasonable solutions. Conduct classroom or group discussions about why the solutions are not reasonable. Example: The mayor said in her speech that she would not raise taxes. Later, during the same speech, she said she would build a new park for the city and repair the sidewalks and streets. Are her claims reasonable? Why or why not?

D. A technique that focuses students' thinking in a new direction involves looking for numbers that *couldn't* be the answer to a given problem! After stating the problem ask students to suggest numbers that can't be the solution. List them on the blackboard and have other students explain why those numbers won't do the trick. In analyzing the problem from this angle, students explore the limits and sense of magnitude that the solution requires. Everyone can give a *wrong* answer and the only student who *<u>is wrong</u>* is the one who gives the correct solution!

Notes and textbook references

E. Assign a few problems from your text or other source and have the students write one wrong answer for each problem (the wrong answers should reflect errors that a fifth grader would make). Students should be prepared to explain why the answer is incorrect.

F. Play **You Be the Judge.** Copy Blackline Master I - 53 on cardstock, laminate, and cut cards apart. Draw a two column chart on the board with two headings: Object: Sustain!

Directions for the game**:**

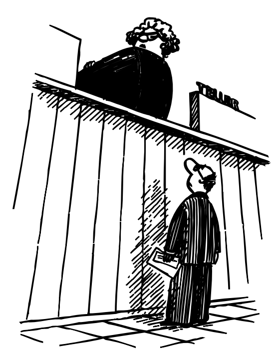
- Students must decide whether or not the math on the cards was done correctly (sustain!) or incorrectly (object!). Allow time for students to “defend” their decisions. Teacher holds cards up one at a time for the students to discuss the reasonableness of solutions and place them in the proper columns.

- After all cards have been placed, the teacher gives the students one last opportunity to make changes. Ask if they rest their case and are ready for a verdict.

- If all cards are place properly the students win their case.

- Note: Additional problems can be written from common mistakes your students make in class and black graduation gowns make wonderful robes for judges and will increase the students’ motivation.

Variation: Students could be divided into three groups - lawyers (defense and plaintiff) and a jury. Assign appropriate rolls. Lawyers receive problems to defend the next day. Jury gives verdict. Roles can be rotated.



G. After playing the game **You Be the Judge** 1.02c) F, have students write distracters for the problems and rewrite it as a multiple choice item. Form groups to discuss possible distracters for these problems and why it is important to look at each answer choice. Have students brainstorm strategies they can/should do to check for the reasonableness of solutions on all problems – multiple choice or not.

Notes and textbook references

Notes and textbook references

1.03 Develop flexibility in solving problems by selecting strategies and using mental computation, estimation, calculators of computers, and paper and pencil.

A. Have students share ways to solve problems. Use the following: The cost of a newspaper is 35 cents per day. How much would that be in a week? In the month of February? In one year? In a leap year? (Do not include the Sunday paper.) *Extension:* If the Sunday paper costs $1.75, how much would you pay to have a paper every day in October?

B. Answer the following questions for each exercise below:

1. Can you solve this problem?
2. What information is missing?
3. Can you supply reasonable numbers for any missing information?
4. What is the solution to the problem?

Situation 1: Eleven girls are in the class. Two boys left the class. How many pupils are in the class now?

Situation 2: Marita purchased one notebook and five pencils for $1.70. How much did the notebook cost?

Situation 3: Sarah's family went on a 15 kilometer bicycle trip. How many kilometers did the entire family travel?

Situation 4: Johnny has two hats, two pairs of shoes, four pairs of pants, and five shirts. How many different outfits can he make?

C. Ask the students (in groups) to develop situations including a variety of information.
Example: Susan rides her bike to school each day of the week. The distance to school is 1.5 km. After school on Tuesday she goes from school to a piano lesson, a distance of 0.6 km, and 0.9 km from the piano lesson home. Thursday, after doing her homework, she rides her bike 0.7 km to the park for soccer practice. It takes her about 10 minutes to ride to school and about 5 minutes to ride to the park. She leaves home at 7:30 a.m. to go to school. School dismisses at 3:00 p.m. Determine the questions that can be answered using the situations developed.

Notes and textbook references

D. On an envelope, write the question from a problem. On separate index cards (inside the envelope) write one sentence of the problem. Also include extraneous information. Ask the students the question, then pull out one card from the envelope. Read the information and have the students discuss whether there is enough information to answer the question. Continue until you have read each of the cards in the envelope and students have solved the problem. Example: "How much money did Jack spend on popcorn?"

Index cards:
1. Jack and Cheryl went to the show.
2. She got $4.50 in change from her $10.00 bill.
3. Jack was tenth in line to buy popcorn.
4. He bought 2 tubs of popcorn costing $1.50 each.
5. They arrive at 7 p.m.
6. Halfway through the movie, Jack went back to the snack bar and bought two orange drinks and another box of popcorn.
7. Cheryl bought their tickets but waited in line for 22 minutes.
8. Popcorn costs $1.50 per tub.
9. The movie was over at 9:30 p.m.

Make several envelopes using a variety of similar problems.

E. Test your visual memory by drawing these. Label each figure as you go and check the results at home (or have these available at school for checking).

1. A circle the size of a dime.
2. A rectangle the size of a stick of gum.
3. A rectangle the size of a dollar.
4. A circle the size of the end of a drink can.
5. A square the size of a soda cracker.
6. A line as long as a new unsharpened pencil.

Have students suggest other visual memory drawings.

Notes and textbook references

F. When working with problems with extraneous information, ask students to write other questions that could be answered. Have students answer each other's questions. When we asked fifth grade teachers for their favorite problem-solving resources, these were some of the books they suggested:

Creative Problem Solving in School Mathematics by George Lenchner.
Daily Mathematics, Grade 5, published by McDougal, Littel.
Make It Simpler by Carol Meyer and Tom Sallee, Addison-Wesley.
Mathwise by Arthur A. and Pamela R. Hyde, Cuisenaire Company of America Inc.
Addenda Series, National Council of Teachers of Mathematics.
The Mathematical Toolbox, Cuisenaire Company of America, Inc.
Problem Parade, Dale Seymour Publications.
Lane Country Mathematics Project, Dale Seymour Publications.
Algebra Thinking: First Experiences, Creative Publications.
Connections, Grade 5, Creative Publications.
Get It Together, EQUALS Foundation.
Overhead Math, Creative Publications.
The Problem Solver, 5, Creative Publications.

G. Use a radio to show the students how decimals are used to identify radio stations. As you tune in radio stations, record the specific station number and the type of music that it plays. From the list, ask the students to do various computations such as: the sum of their three favorite stations, the difference between a rock-and-roll station and a country-western station, etc.

H. In pairs, students measure their heights in meters and decimeters (1/10 of a meter), recording as a decimal number rounded to the nearest tenth (i.e., to the nearest decimeter). Use this information to solve problems like these:

If you and another student lie on the floor in a straight line with feet touching, how much room (length) in meters will you need?
If you shrink one meter, how tall will you be?
If your friend stands on your shoulders, how far would it be from the top of his or her head to the floor in meters (rounded to the nearest tenth of a meter)? What new measurements would you need to take?

I. Divide your students into teams of four and give each team the employment section of the classified advertisements, scissors, construction paper, glue, and calculators. Each team will make a table comparing ten different classified job offerings. The team can choose to look for hourly, weekly, monthly, or yearly pay, but they must calculate the wages for each time frame for each ad. The ads should be cut out and glued to a sheet of construction paper along with the wage table.

Which job would you choose? Explain your reasoning.

Note: You may need to gather data for students to use from an agency such as the unemployment office of a job placement agency.

Notes and textbook references

Technology Integration idea: have students go to the Employment Security Commission website to look for jobs in your area.

Job	Hourly Salary	Weekly Salary	Monthly Salary	Yearly Salary

J. Create "silly" problems for the students to solve:

Farmer Hoe Down hoes 3 3/4 rows of peas each day. Will he get all 17 rows of peas hoed in 5 days? What will happen if it rains?

Rocky Road Runner can run 12 miles in an hour. If he starts running at 2:00, how far will he have run by 4:30?

Have the students create "silly" problems for each other.

K. Brett and Lindy dyed twelve eggs and put them in an egg carton. They made equal numbers of blue, green, and pink eggs. Within each row of the egg carton, every pink egg had eggs of different colors on either side. There was always more than one egg between the pink eggs. Eggs that are the same color within a row did not touch. The last egg in row one was the same color as the first egg in row two. The last egg in row two was blue. Draw a picture or put plastic eggs into a carton correctly. See Blackline Master I - 42.

Notes and textbook references

L. Involve the class in the **Stock Market Adventures**. This is an introduction to the stock market and an application of many mathematics skills and strategies. It was developed originally by Ron Powell, a teacher in western North Carolina. Its objectives are:

- using the calculator as a tool in multi-step problem solving
- the development of cooperative learning skills
- strengthening competence with operations, whole numbers and decimals
- learning about the stock market and its influence on our economy

The suggested length of this activity is from 10 to 20 days to maintain a high interest level. Some teachers use it as an end-of-the-week activity towards the end of the school year.

The materials you will need are:

- daily NY stock market quotes from the newspaper
- calculators, transaction, purchase and recording sheets - see Blackline Masters I - 44 through I - 46.
- investment portfolios (file folders to store transaction, purchase and recording sheets)
- one Final Day-of-Trading sheet per team

Before starting, look through the blackline masters, a copy of the daily stock market report and the rules. These will give you a good overview of the activity. Explain to students that they will be using the NY Stock Exchange to create and follow a portfolio of five different companies. You may wish to model the activity for a few days before the class teams start to assemble their portfolios. Making transparencies of the various recording sheets and entering the daily data will help students understand the processes and enable them to operate independently when they begin. Teams of 2-4 students, individual students or the whole class as a group can engage in the process. Students can be assigned the task of highlighting the chosen stocks each day for ease in reading the data. The guidelines can be reproduced to be used by students as a reference. See Blackline Master I - 43.

This activity can be incorporated into an interdisciplinary unit with extensions such as:

- graphing profits and losses each day with a broken line graph or line plot
- writing a report at the end or a daily summary describing the events that shaped the choice of stocks or the rise and fall of their values
- investigations of the products or services produced by the companies chosen, their geographic locations, or their impact on the environment
- inviting guest speakers who represent the companies chosen or local investment firms

M. Make three sets of cards 1- 10, two sets of cards 11 - 20, and one set of cards 21 - 25. See Blackline Masters I - 50 through I - 52. Shuffle the cards and draw five cards. Students must use all five numbers and any operations (+, -, x , ÷) to get the target number.
Example: The target number is today's date.

Today is the 12th. You draw the following: **10, 6, 24, 17, 15.**

24 ÷ **6** = 4 **17 - 15** = 2 **10** - 4 = 6 2 x 6 = 12 So,

(**17 -15)** x **(10 - 24** ÷ **6**) = 12, the target number!

N. Reproduce copies of the **Video Varsity Store** and the **Video Investigations** for students (see Blackline Masters I - 48 and I - 49). Notice that the numbers used in some of the computations are larger than students are usually expected to work with. However, using technology the tasks are realistic and appropriate. Have half of the class use the Varsity Video information and the others use data from local stores. Students can create additional questions for each other to solve. Be sure to have students discuss the processes they used to solve the problems.

O. The following software has been recommended by fifth grade teachers: *Logo Writer, The Oregon Trail, Operation Neptune, The Math Shop, dBase IV, How The West Was Won.*

P. You can use only the =, -, x, and ÷ keys for calculator operations. Your job is to have your calculator display 672. How many different ways can you find to make 672?

Q. Build a resource file of real-world problems that have "messy numbers" but that calculators make possible for fifth graders. Census data, problems which relate to area and land use, and store inventories and sales are examples of such resources.

Notes and textbook references

Many textbooks have flow charts, lists and schemes to guide students through the problem-solving process. Here is one:

I. Understand the problem.
II. Devise a plan.
III. Carry out the plan.
IV. Look back.

Notes and textbook references

R. Students should have the opportunity to “act out’ the results of their solutions. If they are determining the number of buses needed for a field trip they should apportion students to the vehicles. Is everyone accounted for? Can they really order 6.2 buses or does 7 make more sense?

S. Using a grid or chart students can list alternate strategies that could be used to solve a particular problem. A bulletin board of sample solutions using alternate strategies is one way to illustrate the possibilities. Additionally, teachers can encourage students to solve problems in two *different* ways.

Good multi-step problems need to involve more than one operation, and provide students with situations that include choice and discrimination. Additionally, the inclusion of extraneous information provides students with situations that transcend exercises and are worthy to be called problems.

T. Students work in groups with a set of pattern blocks, a copy of Blackline Master I - 38, and crayons or colored pencils/markers. Students will investigate the concept of one whole and the variety of ways one whole can be divided. Have the students begin by using the yellow hexagon as one whole unit. Use another shape, such as the green triangle, to demonstrate how the whole unit may be divided into six parts, each being labeled $\frac{1}{6}$.

Students shade in a hexagon and trace the green triangles to record that $\frac{6}{6}$ = 1 whole. Students investigate other combinations to complete the whole unit, as well as determine which pattern blocks will not be appropriate for this task. Remind them to record each way they cover the hexagon. For example, they might use a trapezoid and 3 triangles and write 1/2 + 3/6 = 1 whole.

To explore the concept of equivalent fractions, students determine which of the pattern blocks will fill in the same spaces. For example, students place a red trapezoid over one half of the hexagon. Using other pattern block shapes (such as the green triangles), students cover the other half and label according to the amount of pattern blocks used (i.e., 3/6). An equation to explain the relationship of the two fractions could be written below the picture, i.e., 1/2 = 3/6, that is recorded.

U. Provide a scenario with multiple possibilities for problems and approaches. Students can be asked to create the questions. For example, Mrs. Clarks's fifth grade class earned a pizza surprise when everyone in class improved their test scores by 10 percent. Twelve pizzas were delivered, four with only cheese, three with sausage, two with pepperoni, and the rest with mushroom. Each pizza was cut into 8 slices. If the answer is 4/12, what might the question be? If the answer is 8/12, what might the question be? If the answer is 9/4, what might the question be? This idea comes from a publication by Marcy Cook called Numbers Please! Questions Please?, 1991. Either create more scenarios and answers or ask students to create them. Creating a story with possible answers makes a good homework assignment and then students can share their work with each other. This would provide unlimited opportunity for adding and subtracting fractions in the context of problem solving.

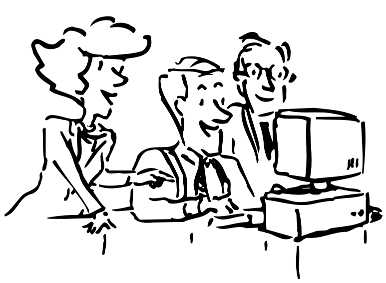
Notes and textbook references

Understand the problem.

Is there enough information?
Read the problem again.
Draw a picture.
What do I know.
What am I looking for?
Read the problem again.

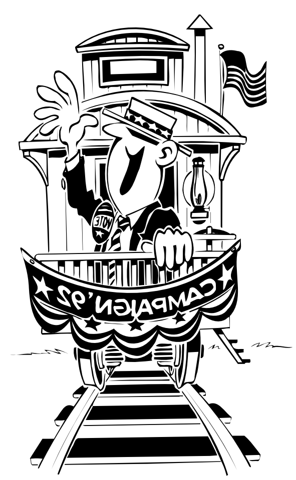
Devise a plan.

Have I ever seen a problem like this before?
Can I simplify the problem?
Is there a pattern?
Can I make a table? draw a picture?
work backward?
What about guess and check? make a list?
Can I write a number sentence?
Read the problem again.



Carry out the plan.

Remember what I'm looking for.
Is this plan taking me where I need to go?
Read the problem again.
Do I need a new plan?



Look back.

Did I answer the question?
Does my answer make sense?
Can I solve this problem any other way?
Read the problem again.