CALCULATOR ACTIVITIES

Add & Subtract Whole Numbers

Change place values to zero

Materials

- An overhead calculator
- A calculator for each student

Procedure

1. Write the number 567,312,984 on the overhead calculator. (**Note:** Calculators differ in their ability to hold large numbers. You may choose to use smaller numbers for this activity.) Direct students to display the number on their calculators.
   - ▸ How could you change the value in the Tens place to 0 by subtracting? ***Subtract 80***
2. Direct the students to subtract 80 from 567,312,984 on their calculators as you demonstrate on yours. ***567,312,984 – 80 = 567,312,904***
3. Display the number 567,312,984 on your calculator again and direct the students to display that number on their calculators. Instruct the students to change to 0 the value in the Hundreds place by subtracting. Give the students time to do the problem on their calculators. Tell them that if they make a mistake, they will need to clear their calculators, enter the original number, and try again. After the students have had time to do the problem, show the correct answer. ***Subtract 900 to display 567,312,084.***
4. Repeat the procedure, calling out places between the One Thousands and One Hundred Millions places in random order.

Subtract two- and three-digit numbers

Materials

- A small container
- A calculator for each student

Preparation

Several small pieces of paper with a 2- or 3-digit number written on each

Procedure

1. Place the pieces of paper in the small container. Direct the students to place a sheet of notebook paper on their desks. Call on two students to each remove one piece of paper from the container.
2. Instruct the class that they are to write a vertical subtraction problem, subtracting the smaller number from the larger number. Instruct the two students to read the numbers to the class. Choose students to tell the difference in the two numbers.
3. Guide the students in checking each answer using their calculators. Repeat the procedure.

Simplify decimal numbers with zeros at the end

Materials

- A calculator for each student

Procedure

1. Write the following problems for display and direct students to subtract the numbers.

   42.36 – 13.36 = ***29.00***

   4,236 – 1,336 = ***2,900***

   - ▸ What is similar about these answers? ***The digits are the same.***
   - ▸ What is different? ***the values differ due to the decimal placement; 29 and 2,900***
2. Instruct students to use their calculators to find the answers to these same problems.
   - ▸ What do you notice about the answers? ***Elicit that when the decimal is followed by zeros only, the zeros are dropped because they do not change the value of the number.***
3. Direct students to use their calculators to find the answer to the first problem in each of the following pairs of problems, then predict the difference for the second problem in the pair, and finally check their prediction using their calculators.

   536 – 236 ***300*** and 53.6 – 23.6 ***30.0 or 30***

   6,294 – 3,294 ***3,000*** and 6.294 – 3.294 ***3.000 or 3***

   $52,742 – $13,742 ***$39,000*** and $527.42 – $137.42 ***$390.00 or $390***

   96,358 – 74,128 ***22,230*** and 963.58 – 741.28 ***222.30 or 222.3***

Multiply by a Whole Number

Make a pyramid

Materials

- Multiplication Pyramid (page 4 in this section of the CD), 1 for every 4 students
- A calculator for each student

Procedure

1. Distribute the multiplication pyramids. Instruct the students to multiply the first two numbers, 1 × 3, and to write the product, ***3***, in the shared box above the two numbers.
2. Repeat the procedure to write the remaining products above each pair of numbers. Instruct the students to use their calculators when they begin to have two-digit multipliers. Allow the students to read the final product at the top of the pyramid. ***27,348,890,625***

				27,348,890,625				
			23,625		1,157,625			
		45		525		2,205		
	3		15		35		63	
1		3		5		7		9

Apply the Distributive Property

Materials

- A calculator for each student

Procedure

1. Remind the students that the Distributive Property can help them solve a larger multiplication problem by breaking one factor into addends and multiplying each addend by the other factor. Write 22 × 8 for display. Direct the students to use the Distributive Property to write an equation for the problem and find the answer using mental calculations (e.g., (20 × 8) + (2 × 8) = 160 + 16 = 176 or (22 × 4) + (22 × 4) = 88 + 88 = 176). Point out that either factor can be broken into addends.
2. Direct the students to enter the original problem into their calculators to check their answers.
3. Follow a similar procedure for the following problems.

   8 × 29 ***(8 × 20) + (8 × 9) = 160 + 72 = 232***

   31 × 20 ***(30 × 20) + (1 × 20) = 600 + 20 = 620***

   205 × 12 ***(200 × 12) + (5 × 12) = 2,400 + 60 = 2,460***

   23 × 110 ***(23 × 100) + (23 × 10) = 2,300 + 230 = 2,530***

Write repeated factors using exponential notation

Materials

- Number Forms (page 5 in this section of the CD) for each student
- A calculator for each student

Procedure

1. Display and distribute the Number Forms page. Direct the students to write 5 × 5 × 5 × 5 in exponent form. ***5^4*** Choose a student to write it for display.
2. Direct the students to enter 5 and then push the × button. Tell them to push the = button next.

   ➤ **What happened?** ***Elicit that the number in the window, 5, was multiplied by 5***

3. Direct them to push the equal sign again. Point out that when you enter a 5 followed by the × sign, with each push of the = button the number will continue to multiply by 5. Direct them to clear their calculator, and enter 5 × followed by 3 pushes of the = button to find the value of 5^4.

   ➤ **What is the value of 5^4?** ***625***

   (**Note:** Some calculators may have a power entry button, but this activity is designed to show the growth of repeated multiplication.)

4. Follow a similar procedure to complete the table.

   6 × 6 × 6 × 6 × 6 × 6 ***6^6; 46,656***

   10 × 10 × 10 × 10 × 10 ***10^5; 100,000***

   10 × 10 × 10 × 10 ***10^4; 10,000***

   10 × 10 × 10 ***10^3; 1,000***

   10 ***10^1; no factored form***

   1 ***10^0; no factored form***

Find square roots

Materials

- A calculator for each student

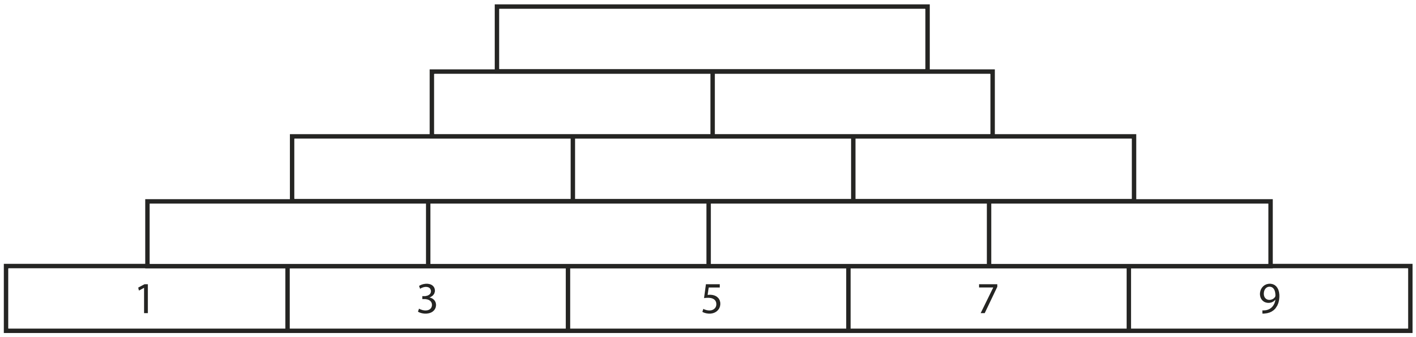
Procedure

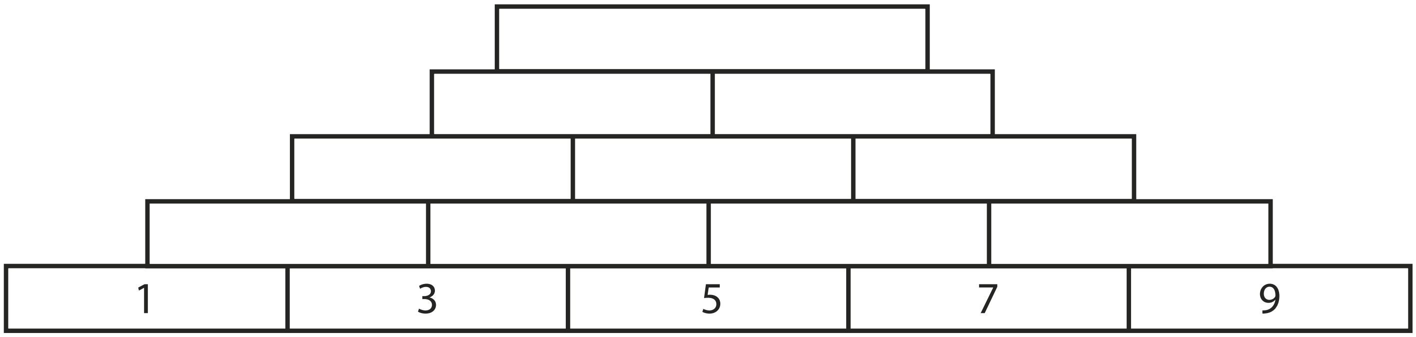
1. Elicit the square roots of 4, 9, and 25 from the students. ***2, 3, 5*** Guide the students in using the calculator to determine these square roots. (**Note:** To find the square root of a number, enter the number on the calculator and then press the square root key.)
2. Point out that these three square roots are rational numbers. A *rational number* is a number that ends or repeats. Direct the students to find the square roots of 2, 5, and 19. Elicit from the students that these three square roots do not terminate or repeat. Point out that numbers that do not terminate or repeat are *irrational numbers*.
3. Instruct the students to find the square root of the number and tell whether it is rational or irrational. $\sqrt{16}$ ***rational***; $\sqrt{7}$ ***irrational***; $\sqrt{26}$ ***irrational***; $\sqrt{49}$ ***rational***

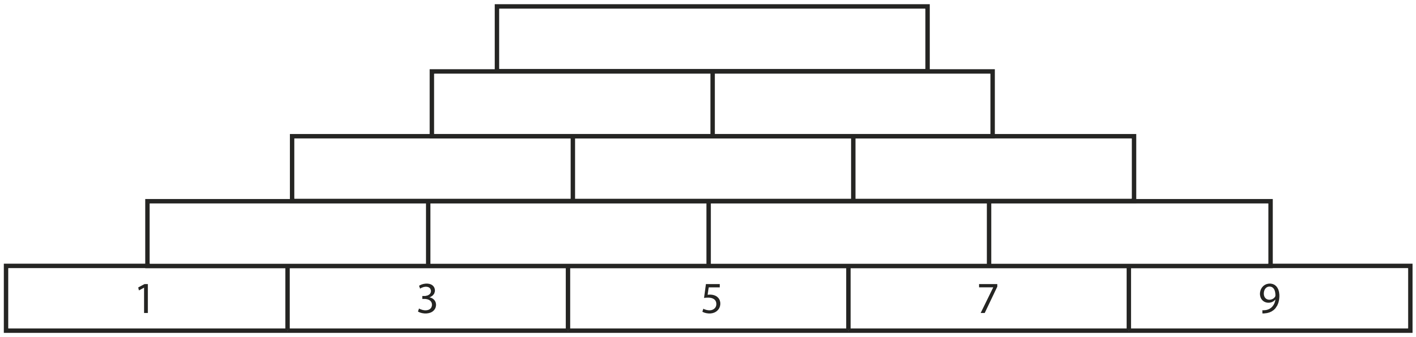
4. Explain that numbers that have rational numbers as their square root can be referred to as *perfect squares*. Direct the students to use their calculators to find other perfect squares. ***Possible answers: 16, 36, 49, 64, 81, 100, 121, 144*** After allowing a few minutes of discovery, elicit that these perfect squares can be found by squaring the natural numbers or multiplying each natural number by itself.

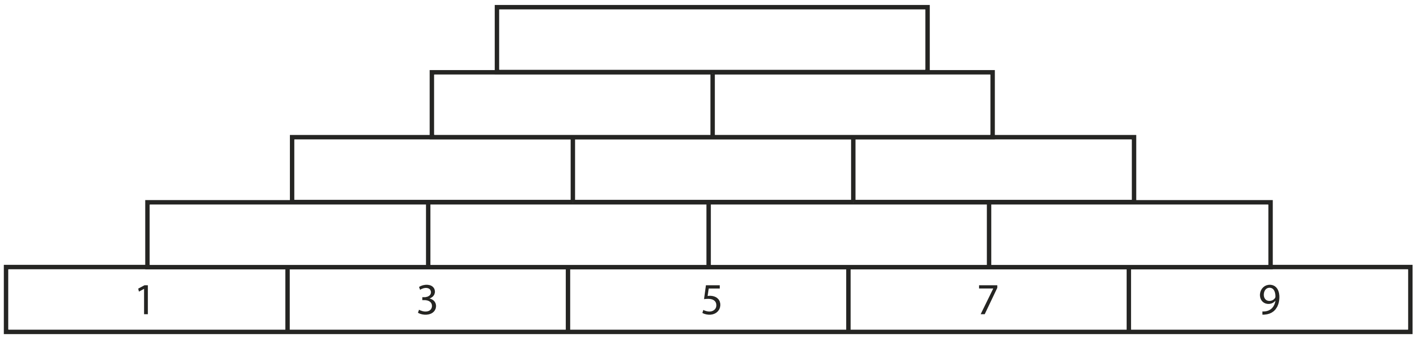
➢ **What are some more examples of square roots that are irrational numbers?** ***Possible answers: 3, 6, 7, 65, 83, 101, 132, 143; Elicit that these include all the natural numbers that come between the square roots of the perfect squares.***

Multiplication Pyramid









Number Forms

	Standard Form	Factored Form	Exponent Form
1.	***625***	$5 \times 5 \times 5 \times 5$	5^4
2.	***46,656***	$6 \times 6 \times 6 \times 6 \times 6 \times 6$	6^6
3.	***100,000***	$10 \times 10 \times 10 \times 10 \times 10$	10^5
4.	10,000	$10 \times 10 \times 10 \times 10$	10^4
5.	***1,000***	$10 \times 10 \times 10$	10^3
6.	10		10^1
7.	1		10^0

Divide by a Whole Number

Estimate a quotient for missing-factor equations

Materials

- Missing-Factor Matching (page 7 in this section of the CD) for each student
- A calculator for each student

Procedure

1. Display the missing factor equations and answer choices as shown below.

   $47 \times n = 1{,}692$ $n = 12$

   $617 \times n = 7{,}404$ $n = 36$

   $n \times 51 = 4{,}182$ $n = 82$

2. Explain to the students that you want to match the equation to the factor that completes it.
   - ➢ **How can you find the value of the variable in these equations?** ***Divide the product by the known factor.***
   - ➢ **How can you estimate the missing factors without solving each division problem?** ***Possible answers: Round the known factor to the place of greatest value and the product to a compatible number: 1,500 ÷ 50 = 30; Round the product to the place of greatest value and the factor to a compatible number: 1,600 ÷ 40 = 40.***
3. Guide the students in using compatible numbers to estimate the answer to each division equation to find the missing factor. Choose students to draw a line from each equation to the correct answer.
4. Place the student copies of Missing-Factor Matching in a math center. Allow students to find a partner to compete with. Instruct the students to see who completes each section first. Allow them to use their calculator to check their answers.

Determine the whole number remainder

Materials

- A calculator for each student

Procedure

1. Write the following problems for display.

   $511 \div 35 =$ __ ***r21*** $466 \div 62 =$ __ ***r32***

   $201 \div 58 =$ __ ***r27*** $55 \div 25 =$ __ ***r5***

2. Group the students in pairs. Direct them to use a calculator to determine the whole number remainder for each problem. Allow the students to brainstorm among themselves to decide how to find the whole number remainder when the quotient is given in decimal form. Hint: Remind the students to think about how the division check is performed in solving these problems.
3. Allow students to share their findings. Elicit that the whole number remainders can be found by multiplying the whole number quotient times the divisor and then subtracting that product from the dividend. (e.g., $511 \div 35 = 14.6$, $14 \times 35 = 490$; $511 - 490 = 21$; 21 is the whole number remainder. Subtracting the product of 14 whole sets of 35 will leave you with the whole number that represents a fractional remainder [$\frac{21}{35}$] of the next set of 35. Twenty-one is 0.6 of the next set of 35. $0.6 \times 35 = 21$ and $\frac{21}{35} = 0.6$.)

Find the height of one billion sheets of paper

Materials

- A stack of 100 sheets of paper
- A ruler
- A calculator for each student

Procedure

(**Note:** This activity can be done as a class or individually at an area in the classroom.)

1. Display the stack of paper, the ruler, and the calculator.
   - ➢ **How could you use a stack of 100 sheets of paper, a ruler, and a calculator to find to the nearest mile the height of a stack of one billion sheets of paper?** ***Answers will vary.***
2. Choose a student to measure the height of the stack of 100 sheets of paper. ***$\frac{1}{2}$ inch*** Then direct them all to use this measurement to determine the height to the nearest inch of 1 billion sheets of paper. Allow time to share conclusions and methods used. ***5,000,000 inches***

   (**Note:** Some students will multiply the number of sheets and the height by increments of 10 until they get to 1 billion, while others will divide 1,000,000,000 by 100 and then multiply $\frac{1}{2}$ times that quotient [10^7] to find the height in inches.)
   - ➢ **How could you find the height of 1 billion sheets of paper to the nearest mile?** ***Elicit that you would need to divide 5,000,000 inches by 12 to find how many feet and then divide the number of feet by 5,280 to find the number of miles.***
3. Guide students in dividing and rounding to the nearest foot or to the nearest mile:

   5,000,000 ÷ 12 ≈ 416,666.67 ≈ 416,667 feet

   416,667 ÷ 5,280 feet (1 mile) ≈ 78.91≈ 79 miles
4. Direct the students to find out about how many times the Sears Tower would have to be stacked up to reach as high as the stack of 1 billion sheets of paper. (**Note:** Instruct the students to find the height of the Sears Tower in a reference book, on the Internet, or provide them with the information; 1,454 feet). ***416,667 ÷ 1,454 ≈ 286.56602 times; rounded to the nearest whole is 287 times***

Missing-Factor Matching

Draw a line to the correct missing factor.

A.

$24 \times n = 384$	$n = 12$
$n \times 52 = 8{,}684$	$n = 96$
$n \times 83 = 7{,}968$	$n = 16$
$52 \times n = 624$	$n = 167$
$44 \times n = 1{,}232$	$n = 28$

B.

$27 \times n = 378$	$n = 14$
$273 \times n = 3{,}822$	$n = 57$
$n \times 143 = 1{,}573$	$n = 14$
$n \times 96 = 2{,}304$	$n = 24$
$46 \times n = 2{,}622$	$n = 11$

C.

$693 \times n = 5{,}544$	$n = 6$
$n \times 867 = 4{,}335$	$n = 12$
$n \times 415 = 2{,}490$	$n = 5$
$58 \times n = 870$	$n = 8$
$114 \times n = 1{,}368$	$n = 15$

D.

$766 \times n = 6{,}128$	$n = 6$
$n \times 207 = 1{,}242$	$n = 3$
$846 \times n = 2{,}538$	$n = 9$
$447 \times n = 2{,}235$	$n = 8$
$n \times 49 = 441$	$n = 5$

Fraction Theory

Find equivalent fractions

Materials

- A calculator for each student

Procedure

1. Write $\frac{48}{95} = \frac{n}{380}$ for display.
   - ▸ **Do you multiply or divide to rename the fraction from 95 parts to 380 parts? How do you know?** ***Multiply; Elicit that you know that you multiply because it takes several sets of 95 to equal 380.***
   - ▸ **How can you find out what you multiplied 95 by to get 380?** ***Answers will vary, but elicit that since n × 95 = 380, then 380 ÷ 95 = n.***
2. Instruct the students to use their calculators to divide 380 by 95. ***380 ÷ 95 = 4***
   - ▸ **What fractional name for 1 was $\frac{48}{95}$ multiplied by to find the equivalent fraction with 380 as the denominator?** $\frac{4}{4}$
3. Point out to the students that since they have the renamed denominator, they only need to multiply the numerator. Allow them to use their calculators to multiply 48 by 4. ***48 × 4 = 192***
4. Choose a student to erase the variable in the problem and replace it with 192. Call on a student to read the number sentence for the two equivalent fractions.
5. Continue the procedure with the following number sentences.

   $\frac{36}{59} = \frac{180}{295}$ $\quad \frac{36}{59} \times \frac{5}{5} = \frac{180}{295}$

   $\frac{73}{91} = \frac{438}{546}$ $\quad \frac{73}{91} \times \frac{6}{6} = \frac{438}{546}$

Find a decimal equivalent for a fraction

Materials

- A calculator for each student

Procedure

1. Remind the students that a fraction expresses a part of a whole and the fraction bar means divided by.
   - ▸ **What decimal represents $\frac{1}{2}$?** ***0.5***
2. Direct the students to enter $\frac{1}{2}$ (1 ÷ 2) into their calculators.
3. Since the decimal system is a base ten system, a fraction that can be renamed as an equivalent fraction with 10 or 100 as the denominator can be written as an equivalent decimal value. Point out that a calculator gives a decimal equivalent for a fraction.
   - ▸ **How can you write $\frac{1}{4}$ as a decimal?** ***0.25*** Direct the students to predict each of the following decimal equivalents, and follow a similar procedure to check their prediction using the calculator.
4. Instruct the students to use their calculators to check their answer. ***1 ÷ 4 = 0.25***
5. Follow a similar procedure for these fractions.

$\frac{1}{4} = 0.25$	$\frac{2}{4} = 0.5$	$\frac{3}{4} = 0.75$	$\frac{1}{8} = 0.125$
$\frac{2}{8} = 0.25$	$\frac{4}{8} = 0.5$	$\frac{4}{10} = 0.4$	$\frac{29}{100} = 0.29$
$\frac{3}{5} = 0.6$	$\frac{4}{5} = 0.8$	$\frac{2}{5} = 0.4$	$\frac{1}{5} = 0.2$

(**Note:** Point out that decimal equivalents can be rounded as in $\frac{1}{3}$ and $\frac{2}{3}$.) $\frac{1}{3} \approx 0.33$ $\frac{2}{3} \approx 0.66$

Apply the order of operations to find an unknown angle measure

Materials

- A calculator for each student

Procedure

1. Write 65° and 35° for display. Tell students that these are two known angle measures of a triangle. Guide students in writing the equation they would use to find the measure of the unknown angle. Tell them to enter their equation into their calculator. Elicit answers.
2. Guide the students in determining that an equation without parentheses will not yield the same answer as an equation with parentheses. One example is the following: 180° – 65° + 35° = 150° and 180° – (65° + 35°) = 80°.

➢ **How can you check your answer?** ***Elicit that you can add the 3 angle measures to see if they total 180°; 150° + 65° + 35° ≠ 180°; 80° + 65° + 35° = 180°***

3. Direct them to use their calculators to check the measure of the unknown angle by finding if the sum of the angles equals 180°.
4. Guide the students to the conclusion that you must follow the order of operations when entering equations into the calculator. ***180° – 65° – 35° = 80°***
5. Follow a similar procedure for the following angle measures.

   15° and 45° ***(180° – 15°) – 45° = 120°***

   95° and 30° ***(180° – 95°) – 30° = 55°***

   103° and 62° ***(180° – 103°) – 62° = 15°***

   (**Note:** This activity can be adjusted to find an unknown angle measure in a quadrilateral. [e.g., 120°, 42°, and 60° becomes ***[(360° – 120°) – 42°] – 60° = 138°***])

Multiply Fractions & Decimals

Multiply a decimal by a power of 10

Materials

- A calculator for each student

Procedure

1. Tell the students that you are going to read a multiplication problem in which they must mentally multiply a decimal by a power of 10, and that you want them to write the problem and the answer only on paper. After each problem, direct the students to check their work with a calculator. Use problems similar to the following.

   $10 \times 3.24 =$ ***32.4*** $100 \times 0.345 =$ ***34.5***

   $10^3 \times 1.789 =$ ***1,789*** $10^2 \times 21.9 = 2{,}190$

2. Continue this activity by encouraging individual students to give a problem and directing the rest of the class to solve the problem mentally.

Multiply a fraction by a power of 10

Materials

- A calculator for each student

Procedure

1. Write $10 \times \frac{1}{2}$ for display.

   ➢ **How could you enter this expression into your calculator as a continuous entry without having to clear your screen? Elicit that your equation would have to follow the order of operations; (10 × 1) ÷ 2 = 5**

   (**Note**: Encourage students who suggest multiplying by a known fraction decimal equivalent [e.g., $10 \times 0.5 = 5$] to write the equation showing the required division.)

2. Follow a similar procedure for the following. Elicit the equation used.

   $100 \times \frac{2}{10}$ ***20; 100 × 2 ÷ 10 = 20***

   $1{,}000 \times \frac{1}{4}$ ***250; 1,000 × 1 ÷ 4 = 250***

   $10^2 \times \frac{3}{4}$ ***75; 10 × 10 × 3 ÷ 4 = 75***

   $10^1 \times \frac{2}{4}$ ***5; 10 × 2 ÷ 4 = 5***

Divide Fractions

Materials

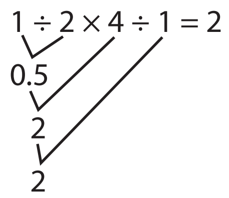
- A calculator for each student

Procedure

1. Write $\frac{1}{2} \div \frac{1}{4} = \_\_$ for display. Choose a student to solve the multiplication problem. *$\frac{1}{2} \times \frac{4}{1} = \frac{4}{2} = 2$* Write 2 in the answer blank of the displayed equation.

   ➢ **How can you write the equation used to solve this problem using whole number and operation signs rather than fractions?** ***Elicit $1 \div 2 \times 4 \div 1 = 2$.*** Choose a student to write the equation for display.

2. Guide the students in entering this equation into their calculators to solve. Discuss each step as shown below.



   ➢ **How do you think you can write the equation $\frac{1}{2} \div \frac{1}{4} = \_\_$ using whole number and operation signs rather than fractions?** ***Answers will vary. Elicit $1 \div 2 \div 4 \div 1 = 2$.***

   (**Note:** Most students will not realize that parentheses are needed.) Choose a student to write the equation for display.

3. Direct the students to enter this equation into their calculators to solve. Discuss each step as shown below.

   ➢ **What is $1 \div 2 \div 1 \div 4$?** ***0.125 or $\frac{1}{8}$***

   ➢ **We know the answer to $\frac{1}{2} \div \frac{1}{4} = 2$, so why is the answer on the calculator 0.125 or $\frac{1}{8}$?** ***Guide the students to the conclusion that the Order of Operations dictates that parentheses are needed in this equation since you are dividing the value of $\frac{1}{2}$ by the value of $\frac{1}{4}$. $(1 \div 2) \div (1 \div 4) = 2$***

4. Direct the students to enter this or any other changes to the equation into their calculators to check their theories. (**Note:** Explain to the students that some calculators have the ability to work equations; however, they will need to first solve what is inside the parentheses and then divide the first quotient [0.5] by the second quotient [0.25].)

Divide Decimals

Divide and multiply money amounts

Materials

- 1 or more grocery store receipts for each student
- A calculator for each student

Procedure

1. Guide the students in using their calculators to figure out the approximate amount a family spends per month if their yearly food budget is \$9,100. ***\$9,100 ÷ 12 = \$758.33*** (**Note:** Explain that sometimes when you divide with decimals the numbers continue dividing beyond the Hundredths place. Remind the students that they can examine the number in the One Thousandths place to determine how to round a quotient to the nearest hundredth.)
2. Guide students in calculating the approximate (rounded) amount spent weekly. \$9,100 ÷ 52 = ***\$175***
3. Direct each student to make his own grocery list for his family for a week's worth of food. Have him refer to provided receipts for general price information on each item. Then instruct him to add the prices to find out how much he plans to spend for one week.

- **How could you find the average cost per year if you usually spend this much per week?** ***Elicit that you would multiply the amount spent per week by 52 because there are 52 weeks in a year.*** Direct each student to multiply his weekly total cost by 52 to find the estimated amount spent per year.
- **How could you find the average amount spent per month?** ***Elicit that you would divide the amount spent per year by 12 because there are 12 months in a year.*** Direct each student to divide his yearly total cost by 12 to find the estimated amount spent per month.

Estimate the quotient of a decimal dividend and a 1-digit whole number divisor

Materials

- A calculator for each student

Procedure

1. Write the following problems for display.

(2) 2.3 5)11.5	(20) 28.9 4)115.6	(50) 56.4 3)169.2	(2) 2.35 2) 4.70
(30) 36.25 7)253.75	(8) 8.02 4)32.08	(70) 77.11 6)462.66	(3) 3.22 7)22.54

- **How could you estimate the quotient of a decimal dividend and a 1-digit whole number divisor?** ***Determine how many whole number digits will be in the answer; find the basic fact or closest basic fact; annex 1 or more zeros as needed and divide the compatible dividend by the divisor mentally to determine an estimated quotient.***

2. Direct the students to copy the problems on a sheet of paper and to write an estimate for each problem. Then instruct them to solve each problem using their calculators, write the quotient, and compare it with the estimate.

Equations

What's the problem?

Materials

- A calculator for each student

Procedure

1. Divide the class into 3 or 4 teams. Write the number 25 for display.
2. Explain to the students that the displayed number, 25, is the answer to a math problem. Each team member will have 1 minute to write an equation on paper with the displayed number as its answer. Students may use any mathematical operation. (e.g., If the answer is 25, any of these problems are acceptable: 5×5, $23 + 2$, $50 \times \frac{1}{2}$, or $100 \div 4$.) Guide each student in checking his problem on his calculator.
3. Following the minute time limit, allow each team member to share his equation and reward points accordingly. A team earns 1 point for each correct problem. A team earns 5 extra points if everyone on their team wrote different problems.
4. Continue the procedure with other numbers. (**Note:** To increase the challenge of the activity, explain that written problems that include more than one operation will earn 2 points. Remind the students that they must follow the correct order of operations: parentheses first, then exponents, then multiplication/division, and finally addition/subtraction.)

Perimeter & Area

Find the perimeter of a large area

Materials

- A measuring tape for every 4–5 students
- A calculator for every 4–5 students

Preparation

Measure the perimeter of a predetermined area to the nearest foot.

Procedure

1. Arrange the students in groups of 4–5, and distribute a measuring tape to each group. Direct each group to assign one person as the record keeper. This person will need paper and pencil to record data.
2. Lead the groups to a large school area (e.g., gym, playground, exterior of building, parking lot). Direct them to use their measuring tapes and calculators to find the perimeter of the designated area to the nearest foot. You many want to offer some incentive for the closest measurement.

Volume

Find the volume of classroom objects

Materials

- Volume Measurement (page 16 in this section of the CD) for each student
- A calculator for every 2 students
- A ruler for every 2 students

Preparation

List/display predetermined objects whose length, width, and height are easily measured by the students (approximately 1 object for every 2 students).

Procedure

1. Group the students into pairs. Distribute the Volume Measurement page. Tell the students that they will use their rulers to measure the lengths, widths, and heights of any 3 of the designated objects in the classroom to the nearest inch, and then they will be using their calculators to determine the volume of each object. They are to record all information on the Volume Measurement page. (**Note:** Depending on the objects, you may choose another unit of measurement and/or measuring tool.)
2. Allow students to share and to compare their measurements.

Volume Measurement

Object	Length unit	Width unit	Height unit	Volume $unit^3$

Ratios, Proportions & Percents

Divide a *games won: games played* ratio to find a percent of games won

Materials

- Percentages in Sports (page 19 in this section of the CD) for each student
- A calculator for each student

Procedure

> Think of your favorite sport. Whether it is baseball, soccer, swimming, tennis, or skiing, each activity uses math in a variety of ways. Information such as scores, time, or distance is recorded. These statistics can be analyzed to evaluate individual or team performance.

1. Explain that for talents to be useful, they need to be developed through self-discipline. (BATs: 2d Goal setting; 2e Work)
2. Display the Percentages in Sports page. Direct attention to the table titled *Soccer Team Records*.
   - **What ratio can help you find the percent of games won in 2007? How do you know?** *$\frac{10}{15}$; Elicit that the denominator gives the total number of games and the numerator tells the total number of games won.*
   - **How will this ratio help you to find the percent of games won?** *Elicit you can set up a proportion of games won to games played with 100 as the second term of the percent ratio because percent is based on 100.*

   Choose a student to write a proportion of games won to games played. $\frac{10}{15} = \frac{?}{100}$
3. Point out that 15 and 100 are not compatible numbers (100 is not a multiple of 15), making the calculations more difficult to find the value of the unknown term. Remind the students that there is another way to find an equivalent percent for a fraction—divide the numerator of the fraction by the denominator, and then change the decimal fraction to a percent.
4. Direct the students to enter $\frac{10}{15}$ (10 ÷ 15) in their calculators to find the decimal equivalent. *$0.\overline{6}$* Choose a volunteer to round the answer to the nearest hundredth *0.67*, change the decimal to a percent *67%*, and write the answer on the page for display.
5. Continue the procedure to complete the first table.
   - **During which season did this school have its best soccer record?** *2007*
   - **Which season had the worst record?** *2010*
   - **During which season did the school soccer record show an improvement over the season before?** *2011*
6. Direct attention to the *Basketball Stats* table. Direct students to use their calculators to find the percent of free throws each player made to complete the table. Kyle $\frac{9}{15} = 60\%$; C.J. $\frac{12}{19} \approx 63\%$; Sean $\frac{18}{26} \approx 69\%$
   - **Who has the best free throw record?** *Sean*
   - **Who has the worst free throw record?** *Kyle*
   - **How many more shots out of the 15 he attempted would Kyle have had to make to have a better record than C.J.?** *1; $\frac{10}{15} \approx 67\%$* **to have a better record than Sean?** *2; $\frac{11}{15} \approx 73\%$*

Calculate sales tax for a purchase and determine the total price including sales tax

Materials

- A receipt that shows the subtotal and the tax amount of a purchase
- An overhead calculator
- A calculator for each student

Procedure

1. Explain to the students that when they go shopping, they may pay something called sales tax. Many states charge sales tax, an additional charge added to the price of the products. The amount of the tax to be paid is calculated by finding a percent of the price of the items purchased. Share with the students the percent of sales tax your state charges. Pass around the receipt and point out the subtotal (the prices of all the purchased items added together) and the sales tax that was added to the subtotal to get the total.

> Hannah got a box of whole-wheat muffins from the bakery of the grocery store. The price of the muffins is $5.00. If the sales tax is 6%, how much will Hannah pay at the register for the muffins?

2. Write $5.00, 6%, and *subtotal* + *sales tax* = *total* for display. Explain to the students that finding the total cost is a two-step process. First you must determine the amount of the sales tax on the item(s) and then you must add the sales tax to the cost of the item(s).
   - **How can we find 6% of $5.00?** *Possible answers: Change the percent to a decimal fraction and multiply the decimal fraction by the price (0.06 × 5); set up a part-to-whole proportion ($\frac{6}{100} = \frac{?}{\$5}$) to find the missing part.*
3. Explain that you can use a calculator to find a percent of a number. When the percent key is pressed, the calculator recognizes as a percent the number that was entered previously. Display the overhead calculator and point out the percent key. Demonstrate each step.
4. Direct the students to enter the cost of the item(s), 5.00.
   - **What happened to the zeros when you entered $5.00? Why?** *They disappeared. Elicit that they were not needed because they did not change the value of the 5 dollars.*
5. Explain that if you want to find 6% of $5.00, you first enter the amount, 5, and then multiply by the percent. Direct them to enter × 6%.

   Point out that you do not need to push the equals key for the answer. The calculator will automatically show the answer. *0.3*
   - **What amount of money is 0.3 equal to?** *$0.30*
   - **What was the total Hannah paid for her box of $5.00 muffins if the 6% sales tax is $0.30? Why?** *$5.30; $5.00 + $0.30 = $5.30*

Choose a student to write the equation to show the amount Hannah paid. ***$5.00 + $0.30 = $5.30***

6. Explain that you can enter + 5 to add the subtotal to the sales tax to find the total. Direct the students to find the total using their calculators.
7. Follow a similar procedure to solve the following problems.

   subtotal of $22.00 and sales tax of 4%

   sales tax: 22 × 4% = $0.88, total: $22.00 + $0.88 = $22.88

   subtotal of $36.00 and sales tax of 5%

   sales tax: 36 × 5% = $1.80, total: $36.00 + $1.80 = $37.80

Calculating Interest

Materials

- A calculator for each student

Procedure

> Janet has $365.26 in a savings account in a bank which has an annual interest rate of 3.8%. If Janet makes no other deposits or withdrawals, how much interest will Janet make on her savings account per year?

1. Explain to the students that they can find the annual interest by multiplying the interest rate times the principal amount. Guide them in writing the decimal fraction/percent equation and using their calculators to solve the problem. ***365.26 × 3.8% or 0.038 × $365.26 = $13.88***
2. Explain that they can find the balance for the end of the year by adding the interest to the principal. ***$365.26 + $13.88 = $379.14***
3. Follow a similar procedure to find the annual interest of the following rates and principals.

   principal of $347.02 and annual interest rate of 6.2%

   annual interest earned: $347.02 × 6.2% = $21.52, balance: $347.02 + $21.52 = $368.54

   principal of $460.31 and annual interest rate of 4.5%

   annual interest earned: $460.31 × 4.5% = $20.71, balance: $460.31 + $20.71 = $481.02

   principal of $298.75 and annual interest rate of 5.3%

   annual interest earned: $298.75 × 5.3% = $15.83, balance: $298.75 + $15.83 = $314.58

Percentages in Sports

Soccer Team Records			
Season	Games Won	Games Lost	Percent Won
2007	10	5	
2008	12	7	
2009	15	9	
2010	14	9	
2011	13	7	

Basketball Stats			
Player	Freethrows Attempted	Freethrows Made	Percentage of Freethrows Made
Kyle	15	9	
C. J.	19	12	
Sean	26	18	

Rename customary measurements

Materials

- A calculator for each student

Procedure

1. Instruct students that you are going to read a story with missing measurements. They are to write down the equivalencies they hear as you read the story. Guide them in writing the first one: 3 mi = ___ ft.

> Sam and his grandfather went fishing. The river is 3 miles or ___ ***15,840*** feet down the road. They decided to walk down to the river. On the way, Sam spotted a deer about 12 yards or ___ ***432*** inches away. At the river, Sam's grandfather caught a huge fish. He thought it was 2 feet 11 inches long or ___ ***35*** inches long. At home Sam's grandfather weighed the fish. It weighed 128 ounces or ___ ***8*** pounds.

Instruct students to check to see if they have all the equivalencies as you elicit them.

3 mi = ___ ft ***3 × 5,280***

12 yd = ___ in. ***12 × 36***

2 ft 11 in. = ___ in. ***(2 × 12) +11***

128 oz = ___ lb ***128 ÷ 16***

2. Guide the students in identifying the operation/equation they can use to rename the measurement. Then instruct the students in using a calculator to rename the measurements.
3. Reread the complete story.
4. Instruct the students to write their own story using customary measurements to be renamed. Direct them to exchange their stories with one another and to use a calculator to find the correct answers.

Rename metric measurements

Materials

- A calculator for each student

Procedure

Write the following equivalencies for display. Direct students to identify and write the operation needed to rename the units as the other unit (e.g., × 10 or ÷ 100). Then direct them to enter the number of units they have and the operation they predict is needed to find the number of equivalent units. Choose students to write the answers for display to complete the equivalency.

23 m = ___ cm ***× 100; 2,300***
16 mm = ___ m ***÷ 1,000; 0.016***
465 kg = ___ g ***× 1,000; 465,000***
917 mL = ___ L ***÷ 1,000; 0.917***
58 cm = ___ mm ***× 10; 580***
12546 mg = ___ g ***÷ 1,000; 12.546***
18 L = ___ mL ***× 1,000; 18,000***

Integers

Adding and subtracting integers

Materials

- A calculator with a +/– sign button for each student

Procedure

1. Write the following problems for display. Guide the students in entering addition and subtraction problems with negative addends. Instruct them to enter the digits of the negative number first and then the negative sign. No sign needs to be entered for a positive integer. Students will know if they entered it correctly if they get the same answer.

$11 + {}^{-}11 = 0$	${}^{-}23 + 23 = 0$	$4 + {}^{-}2 = 2$
${}^{-}17 + 4 = {}^{-}13$	$5 - {}^{-}3 = 8$	${}^{-}6 + {}^{-}6 = {}^{-}12$
${}^{-}9 - {}^{-}3 = {}^{-}6$	$18 - {}^{-}5 = 23$	${}^{-}12 - {}^{-}13 = 1$

2. Direct students to write addition and subtraction equations using larger integers. Guide them in using their calculators to check their answers.

Multiplying integers with like signs

Materials

- A calculator for each student

Procedure

1. Guide students in entering the following numbers into their calculator to find the product.

1^2 *1*	$({}^{-}1)^2$ *1*	2^2 *4*	$({}^{-}2)^2$ *4*
3^2 *9*	$({}^{-}3)^2$ *9*	4^2 *16*	$({}^{-}4)^2$ *16*
5^2 *25*	$({}^{-}5)^2$ *25*	6^2 *36*	$({}^{-}6)^2$ *36*
7^2 *49*	$({}^{-}7)^2$ *49*	8^2 *64*	$({}^{-}8)^2$ *64*
9^2 *81*	$({}^{-}9)^2$ *81*	10^2 *100*	$({}^{-}10)^2$ *100*
11^2 *121*	$({}^{-}11)^2$ *121*	12^2 *144*	$({}^{-}12)^2$ *144*

2. Guide the students to the conclusion that the square roots of perfect squares can be either positive or negative integers (e.g., $\sqrt{64}$ can be either 8 or ${}^{-}8$).