MIDDLE SCHOOL ACTIVITIES

for the

Casio FX-300ES

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Activity 1
A Prime Factorization Challenge

**Topic Area: Number Sense & Problem Solving**

**NCTM Standards:** Number and Operations, Problem Solving, Connections

**Objective**

Students will demonstrate the ability to generate a number, determine whether it is prime or composite, and if it is composite, determine its product of prime factors.

**Materials Needed**

Casio fx-300ES Calculator, index cards numbered from 0-9, pencil and paper

**Engage**

Divide students into groups of 2. Each group receives 10 index cards and numbers each one from 0 to 9. Shuffle the cards and turn them face down. Have one student draw 2 cards to form a two-digit number. The first number drawn equals the ones digit and the second number drawn equals the tens digit. Then, the student who drew the number determines its prime factorization. One point is given for each different prime factor. For example, if the number is 12, the prime factorization is $2^2 \times 3$, the student receives two points because there are two different prime factors in the prime factorization of 12. If the number was 16, the student receives only one point because the prime factorization of 16 is $2^4$. The other member of the group must check the work to make sure it is accurate. The first person to reach 10 points wins the game, providing that each student has had the same amount of turns.

Answers should be expressed as a product of prime factors and use exponential notation when possible. For example, the prime factorization of 16 is $2^4$. It can also be expressed as $2 \times 2 \times 2 \times 2$. Have them use the calculator to check both forms.

**Explore**

1. Using the calculator, model how to use the exponent key.
2. Using the calculator, model how to solve exponent expressions such as $2^3 + 5^2$.

**Explain**

Have students explain how to determine the prime factorization of 40.

**Elaborate**

Have students explain how to determine when a number is prime or composite. Have students communicate a method of finding the differences between a prime and composite number. Some suggestions might include the use of divisibility rules and/or the use of various prime numbers as possible factors.

**Extension**

Have students play again creating three digit numbers.

**Evaluate**

Students will be given a series of prime factorization problems and be asked to solve them. Students will express their answers in exponential and factored form.
Steps for Solving the Problems

How to Use the Exponent Template on the Casio fx-300ES:
To find $2^3 \times 4^2$, do the following steps:

1. Turn calculator ON and press MODE. Press 1 for Computation.

2. Press SHIFT SETUP followed by 1: MthIO (Math Input/Output).

3. Enter a number, 2. Then Press the $x^2$ key.

4. Enter the number 3. Then press the right arrow on the REPLAY pad.
5. Press the multiplication key. Then press the number 4.

6. Press the \(x\) key. Then press the number 2.

7. Press \(=\) key. The answer is 128.
Activity 1 • A Prime Factorization Challenge

Getting Started

Any composite number can be expressed as a product of prime factors. An easy way for determining the prime factorization of any number is to first determine if the number is even or odd. If the number is even, then it is a multiple of 2 and since 2 is a prime number, we can then count it as a prime factor. Therefore, if we wanted to find the prime factorization of 72, we must first determine if it is an even number or an odd number. Since 72 is even, we know that it will have 2 as a factor. To determine its other factor, we could divide 72 by 2 to get 36. Therefore, 2 times 36 equals 72. Since 36 is an even number that is a composite number, we know that it has a factor of 2. To determine its other factor, we could divide 36 by 2 to get 18. 18 is an even composite number and is a multiple of 2. Therefore, 2 times 9 equals 18 and becomes our next line in the prime factorization. Since 9 is not even, but is divisible by 3 and 3 is a prime number, we can conclude that 3 times 3 equals 9. Since 3 is a prime number, we have completed our prime factorization. Our factor tree looks something like this:

```
    72
   /   \
 2 x 36
   /   \ 
2 x 2 x 18
     /   \ 
2 x 2 x 2 x 9
       /   \ 
2 x 2 x 2 x 3 x 3
```

We can then use the calculator to determine if this is the correct prime factorization by entering $2 \times 2 \times 2 \times 3 \times 3$ or by entering $2^3 \times 3^2$.

Problems

1. What is the prime factorization of 72? _________________________________________
2. What is the prime factorization of 100? ________________________________________
3. How do you express 128 as a product of prime factors? _________________________________________
4. What is the product of the first 5 prime factors? _________________________________________
5. Is $2^2 + 3^2$ the same as $(2+3)^2$? Explain. _________________________________________
Solutions and Answers for Activity 1

1. \(2 \times 2 \times 2 \times 3 \times 3\) or \(2^3 \times 3^2\)

2. \(2 \times 2 \times 5 \times 5\) or \(2^2 \times 5^2\).

3. \(2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2\) or \(2^7\)

4. The first five prime factors are 2, 3, 5, 7, and 11. The product of \(2 \times 3 \times 5 \times 7 \times 11 = 2,310\).

5. \(2^2 + 3^2\) is not the same as \((2+3)^2\). \(2^2 + 3^2 = 13\) and \((2+3)^2 = 25\)
Activity 2
Measures of Central Tendency

Topic Area: Data Analysis, Statistics, Problem Solving, and Number Sense
NCTM Standards: Data Analysis and Probability, Problem Solving, Communications, Number and Operations

Objective
Students will demonstrate the ability to determine the mean, median, and mode for a set of data.

Materials Needed
Casio fx-300ES Calculator, pencil, paper, number cubes

Engage
Discuss with students how to generate a sample space when two number cubes are rolled. For some students, it may be difficult for them to understand that there are 36 possible combinations as opposed to 12. Modeling how to generating a chart and complete it may be helpful for some students. This will be helpful in explaining the rules for this lesson’s activity.

Explore
1. Using the calculator, model how to use the STAT application for 1 variable statistics.
2. Review how to calculate the mean, median, and mode for a set of data.
3. Using the calculator, model how to use the STAT application to determine the mean.

Explain
Have students explain which measure of central tendency (mean, median, or mode) best describes a particular set of data and why.

Elaborate
If possible, you may choose to have the students roll two different colored number cubes. This can be very helpful for those students having difficulty with the outcomes chart. Designate one color as the first cube and the other color as the second cube. This may help reinforce the idea that when two number cubes are rolled, there are 36 different outcomes.

You may decide to increase the challenge of this activity by having the students roll more than 5 times to create their data set or increase the number of points needed in the activity.

Number Game
Each player takes turns rolling two number cubes. Each outcome is recorded on the Casio fx-300ES in a one-variable stat list. Use the calculator to determine the mean of these five numbers. The person with the highest mean wins one point. Then, determine who has the greater median and mode. One point is awarded to the person with the greater median and to the person with the greater mode. A maximum of three points can be awarded each round. If a person rolls a pair of doubles, that person gets an additional roll. Calculate the mean, median, and mode accordingly.
Extension

It is very important for students to have a solid understand of the measures of central tendency. As an extension to this activity, have students write a journal entry about the many ways we use and need averages and why averages are important. Also, it is important for students to find an average, determine a median and identify a mode, but what if instead of finding the measures of central tendency, your students had to come up with the numbers in the data set?

For example:

- Identify 5 different integers that have a mean of 9.
  
  (4, 7, 8, 11, 15)

- Identify 5 integers that have a mean of 7 and a mode of 4.
  
  (4, 4, 8, 9, 10)

- Identify 5 integers that have a mean of 8, a median of 7 and a mode of 11.
  
  (5, 6, 7, 11, 11)

Evaluate

Students will be given a series of problems as well as activities and be asked to determine the mean of a particular set of data.
**Steps for Solving the Problems**

To determine the mean of a set of data:

1. Press **MODE**.

2. Press 2 for **STAT**.

3. Press 1 for 1-Variable Statistics.

4. Enter the number in the highlighted cell and press **=**.
   Once you have entered all of the data into the list, press **AC**.
5. Press, **SHIFT** followed by **1** for the STAT functions.

6. Press **5** for Variables.

7. Press **2** for $\bar{X}$ (mean).

8. Press **=**. The mean of your data set will appear in the lower right corner of the display.

NOTE: If you do not press the **AC** key after you have entered all of the data and immediately press **SHIFT 1 STAT**, the mean will be entered into the next available cell in the list. If you need to add more data to the list, you must delete that cell prior to adding or deleting any cell information.
Activity 2 • Measures of Central Tendency

Getting Started

Mark and Pam are playing a game using number cubes. In this game, each player rolls the number cubes five times and records the outcomes on their paper. Then, they each calculate the mean, median, and mode for the outcomes they have rolled. A point is given to the person who has the greater mean (average), median, and mode. A total of three points can be awarded each round. If there is a tie, neither player is awarded a point. The first person to get to 7 points wins the game.

Before they begin playing, Mark wants to know what is the most probable outcome when rolling two number cubes. Pam says that they can determine the answer by creating a chart. The first chart shows the individual outcomes for each roll when two number cubes are used.

Sample Space for Rolling Two Number Cubes (Outcomes)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(1, 1)</td>
<td>(1, 2)</td>
<td>(1, 3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>(2, 1)</td>
<td>(2, 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>(3, 1)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td></td>
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<td>5</td>
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<td>6</td>
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</tr>
</tbody>
</table>

Can you complete the rest of the chart for Pam and Mark?

Pam explains to Mark that the first number indicates the outcome on the first number cube and the second number indicates the outcome on the second number cube. Then, Pam creates another table to show the sum of each roll.

Sample Space for Rolling Two Number Cubes (Sum)

<table>
<thead>
<tr>
<th>+</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
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<td></td>
<td></td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>10</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>10</td>
<td>11</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Can you complete the rest of the chart for Pam and Mark?
Activity 2 • Measures of Central Tendency (continued)

Problems
1. Pam and Mark need to determine the probabilities for each outcome. Looking at the chart, Pam has determined that there are a total of 36 different outcomes. On the lines provided, write the probability for each sum when rolling two number cubes.

\[
\begin{align*}
P (2) &= \_\_\_\_\_\_\_\_\_\_ \quad P (8) = \_\_\_\_\_\_\_\_\_\_ \\
P (3) &= \_\_\_\_\_\_\_\_\_\_ \quad P (9) = \_\_\_\_\_\_\_\_\_\_ \\
P (4) &= \_\_\_\_\_\_\_\_\_\_ \quad P (10) = \_\_\_\_\_\_\_\_\_\_ \\
P (5) &= \_\_\_\_\_\_\_\_\_\_ \quad P (11) = \_\_\_\_\_\_\_\_\_\_ \\
P (6) &= \_\_\_\_\_\_\_\_\_\_ \quad P (12) = \_\_\_\_\_\_\_\_\_\_ \\
P (7) &= \_\_\_\_\_\_\_\_\_\_ \quad P (\text{doubles}) = \_\_\_\_\_\_\_\_\_\_ \\
\end{align*}
\]

2. What observations do you notice about the sums when rolling two number cubes?

____________________________________________________________________________

3. What sum has the same probability as rolling a pair of doubles (two individual outcomes are exactly the same)?

____________________________________________________________________________

4. Looking at the outcomes when rolling two number cubes, what is the probability of rolling at least one number 4? Explain how you obtained your answer.

____________________________________________________________________________

5. What is the most likely sum to occur when rolling a pair of number cubes? What number is the least likely to appear when rolling a pair of number cubes?

____________________________________________________________________________

6. Define mean, median, and mode.

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

7. In your opinion, what is the most important measure of central tendency (mean, median, or mode) to use when analyzing a set of data?

____________________________________________________________________________

____________________________________________________________________________
Answers to Selected Problems:

1. Pam has determined that there are a total of 36 different outcomes.
   
   \[
   \begin{align*}
   P(2) &= 1/36 \\
   P(3) &= 2/36 = 1/18 \\
   P(4) &= 3/36 = 1/12 \\
   P(5) &= 4/36 = 1/9 \\
   P(6) &= 5/36 \\
   P(7) &= 6/36 = 1/6 \\
   P(8) &= 5/36 \\
   P(9) &= 4/36 = 1/9 \\
   P(10) &= 3/36 = 1/12 \\
   P(11) &= 2/36 = 1/18 \\
   P(12) &= 1/36 \\
   P(\text{doubles}) &= 6/36 = 1/6
   \end{align*}
   \]

2. Some possible answers include:
   - The probabilities of rolling a 2 and a 12 are the same.
   - The probabilities of rolling a 3 and an 11 are the same.
   - The probabilities of rolling a 4 and a 10 are the same.
   - The probabilities of rolling a 5 and a 9 are the same.
   - The probabilities of rolling a 6 and an 8 are the same.
   - The probabilities of rolling a 7 and doubles are the same.
   - Seven is the most likely sum when rolling two number cubes.

3. The probability of rolling a 7 and rolling doubles are exactly the same.

4. The probability of rolling at least one 4 is 11/36. The following outcomes contain at least one 4: (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (1, 4), (2, 4), (3, 4), (5, 4), and (6, 4)

5. The most likely sum to appear when rolling a pair of number cubes is 7. The least likely sum to appear is either 2 or 12.

6. The mean is the average of the items in a set of data. The average is found by determining the sum of all the items in the data set and then dividing that sum by how many items there are in that set. The median is determined as the middle number when the items in a data set are arranged in order from least to greatest. If there are an even amount of items in the data, then the median is determined by taking the mean (or average) of the two middle numbers when they are in order from least to greatest. The mode is the most frequent number that appears in a data set.

7. Answers may vary.
Activity 3
To Invest Is Best

Topic Area: Patterns and Functions – Algebraic Thinking

NCTM Standards: Number and Operations, Algebra, Problem Solving, Reasoning, Communications, Connecting, and Representations

Objective

Students will be able to use a function for compounding interest to determine when an investment will double. Students will also be able to use that function to determine the amount an investment will be worth at a specified period of time.

Materials Needed

Casio fx-300ES Calculator, pencil and paper.

Engage

Ask students to describe the differences between simple interest and compound interest. Provide examples of each type of interest if clarification is needed. Then, ask students to describe different ways they can invest money. Use a traditional savings account at a bank as an example of a simple interest (linear) model and a retirement account or mutual fund account as an example of a compound (exponential) model. Facilitate any questions or comments regarding financial investing and opinions towards saving money.

Explore

1. Using the calculator, model how to use the TABLE application to input a linear or exponential model.
2. Using the calculator, model how to input an appropriate starting value, ending value, and step value to see all of the values of a desired function.

Explain

Have students explain which savings model is better over a period of time. Also, have students describe how to determine the appropriate amount of time when an investment will double.

Elaborate

Have students describe what happens to the investments when you change the interest rate and/or the amount of time for the investment. As a suggestion, you may want to have the students work in cooperative groups to discuss these issues or write their reactions in their journals.

Evaluate

Students will be given a series of problems relating to investments and be asked to determine their worth at a specified time.

Extensions

Have students research a topic pertaining to investments (stocks, mutual funds, savings bonds, savings accounts). Then, have students present a brief report to the class about their findings.
Steps for Solving the Problems

1. Press MODE. Enter 3 for Table.

2. At the f(x) = prompt, type in the compound interest formula. (For example, enter the expression 1,000(1+.05)^X by pressing 1000 ( 1 + .05) X^ ALPHA X.

3. Press =.

4. Where it says Start?, press 0 so that the equation will equal $1000 at the beginning. Press =.
5. When prompted to End? enter 10 to evaluate what the investment yields after 10 years. Press =.

6. Enter 1 for the step because the investment is being compounded yearly. Press =.

7. Examine the table to determine what the $1,000 principal yields after each year.

8. Press AC to exit the table.

Additional Notes

You may need to change the step value in the table in order to answer some of the questions. For example, the step may need to be set at 5 or 10 instead of 1 in order to access the values in the table.

Conclusion

Through compound interest, you can see that an investment will yield a greater return based upon the rate, the time of the investment, and how much was initially invested. You can explore different scenarios by simply changing the principal, rate, time, and amount of compounding during the year. Regardless, compounding interest is a more powerful or exponential model of growth as opposed to simple interest, which is a linear model.
Activity 3 • To Invest is Best

Getting Started

It's never too early to start thinking about how to invest your money. Compounding your money will yield greater returns the longer that money is invested. Naturally, there are different ways to invest your money such as mutual funds, stocks, or savings accounts, but finding an investment that allows you to compound your money over time will provide you with the most money when you are older.

A formula for compound interest will help you determine the amount of money your investment will yield over a period of time.

The formula is: $A = P \cdot (1 + R)^{nt}$ where $A$ = the amount of money you will have at a certain period of time

$P$ = the starting amount of money you place into the account

$R$ = the percentage of interest for the investment, $n$ = the amount of times you will take the interest during the year

$t$ = the number of years you hold onto that investment.

Imagine taking a certain amount of money and investing it now. Remember that investments yield money based upon an average return. Some investments may do better than others over a certain period of time and you should consult with a financial professional to help you decide which investment is best for you.

Use your calculator to solve each problem.

Problems

1. Given a $1,000 principal, how long will it take for that money to double if you invest it at a rate of 5% compounded annually? ________________________

2. Given a $1,000 principal, how long will it take for that money to double if you invest it at a rate of 8% compounded annually? ________________________

3. Given a $1,000 principal and a rate of 8%, how much money will that investment be worth if you let in compound for:

   20 years? _____________

   40 years? _____________

   30 years? _____________

   50 years? _____________
Activity 3 • To Invest is Best

4. What do you notice about the amount of your investment the longer you let it compound?
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

5. What happens to your investment over time if you increase the principal?
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

6. What happens to your investment if your interest is compounded semi-annually, quarterly, or monthly instead of compounded annually? Use the table function to determine how the return changes when the principal is compounded semi-annually, quarterly, or monthly?
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
Solutions and Answers for Activity 3

1. The amount will double in the 15th year and will yield an amount of $2,078.90.

2. The amount will double in the 10th year and will yield an amount of $2,158.90.

3. for 20 years? [$4,660.90]
   30 years? [$10,062.00]
   40 years? [$21,724.00]
   50 years? [$46,901.00]

4. The longer the time the investment is compounded, the more money you will have.

5. If you increase the amount of the principal, then you will have a larger return at the end of the investment.

6. There will be a greater return if you compound an investment monthly as opposed to quarterly, semi-annually, or annually.
Activity 4  
Exploring Fractions

Topic Area: Number Sense

NCTM Standards: Number and Operations, Problem Solving, Reasoning, Communication

Objective

Students will demonstrate the ability to solve problems involving operating with fractions.

Materials Needed

Casio fx-300ES Calculator, pencil and paper

Engage

Ask students to solve the problem 1/3 + 2/5 without using a calculator and when they have completed the problem, discuss their answers and review the process of adding fractions without common denominators. Review how to subtract, multiply, and divide fractions without using a calculator. Provide additional problems and practice if necessary prior to engaging the students in this activity.

Explore

1. Using the calculator, model how to solve a fraction problem in the MathIO format.
2. Using the calculator, model how to solve a fraction problem in the LineIO format.
3. Using the calculator, model how to access the TABLE function, input a function, and generate a table of values.

Explain

Have students explain the differences between a proper and an improper fraction. Additionally, have students communicate how to estimate an answer to a fraction problem.

Elaborate

Discuss any questions or comments with your students. Have students discover the differences between f(x) = (1/2)X and f(x) = 1/2X. Once they generate a table of values with the calculator, have them describe either verbally or in their journals, the change in f(x) as x increases or decreases.

Extension

Have students examine these two functions: f(x) = (1/2)X and f(x) = 1/2X. Have them access the table function and evaluate each function from 0 to 10 with a step of 1. Ask: What do you notice about each function’s table of values? Is there any point where (x, f(x)) are the same? Sketch a graph of each of these functions. What similarities or differences do you notice between these two functions?

Evaluate

Students will be provided a series of fraction problems and be asked to solve them.
Steps for Solving the Problems

To Access the Fraction Template

1. Press MODE and then 1 for COMP.
2. Press SHIFT MODE (to access the SETUP menu) followed by 1 for MthIO (Math Input/Output).

To Enter a Fraction:

1. To input a fraction such as 4/10, press the fraction template key \( \frac{4}{10} \).
2. Input the numerator 4.
3. Press the down arrow on the REPLAY keypad.
4. Input the denominator 10. Press the = key. Notice that the fraction will appear in the lower right corner of the display in simplest form as 2/5.
To Enter a Mixed Number:
1. To input a mixed number such as 4 1/2, press SHIFT followed by the mixed fraction template key \( \frac{\text{a}}{\text{b}} \).
2. Input the whole number 4.
3. Press the right arrow on the REPLAY keypad.
4. Input the numerator 1.
5. Press the down arrow on the REPLAY keypad.
6. Input the denominator 2.
7. Press the \( = \) key.

Notice that the mixed number will appear in the lower right corner of the display in simplest form and as an improper fraction. If you want the number to be displayed as a mixed number, press the SHIFT key followed by the \( \frac{\text{a}}{\text{b}} \leftrightarrow \frac{\text{c}}{\text{d}} \) key.
Activity 4 • Exploring Fractions

Getting Started

Fractions help us express a relationship between a certain number of parts in relation to a whole amount. The number that appears above the fraction bar is called the numerator and the number that appears below the fraction bar is called the denominator.

When the numerator is smaller than the denominator, such as \( \frac{2}{5} \), we call it a “proper fraction.” When the numerator is larger than the denominator, such as \( \frac{5}{2} \), we call it an “improper fraction.” Improper fractions can be converted to a mixed number by determining how many multiples of the denominator are found in the numerator. For example, a fraction such as \( \frac{17}{5} \) would equal \( 3 \frac{2}{5} \).

Fractions are usually expressed in simplest form. For example, a fraction such as \( \frac{4}{10} \) would be reduced to \( \frac{2}{5} \) as 2 can be divided evenly into both its numerator and denominator. Whenever a numerator and a denominator share a common factor, you can reduce the fraction by that factor.

It is also important to remember that you must find a common denominator whenever you are adding or subtracting fractions. Finding a common denominator will allow you to determine an equivalent fraction before beginning the mathematical operation. However, you do not need to find a common denominator when multiplying or dividing fractions.

Many daily activities and occupations rely on a strong understanding of fractions. A chef needs to measure ingredients for a recipe and will use fractions to properly measure those items according to the recipe. A carpenter uses fractions to properly measure the lengths of materials or where to cut a piece of lumber. Can you think of other activities or occupations that rely on fractions? Have you used fractions today and if so, where? Take a moment to discuss this with your teacher or with someone in your group.

Use your calculator to solve each problem.

Problems

Part 1

1. Write three equivalent fractions for 2/5.

__________________   ____________________   ____________________

2. What is 9/4 as a mixed number?

3. What is the least common denominator of 2/7 and 1/3?

4. What is the least common denominator of 3/4, 3/8, and 2/7?
Activity 4 • Exploring Fractions

Part 2
5. What is the sum of $\frac{1}{4} + \frac{2}{3}$? ____________________
6. What is the difference of $\frac{11}{12} - \frac{2}{4}$? ____________________
7. What is the product of $\frac{4}{7} \times \frac{1}{5}$? ____________________
8. What is $4$ divided by $\frac{1}{8}$? ____________________

Part 3
9. What is $\frac{1}{2} + \frac{2}{3} + \frac{3}{4}$? ____________________
10. What is $\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4}$? ____________________
11. Explain two ways to determine the answer to number 10 without using a calculator.
   __________________________________________________________________________
   __________________________________________________________________________
12. What does $(\frac{1}{2})/5$ equal? ____________________
13. What is $(\frac{1}{2})/5 \times (\frac{3}{4})/10$? ____________________

Part 4
14. Of $\frac{1}{8}$, $\frac{3}{4}$, $\frac{1}{5}$, and $\frac{1}{3}$, which three of these four fractions can you add together to get a sum less than 1? ________________
15. Of $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{5}$, and $\frac{1}{3}$, which three of these four fractions can you add to get a sum that equals 1.45? ________________
16. Given the fractions, $\frac{3}{7}$ and $\frac{4}{9}$, what fraction must you add to them to get a sum that equals 1? ____________________

Part 5
17. Access the table function and input the function, $f(x) = (\frac{1}{2})x$.
   What value of $X$ will make $f(x)$ equal 14.5? ____________________
18. Access the table function and input the function, $f(x) = (\frac{1}{2})x^{2}$.
   What value of $X$ will make $f(x)$ equal 24.5? ____________________
19. What is the difference between these functions? $f(x) = (\frac{1}{2})x$ and $f(x) = (\frac{1}{2})x^{2}$.
   __________________________________________________________________________
Solutions and Answers for Activity 4

Part 1:
1. Answers may vary. (Possible answers may include 4/10, 8/20, 20/50)
2. $2 \frac{1}{4}$
3. 21
4. 56

Part 2:
5. $\frac{11}{12}$
6. $\frac{5}{12}$
7. $\frac{4}{35}$
8. 32

Part 3:
9. $1 \frac{11}{12}$
10. $\frac{1}{4}$
11. One way to solve the problem $\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4}$ is to multiply the numerators and then multiply the denominators. Then, simplify the product. Another way is to use cross canceling to get the answer $\frac{1}{4}$.
12. $\frac{1}{10}$
13. $\frac{3}{400}$

Part 4:
14. $\frac{1}{8}$, $\frac{1}{5}$, and $\frac{1}{3}$
15. $\frac{1}{2}$, $\frac{1}{5}$, and $\frac{2}{4}$
16. $\frac{8}{63}$

Part 5:
17. $X = 29$
18. $X = 7$
19. The difference between the functions $f(x) = (1/2)X$ and $f(x) = (1/2)X^2$ is that the function $f(x) = (1/2)X$ is linear while $f(x) = (1/2)X^2$ is quadratic.
Activity 5
Not Just Another
Chocolate Chip Off The Old Block

Topic Area: Patterns and Functions

NCTM Standards: Number and Operations, Algebra, Problem Solving, Communications, Connecting and Representations

Objective
Students will demonstrate the ability to create a formula and use it to determine a break-even point for income vs. expenses.

Materials Needed
Casio fx-300ES Calculator, pencil and paper

Engage
Discuss with students what factors should be considered when entering into a business. Have students determine an acceptable business plan and define such terms as income, expense, profit, loss, and break-even point.

Explore
1. Using the calculator, model how to access the TABLE application, input a function, and set an appropriate starting, ending, and step value.
2. Using the calculator, model how to determine a break-even point through the values given by a function.

Explain
Discuss with students the significance of determining a break-even point for any business. Facilitate a discussion on how businesses determine profits and losses.

Elaborate
Discuss with students what factors might affect Melinda’s business. For example, if Melinda cuts expenses, will that result in increased profits? How does the quality of the ingredients affect the actual profit? Based on the current model, does this appear to be a profitable business opportunity for Melinda?

Extension
Facilitating a discussion based upon student questions and comments regarding this scenario are integral to the effectiveness of this lesson. This is a great opportunity for students to witness how manipulating a formula can affect a desired output. Furthermore, having students work cooperatively on this scenario can increase team-building and workplace readiness skills.

Evaluate
Students will be given a series of problem and be asked to solve them, communicate their reasoning, and have their peers critique their decisions regarding Melinda’s business and her potential profits and losses.
Calculator Notes for Activity 5

Steps for Solving the Problem

1. Press MODE.

2. Enter 3 for Table.

3. Enter the function you derived which models the problem.
4. Enter a starting value of 0 to indicate that Melinda has sold 0 cookies.

5. Press =.
6. Enter an ending value of 60 to indicate the 5-dozen cookies each batch will produce.

7. Press = .

8. Enter a step value of 5 .

9. Examine the table to determine how much money Melinda will earn from selling all of the cookies.

10. You may need to alter the starting value and step value to determine the break-even point.
Activity 5 • Not Just Another Chocolate Chip Off The Old Block

Getting Started

Melinda has decided to create a gourmet cookie business and is going to sell chocolate chip cookies. She believes people would rather buy homemade chocolate chip cookies rather than bake them. With this hypothesis, she has created a business plan to begin selling her cookies. She has gone to the store and purchased all of the materials she needs to bake her cookies. She purchased flour, sugar, dark chocolate chips, eggs, vanilla, baking soda, baking powder, salt, milk, butter, nuts, and bags. Melinda determines that she will spend $23.25 on supplies and expenses. She will sell each cookie for $ .75. Each batch will yield five-dozen cookies. (Note: There is no discount per dozen cookies sold. The rate is per cookie.)

Problems

1. Determine a function rule that models Melinda’s gourmet cookie business.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

2. Enter the function into the calculator to determine the break-even point (The break-even point is when Melinda’s cookie sales equals her expenses.)

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

3. If each batch of cookies produces 5-dozen cookies, will Melinda make a profit or take a loss from making these cookies? Explain.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

4. In the box below, sketch a graph of the function.
Activity 5 • Not Just Another
Chocolate Chip Off The Old Block

5. In your opinion, should Melinda charge more or less for the cookies? Explain your reasoning and provide a model showing how much Melinda will profit from these cookies.
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

6. In the box below, sketch a graph of your model and indicate the break-even point on the graph.

7. What part of your function is different from Melinda’s?
Solutions and Answers for Activity 5

1. \( f(X)=0.75X-23.25 \)
2. Melinda will break-even when she has sold 31 cookies at $ .75 per cookie.
3. If each batch produces 60 cookies, Melinda will make a profit. She will make a profit of $21.75 per batch.
4. 
   ![Graph showing the function](image)

5. Answers may vary.
6. Answers may vary.
7. Since you changed the price of the cookies that part of the function is different from Melinda's. In comparing the linear functions, the slopes are different.
Activity 6
Let’s Take a Vacation!

Topic Area: Number Sense & Problem Solving

NCTM Standards:  Measurement, Algebra, Number Sense

Objective

Students will demonstrate the ability to research temperatures in various cities and convert their temperatures from Celsius to Fahrenheit.

Materials Needed

Casio fx-300ES Calculator, Internet and/or newspaper, pencil and paper

Engage

Ask students to describe the present temperature. Then, ask students to convert that temperature to a measure in degrees Celsius. Ask students which method of expressing temperatures is better and why.

Explore

1. Using the calculator, model how to access the COMP application and use parentheses to convert temperatures from Fahrenheit to Celsius and vice versa.
2. Using the calculator, model how to access the TABLE application, input a function, (formula for converting temperatures from Fahrenheit to Celsius and vice versa) and set a starting, ending, and step value.

Explain

Discuss how different countries measure their temperatures in degrees Celsius as opposed to degrees Fahrenheit. Use the conversion formulas to express the temperature in both measurement forms.

Elaborate

Discuss any questions or comments from your students. Have students use their estimation skills and strategies to correctly predict a reasonable estimate for any temperature expressed in either degrees Fahrenheit or degrees Celsius.

Extension

As an extension to this activity, have students develop a travel budget to a particular city. Project the cost for air travel, hotel, and meals for a designated vacation based upon researched quotes from the Internet or advertised prices from the newspaper. Then, have students increase their projected budget by 15% to cover any additional or unexpected expenses. Once completed, students can present their vacation package via a proposal or report to the class.

Evaluate

Students will be given a series of problems and be asked to successfully convert the measurement between each temperature.
Steps for Solving the Problems

The formula for converting a Fahrenheit temperature to a Celsius temperature is as follows: \( C = \frac{5}{9}(F - 32) \) where \( C \) = the temperature in degrees Celsius and \( F \) = the temperature in degrees Fahrenheit. The formula for converting a Celsius temperature to a Fahrenheit temperature is as follows: \( F = \left( \frac{9}{5} \cdot C \right) + 32 \)

To convert a temperature measured in degrees Fahrenheit to degrees Celsius, you will need to use the fraction template.

To Access the Fraction Template
1. Press MODE and then 1 for COMP
2. Press SHIFT SETUP followed by 1 for MthIO (Math Input/Output).

To Enter a Fraction:
1. To input a fraction such as 9/5, press the fraction template key \( \frac{\text{9}}{\text{5}} \).
2. Input the numerator 9.
3. Press the Down Arrow on the REPLAY keypad.
4. Input the denominator 5.
5. Press the "=" key.

Notice that the fraction will appear in the lower right corner of the display.

6. To find the decimal equivalent of that fraction, press the S⇌D key.
To determine the mean of a set of data:

1. Press MODE .
2. Press 2 for STAT.

3. Press 1 for 1-Variable Statistics.

4. Enter the number in the highlighted cell and press = .
5. Once you have entered all of the data into the list, press AC .
6. Press SHIFT STAT .
7. Press 5 for Variables.
8. Press 2 for $\bar{X}$ (mean).

The mean of your data set will appear in the lower right corner of the display.

NOTE: If you do not press the AC key after you have entered all of the data and immediately press SHIFT STAT, the mean will be entered into the next available cell in the list. If you need to add more data to the list, you must delete that cell prior to adding or deleting any cell information.
Activity 6 • Let’s Take a Vacation!

Getting Started

It’s time to take a vacation! You and your family have decided to travel to a foreign country. You have researched the average temperatures of various countries either on the Internet or at the local library. Since many foreign countries measure temperature in Celsius degrees as opposed to Fahrenheit, you will need to convert these temperatures to the more familiar Fahrenheit scale we use here in the United States.

Research temperatures for the following countries and convert their daily temperatures from Celsius to Fahrenheit or from Fahrenheit to Celsius.

<table>
<thead>
<tr>
<th>Country</th>
<th>Celsius Temperature</th>
<th>Fahrenheit Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montreal, Canada</td>
<td></td>
<td></td>
</tr>
<tr>
<td>London, England</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madrid, Spain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paris, France</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rome, Italy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Munich, Germany</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tel Aviv, Israel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tokyo, Japan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Problems

1. Rank the cities in order from the coldest temperatures to the warmest temperatures.

   1
   2
   3
   4
   5
   6
   7
   8
Activity 6 • Let’s Take a Vacation!

2. Research the daily temperature for 5 consecutive days for each of the cities listed in the table. Determine the mean temperature in both Celsius and Fahrenheit.

<table>
<thead>
<tr>
<th>Celsius (mean)</th>
<th>Fahrenheit (mean)</th>
</tr>
</thead>
</table>

3. What is the median temperature of the cities listed in the table?

Median Temperature

4. Find a city other than the ones listed in the table located anywhere but North America and determine its temperature in degrees Celsius and Fahrenheit.

City: __________________________

<table>
<thead>
<tr>
<th>Celsius (mean)</th>
<th>Fahrenheit (mean)</th>
</tr>
</thead>
</table>

5. What is the change in degrees Celsius each time there is change in one degree Fahrenheit?

______________________________

6. What is the boiling point of water in degrees Celsius and Fahrenheit?

<table>
<thead>
<tr>
<th>Celsius</th>
<th>Fahrenheit</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______</td>
<td>__________</td>
</tr>
</tbody>
</table>

7. What is the freezing point of water in degrees Celsius and Fahrenheit?

<table>
<thead>
<tr>
<th>Celsius</th>
<th>Fahrenheit</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______</td>
<td>__________</td>
</tr>
</tbody>
</table>

8. What is the temperature today in your city? Express your temperature in both degrees Celsius and Fahrenheit.

<table>
<thead>
<tr>
<th>Celsius</th>
<th>Fahrenheit</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______</td>
<td>__________</td>
</tr>
</tbody>
</table>
9. Write a paragraph describing which temperature measurement (either Celsius or Fahrenheit) you prefer. Do you think the United States will ever fully adopt recording temperatures in degrees Celsius as opposed to Fahrenheit? Explain your reasoning.
1. Answers will vary depending upon the time of year.
2. Answers will vary depending upon the time of year.
3. Answers will vary depending upon the time of year.
4. Answers will vary depending upon the time of year.
5. Each time the temperature increases one degree Fahrenheit; the temperature increases by $\frac{5}{9}$ degrees Celsius.
6. The boiling point of water in degrees Celsius is 100 and in degrees Fahrenheit is 212.
7. The freezing point of water in degrees Celsius is 0 and in degrees Fahrenheit is 32.
8. Answers will vary depending upon the time of year.
Activity 7
Maximizing Space

Topic Area: Spatial Sense, Functions, and Patterns

NCTM Standards: Geometry, Measurement, Problem Solving, Reasoning and Proof, Communications, Connecting

Objective

Students will demonstrate the ability to maximize the area of a rectangular region as well as to solve problems involving perimeter and area.

Materials Needed

Casio fx-300ES Calculator, graph paper, pencil and paper

Engage

Have students define the difference between area and perimeter. Allow them time to describe these terms using words and pictures to determine how well they understand these concepts. Then, ask students to define the perimeter and area of a rectangle that measures 5 units by 7 units.

Explore

1. Using the calculator, model how to find the square root of a number.
2. Using the calculator, model how to determine the perimeter of a rectangular region when its area is not a perfect square.

Explain

Explain how to determine the length of one side of a rectangular region when you know its area. Model how a number expressed in radical form has a decimal equivalent, but is easier to perform calculations with the number in radical form (i.e. multiplication).

Elaborate

This is a great opportunity to discuss with your students the product of square roots. For example, students should be able to understand $\sqrt{7} \times \sqrt{7} = \sqrt{49} = 7$. Also, have students see that determining an equivalent radical form to an answer is beneficial for those students taking Algebra and Geometry to see that radicals can be expressed in various forms.

Extension

Once students gain some familiarity with square roots, it will make working with them in a formal Algebra course much easier. Another extension to this activity is to ask them between what two consecutive integers does a square root fall between. For example, between what two consecutive integers is the $\sqrt{135}$? This type of question will reinforce knowledge of square roots as well as strengthen their overall number sense skills.

Evaluate

Students will be given a series of area and perimeter problems involving square roots and will solve them based upon the information learned in this activity.
Calculator Notes for Activity 7

Steps for Solving the Problems

To evaluate the square root of a number:

1. Turn calculator on and press MODE. Press 1 for Computation.
2. Press SHIFT SETUP followed by 1: MthIO

3. Press the \( \sqrt{\square} \) key to display the square root template.

4. Enter the number you want to find its square root. (Notice that the square root symbol will lengthen depending upon the number of digits.)

For example, if you input the square root of 20 and press \( = \), you will notice that the answer is displayed as \( 2\sqrt{5} \). If you want to determine its decimal equivalent, press the S\( \leftrightarrow \)D key.
Getting Started

Rectangular regions have perimeter and area. The perimeter measures the distance around a region while the area measures the space inside of the region measured in square units. What is the maximum area of a rectangular region with a perimeter of 28 units?

One way to obtain a solution is to create a table of values for the length and width in relation to its perimeter. Since the perimeter of the rectangle is 28 units, the length plus the width must equal 14. We could create a table such as the one pictured below.

<table>
<thead>
<tr>
<th>Length</th>
<th>Width</th>
<th>Perimeter $P = 2(L + W)$</th>
<th>Area $A = L \cdot W$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13</td>
<td>28</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>28</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>28</td>
<td>33</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>28</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>28</td>
<td>45</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>28</td>
<td>48</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>28</td>
<td>49</td>
</tr>
<tr>
<td>8</td>
<td>6</td>
<td>28</td>
<td>48</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>28</td>
<td>45</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>28</td>
<td>40</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>28</td>
<td>33</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>28</td>
<td>24</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>28</td>
<td>13</td>
</tr>
</tbody>
</table>

To maximize the area of a rectangular region, the region must be a square. However, if you know the area of a square, how do you determine the length of one side? To determine the length of one side, you must find the square root of its area.

For example, if you have a square that has an area of 49 square units, the length of one of its sides measures 7 units, as the $\sqrt{49}$ is 7. What happens when the square’s area is not a perfect square? The following questions will help explore the idea of maximizing area and determining the perimeter of a square.
Activity 7 • Maximizing Space

Problems

Part 1

1. What is the measure of one side of a square that has an area of 64 square units?

2. What is the perimeter of a square that has an area of 64 square units?

3. What is the measure of one side of a square that has an area of 53 square units?

4. What is the perimeter of a square that has an area of 53 square units?

5. What is the area of a square whose side measures the $\sqrt{11}$?

6. What is the length of a square's side whose area measures $n$ square units?

7. What is the perimeter of a square whose area measures $n$ square units?

Part 2

8. What is $\sqrt{1} + \sqrt{4} + \sqrt{9} + \sqrt{16} + \sqrt{25} + \sqrt{36} + \sqrt{49} + \sqrt{64} + \sqrt{81} + \sqrt{100}$?

9. What is the $\sqrt{1} + \sqrt{4}$?

10. What is the $\sqrt{1} \cdot \sqrt{4}$?
Activity 7 • Maximizing Space

11. Explain why the $\sqrt{25} \cdot \sqrt{100} = 50$.
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

12. What is the $\sqrt{100} \cdot \sqrt{100}$?
____________________________________________________________________________

13. What is $2\sqrt{3} + 5\sqrt{3}$?
____________________________________________________________________________

14. Describe how to multiply radicals (square roots).
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

15. Describe how you would estimate the $\sqrt{53}$ without using a calculator?
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
Solutions and Answers for Activity 7

Part 1:
1. 8 units
2. 32 units
3. \( \sqrt{53} \)
4. \( 4 \cdot \sqrt{53} \)
5. 11 square units
6. \( \sqrt{n} \)
7. \( 4 \cdot \sqrt{n} \)

Part 2:
8. 55
9. 3
10. 2
11. \( \sqrt{25} \cdot \sqrt{100} = 50 \) because according to the Product of Square Roots Property, when multiplying square roots, you find the product of the two square roots and then evaluate it. Since \( \sqrt{25} \) and \( \sqrt{100} \) equals the square root of 2500, that can be simplified to equal 50.

12. 100
13. \( 7\sqrt{3} \)
14. In order to multiply radicals, you must multiply any numbers that are outside of the radicals and then multiply any numbers that are inside of the radicals.
15. Since \( \sqrt{49} \) equals 7 and the \( \sqrt{64} \) equals 8, the \( \sqrt{53} \) must be between 7 and 8. To estimate it further, there are 14 numbers between 49 and 64 and since 53 is approximately one-third of the way between 49 and 64, the decimal equivalent of the \( \sqrt{53} \) must be around 7.3.
Activity 8
Buying a Car (Exploring Depreciation)

Topic Area: Patterns and Functions

NCTM Standards: Numbers and Operation, Algebra, Problem Solving, Communications, Connecting and Representations

Objective
Students will demonstrate how to use a depreciation formula to calculate the value of an item after a certain period of depreciation.

Materials Needed
Casio fx-300ES Calculator, Internet, pencil and paper

Engage
Ask students why most cars depreciate as opposed to increasing their value over time. Ask students how they could calculate a depreciation of 5% per year over a period of three years.

Explore
1. Using the calculator, model how to access the TABLE application, input a function as well as the appropriate starting, ending, and step values.
2. Using the calculator, model how to access the COMP application and calculate a depreciation by determine the amount of depreciation each year and subtracting that amount from the previous year's value.

Explain
Have students explain why the amount of depreciation is not the same amount each year. Students should discover that when the depreciation is based upon a certain percentage that amount changes each year based upon the overall value of the car at a specified time.

Elaborate
Discuss any questions or comments with your students. Then, ask them to determine if a car's value can ever be a negative number. Have students write a response in their journals and if they choose, share their observations with the class.

Extension
Have students research the purchase of a new car. Students should state the cost of the automobile, research its depreciation rate, and calculate its value over a period of 7 years. Then, students can present their findings to the class through a verbal presentation or written report.

Evaluate
Students will be given a scenario and asked to successfully answer the problems. Students will also be evaluated on calculating the value of the car at a particular time (number of years) or when it loses half of its initial value.
Steps for Solving the Problems
To Enter a Function and Create a Table of Values:

1. Turn calculator on and press MODE. Press 3 for Table.

2. Enter the function after $f(x) =$.

3. Press $=$.

4. Set a Start Value and an End Value.

5. Set a Step Value.

6. Press $=$.
Activity 8 • Buying a Car (Exploring Depreciation)

Getting Started

For most people, cars are a necessity to commute to work as well as to drive to meet friends, run errands, and go places rather than relying on public transportation. Vickie needs to buy a new car. Her current automobile is old and is starting to need some major repairs. Rather than fix the car, she believes that it is time to purchase a new automobile. After much research, Vickie decides to purchase a new automobile that sells for $33,000. It is estimated that the car’s value will depreciate by 10% each year. Vickie plans on keeping the car for 7 years and estimates that she will drive approximately 12,000 miles per year.

Problems

Vickie purchases the car at a designated time we will call Year 0. Complete the table to show the number of years she has owned the car, the estimated mileage per year, and the car’s depreciated value at the end of each year.

<table>
<thead>
<tr>
<th>Years</th>
<th>Mileage</th>
<th>Depreciated Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>4</td>
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<td>5</td>
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<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Write a formula that will help Vickie determine the amount of miles and depreciated value of the car if she decided to keep the car more than 7 years. Explain.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
2. What factors may affect whether or not Vickie will keep the car longer than 7 years?
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

3. What percent of the car’s original value has it retained after 3 years?
____________________________________________________________________________

After 7 years?
____________________________________________________________________________

4. Vickie has decided that she does not want to keep the car beyond 110,000 miles. During what year would Vickie have at least 110,000 miles on her car?
____________________________________________________________________________

5. If Vickie drives 12,000 miles per year and averages 23 miles per gallon, how many gallons of gas will she need to purchase during the year?
____________________________________________________________________________

If gas sells for $2.37 per gallon, how much will it cost for her to put gas in the car for the year?
____________________________________________________________________________

6. Your family has decided to buy a new car and it’s time to do some research. Using a newspaper advertisement or the Internet, choose a car that you would like to own. It can be any type of car you choose (Hybrid, Compact, Sedan, SUV, Convertible, Truck, Sports Car, etc…).

Through your research, determine a reasonable depreciation rate for your automobile. Remember that cars depreciate at different rates based upon manufacturer and style. Then, create a table to show the depreciated value of a car for a period of 7 years.
1. If Vickie decides to keep the car longer than 7 years, she can determine the mileage by calculating \( F(x) = 12000X \) where \( X \) = the number of years she owns the car. To calculate the depreciated value, she would use \( f(x) = 33000 \cdot 0.9^x \), where \$33,000 equals the starting value of the car at the time it was purchased and 0.9 represents the growth factor where the car retains 90% of its value each year after it is purchased.

2. Some factors that may determine whether or not Vickie keeps the car longer than 7 years are: if the car is still in good condition, whether or not she still likes the car, whether or not she is in a financial situation to purchase a new car, etc... (Student answers may vary.)

3. 72.9% of the car's original value is retained after 3 years. This is calculated by:

\[
\frac{\text{depreciated value}}{\text{original value}} \times 100 = \text{Percent of Retained Value}
\]

\[
\frac{24057}{33000} \times 100 = 72.9\%
\]

The retained value after 7 years is approximately 47.8%. This was calculated by

\[
\frac{15783}{33000} \times 100 = 47.8\%
\]

4. At a rate of 12,000 miles per year, we can determine that Vickie will have 110,000 miles during the 10th year that she owns the car. Since \( 12,000 \times 9 = 108,000 \), we can conclude that at some point during the 10th year of owning the car, Vickie's automobile will have 110,000 miles.

5. Since 12,000 miles divided by 23 miles per gallon equals 521.74, one can conclude that Vickie will need to purchase 522 gallons of gasoline. At a cost of \$2.37 per gallon, Vickie will need to spend \$1,237.14 (522 \times \$2.37) on gasoline.

6. Answers will vary.
Activity 9
The nth Root

Topic Area: Algebra, Number Sense, Patterns and Functions

NCTM Standards:  Number and Operations, Algebra, Problem Solving, Connecting, Representations

Objective
Students will demonstrate the ability to determine the root of any number. Students will demonstrate the ability to determine between what two consecutive integers an nth root exists.

Materials Needed
Casio fx-300ES Calculator, pencil and paper

Engage
Ask students to draw a square and a cube. Have students communicate the differences between the two figures. Then, ask students how to calculate the lengths of each side.

Explore
1. Using the calculator, model how to find the square root of a number.
2. Using the calculator, model how to raise a number to a power.
3. Using the calculator, model how to generate a random number.

Explain
Define square numbers and cubic numbers. Have students determine a series of square numbers and cubic numbers.

Elaborate
Have students discuss any questions or comments. Then, discuss the algebraic representation of variables that are squared and cubed. For example, \( x^2 \) and \( x^3 \) are the algebraic representations of numbers that are squared or cubed.

Extension
Create groups of two. Each member of the group will take turns generating a random number to determine if it is a square number, cubic number or a number raised to the fourth or fifth power. Look at the number that appears to the right of the decimal point. These numbers will range from 000-999. Points are awarded as follows:

- Square Number = 2 points
- Cubic Number = 3 points
- A Number Raised to the 4th Power = 4 points
- A Number Raised to the 5th Power = 5 points

The first person to get to 10 points wins.
Activity 9
The nth Root

Extension Questions:
1. Since we are only dealing with random numbers from 0 – 999, how many square numbers are there between 0 and 999?
2. How many cubic numbers are there between 0 and 999?
3. How many numbers raised to the fourth power are there between 0 and 999?
4. How many numbers raised to the fifth power are there between 0 and 999?

Extension Answers:
1. 31 {1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, 256, 289, 324, 361, 400, 441, 484, 529, 576, 625, 676, 729, 784, 841, 900, 961}
2. 9 {1, 8, 27, 81, 125, 216, 343, 512, 729}
3. 5 {1, 16, 81, 256, 625}
4. 3 {1, 32, 243}

Evaluate
Students will participate in an activity and be given a series of problems to solve. As these activities progress, students should be able to estimate between which two consecutive integers is a square root or cubic root. Furthermore, the ability to increase these estimation strategies will also enhance one’s overall number sense.
Steps for Solving the Problems

To Use the Power Keys:

1. Make certain that the fx-300ES is in the COMP mode.

2. Press SHIFT SETUP.

3. Press 1 for MthIO (Math Format).

4. Enter the base number 2 followed by the exponent key $x^\text{2}$. Enter the exponent 5 and press = .

5. As a shortcut, you can use the $x^2$ or the $x^3$ keys if you are squaring or cubing a number.
Calculator Notes for Activity 9

To Use the Root Keys:
1. Make certain that the fx-300ES is in the COMP mode and MthIO format.
2. Press the square root key: \( \sqrt{ } \).
3. Enter the number you want to take the square root of underneath the square root sign.
4. If you want to take the nth root of a number, press the \texttt{SHIFT} \( \sqrt[n]{ } \) key to activate the nth root template.
5. Enter the root.
6. Move the cursor by pressing the right arrow on the Replay Pad.
7. Enter the number underneath the radical.
8. Press \( = \).

To Use the Random Number Generator:
1. Make certain that the fx-300ES is in the COMP mode.
2. Press \texttt{SHIFT} \texttt{MODE/SETUP}.
4. Press \texttt{SHIFT} \texttt{Ran#} (The \texttt{Ran#} key is located above the decimal point key.)
5. Press \( = \).
6. To generate a new random number, press \( = \).
Activity 9 • The nth Root

Getting Started

Allow x to be any integer greater than 0. When you take a value for x and multiply it by itself \((x^2)\), you then determine the set of square numbers. Taking any positive integer \((x)\) and multiplying it by itself three times \((x^3)\) determines the set of cubic numbers.

In this example, 16 is a square number because each side of the square measures 4 units and its area equals 16 square units. The square root of 16 is 4 because that is the length of one of the square's sides.

In this example, 125 is a cubic number because each side of the cube measures 5 units and its volume measures 125 cubic units. The cubic root of 125 is 5 because that is the length of one of the cube's sides.

We can continue by taking any positive integers \((x)\) and raising that integer to a specified power \(x^n\).

Problems

1. List the first 10 square numbers.

2. List the first 10 cubic numbers.

3. List the first 5 numbers that belong to the set of positive integers raised to the fourth power.
Activity 9 • The nth Root

4. List the first 5 numbers that belong to the set of positive integers raised to the fifth power.

____________________________________________________________________________

5. What number belongs to the set of square numbers, cubic numbers, numbers raised to the fourth power, and numbers raised to the fifth power?

____________________________________________________________________________

6. What similarities do you notice between the set of square numbers and numbers raised to the fourth power?

____________________________________________________________________________
____________________________________________________________________________

7. Between what two consecutive integers is \( \sqrt[9]{94} \) ?

____________________________________________________________________________

8. Between what two consecutive integers is \( \sqrt[3]{74} \) ?

____________________________________________________________________________

9. Between what two consecutive integers is \( \sqrt[4]{1398} \) ?

____________________________________________________________________________

10. Between what two consecutive integers is \( \sqrt[5]{2150} \) ?

____________________________________________________________________________

11. Is \( \sqrt[3]{5} + \sqrt[3]{5} = 2\sqrt[3]{5} \) ?

____________________________________________________________________________
1. \{1, 4, 9, 16, 25, 36, 49, 64, 81, 100\}
2. \{1, 8, 27, 64, 125, 216, 343, 512, 729, 1,000\}
3. \{1, 16, 81, 256, 625\}
4. \{1, 32, 243, 1024, 3,125\}
5. 1
6. If you take any square number and square it, you will get the set of numbers raised to the fourth power.
7. 9 and 10
8. 4 and 5
9. 6 and 7
10. 4 and 5
11. Yes
Activity 10
Crack the Code

Topic Area: Permutations and Combinations

NCTM Standards: Numbers and Operations, Data Analysis and Probability, Problem Solving, Reasoning and Proof, Communications

Objective

Students will demonstrate the ability to solve various permutations and combinations in order to determine a secret code.

Materials Needed

Casio fx-300ES Calculator, pencil and paper

Engage

Begin class by creating a scenario that a local radio station is having a contest as described in the student pages. Ask students to describe the sample space for the first scenario and discuss how that sample space was created.

Explore

1. Using the calculator, model how to calculate a permutation.
2. Using the calculator, model how to calculate a combination.

Explain

Discuss the differences between a combination and a permutation. Have students provide examples of when to use a permutation or a combination to calculate the total number of arrangements.

Elaborate

Provide examples of different contests and have students determine the total number of possibilities. You may want to model your state lottery or conduct a simple drawing in class to help students gain an understanding of this concept.

Extension

Have students create a new radio station contest that will be creative and challenging. The students must describe the contest and calculate the total number of different outcomes or possibilities for that contest. If desired, you may want to have the students conduct the contest within your class or at your school.

Evaluate

The students will be given a series of scenarios relating to a radio station contest and will be asked to correctly answer the accompanying questions.
Steps for Solving the Problems

If order is important, you will need to compute a permutation:

1. Set MODE to 1 (COMP).

2. Enter the total number of items in the set.
3. Press SHIFT and the multiplication key to activate the Permutation key: nPr.
4. Enter the total number of items you are going to choose from the set.
   For example, if you wanted to select 3 people from a group of 10 in a particular order, you would press: 10 nPr 3 =

If order is not important, you will need to compute a combination:

1. Set MODE to 1 (COMP).
2. Enter the total number of items in the set.
3. Press SHIFT and the division key to activate the Combination key: nCr .
4. Enter the total number of items you are going to choose from the set.
   For example, if you wanted to select 3 people from a group of 10 and order was not important, you would press: 10 nCr 3 =
Activity 10 • Crack the Code

Getting Started

Scenario 1:
A local radio station is planning a contest in which its listeners will have a chance to open a special safe that contains $10,000. In order to Crack the Code you will need to correctly identify the three secret numbers to the combination. On the safe is a combination dial that contains the numbers from 0 through 49. Each number can be used once and only once, meaning that no number can be repeated in the combination. How many possible combinations are there to Crack the Code?

Scenario 2:
After someone wins the contest, the radio station decides to run another Crack the Code contest. This time, the numbers in the combination can be repeated. How many possible combinations are there to Crack the Code?

Scenario 3:
The station manager believes that the contest is too easy and wants to make it more difficult. The combination dial is still numbered from 0 through 49, but this time the winner will need to identify the four numbers in the combination to Crack the Code? When the winner correctly identifies the secret combination, he/she will win $20,000. Each number can only be used once in the combination of the safe. How many possible combinations are there to Crack the Code? How many more combinations are there in this version as opposed to the original version of Crack the Code?

Scenario 4:
The latest version of this contest was very successful, but the station manager decides to hold one final Crack the Code contest. This contest will be the biggest and most difficult yet. The person who can correctly Crack the Code will win $50,000! The contest has the following guidelines.
- The combination dial contains numbers ranging from 0 through 99.
- There are five numbers in the secret combination.
- Each number is used once and only once.
- The first two numbers in the code are prime.
- The third number is a composite number that is divisible by 3.
- The fourth number is a composite number that is divisible by 5
- The fifth and final number is not divisible by 3 or by 5 and is greater than 60.

Can you Crack the Code? Your teacher holds the secret combination.
Activity 10 • Crack the Code

Problems
1. Describe how you obtained the solution to each of the above scenarios.
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

2. Which scenario is the most interesting to you and why?
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

3. What is the difference between a permutation and a combination?
   Does using a permutation or a combination solve the scenarios above?
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

4. What is the difference between a prime and a composite number?
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

5. What is the difference between a factor and a multiple?
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
Answers to Scenario Problems:

Scenario 1:
Considering that the numbers on the combination lock range from 0 to 49, there are 50 numbers on the lock. Since each number can be used only once, there are 117,600 different combinations to Crack the Code. This is calculated by choosing one of 50 numbers for the first number in the combination, one of 49 numbers for the second number in the combination and finally, one of 48 numbers for the third and final number in the combination lock. Since order is important, the answer is calculated by using a permutation, 50P3, to equal 117,600. Another way of calculating the problem is to multiply 50 × 49 × 48. The factors represent 50 possible numbers to select the first number in the combination, 49 possible numbers to select the second number, and 48 possible numbers to select the third and final number.

Scenario 2:
Since the numbers in the combination can be repeated, each number in the combination is chosen from 50 different numbers. Therefore, the solution is obtained by multiplying 50^3 or 50 × 50 × 50 to equal 125,000 different combinations.

Scenario 3:
This problem is solved similarly to Scenario 1 but this time, there are four numbers in the combination to unlock the safe. In order to Crack the Code, the combination is solved by using a permutation, 50P4, to equal 5,527,200 different combinations. Another way to calculate the problem is to multiply 50 × 49 × 48 × 47. The factors represent the possible numbers to choose from for each of the numbers in the combination.

Scenario 4:
In order to Crack the Code, you must identify the following numbers from 1 – 100.

- The first two numbers in the code are prime. The prime numbers are: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, and 97. There are a total of 25 prime numbers between 1 and 100.

- The third number in the code is a composite number that is divisible by 3. Those numbers are: 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 54, 57, 60, 63, 66, 69, 72, 75, 78, 81, 84, 87, 90, 93, 96, and 99. There are a total of 32 composite numbers divisible by 3 between 1 and 100.

- The fourth number in the code is a composite number divisible by 5. Those numbers are: 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, and 100. There are a total of 18 composite numbers divisible by 5 between 1 and 100. (Excluding any number that could be used as a third number.)

- The fifth and final number is a composite number greater than 60 that is not divisible by 3 or 5. Those numbers are: 62, 64, 68, 74, 76, 77, 82, 84, 86, 88, 91, 92, 94, and 98. There are a total of 14 composite numbers greater than 60 that are not divisible by 3 or 5.
To calculate the total number of possible combinations, you can computer \( (25P2)(32P1)(18P1)(14P1) \) to equal 4,838,400 possible combinations to *Crack the Code* and win $50,000 in the radio station contest.

**Answers to Problems:**

1. Check student responses.
2. Check student responses.
3. You use a permutation to calculate the different outcomes of a set of objects that must be in order. You use a combination to calculate the different outcomes of a set of objects when order is not important.
4. A prime number is a number that is only divisible by the number 1 and itself. A composite number is a number that is divisible by the number 1, itself, and at least one other number.
5. A factor of a particular number divides that number evenly with a remainder of zero. A multiple of a particular number is that number multiplied by another whole number. One could say that any number has a limited number of factors, but an infinite number of multiples. For example, the factors of 10 are 1, 2, 5, and 10, but the multiples of 10 are infinite, such as 10, 20, 30, 40, etc…
Activity 11
Finding Functions and Their Values

Topic Area: Algebraic Patterns and Functions

NCTM Standards: Number and Operations, Algebra, Problem Solving, Reasoning and Proof, Communications, and Connecting

Objective
Students will demonstrate the ability to examine a mathematical sequence or a table of values to identify a function equation. Students will also be able to demonstrate the ability to examine a function and evaluate it at a specific value.

Materials Needed
Casio fx-300ES Calculator, pencil and paper, index cards

Engage
Have students identify the next three terms in a particular sequence. Students should be able to communicate their reasoning as well as determine the value of a particular term that occurs later in the sequence.

Explore
Using the calculator, model how to access the TABLE application, input a function, set starting, ending, and step values and examine the table of values.

Explain
Have students explain how they complete a table of values when given a function. Students should be able to communicate what changes occur in the f(x) values when x increases or decreases.

Elaborate
Discuss any questions or comments with your students. Have students explain how they derive a function rule for a sequence. This can be a very difficult concept for some students and providing ample time for people to describe their reasoning may be very beneficial for your students.

Extension
As an extension to this activity, have students write a journal entry describing how they were able to determine the function when given a sequence. Then, have the students work in pairs to create their own problems on index cards where they create a table and enter the values for x and f(x) and have their partners determine the function.

Evaluate
Students will be given a series of function tables. In some problems, students will be given a function rule and they must complete the table for assigned values. In other examples, students will be given the table of values and must derive the correct function. Here, they can use their calculator to prove whether or not they have the correct function.
Steps for Solving the Problems

To Enter a Function and Create a Table of Values:
1. Press MODE.
2. Press 3 for TABLE.

3. Enter the function after f(x) =.

4. Press =.
5. Set a Start Value. Press =.
7. Set a Step Value. Press =.

8. Press =.
Activity 11 • Finding Functions and Their Values

Getting Started

Identify the next three numbers in each sequence.

a. 4, 7, 10, ________, ________, ________

b. -1, -8, -15, ________, ________, ________

c. 5, -10, 20, -40, ________, ________, ________

d. 0, 3, 2, 5, 4, ________, ________, ________

e. 100, 50, 25, ________, ________, ________

How were you able to determine the next three numbers in each of these sequences?

In mathematics, when we examine a sequence of numbers, we want to determine a general rule or formula for that sequence. We must carefully examine that sequence to see if there is some type of pattern happening. It might be something as simple as adding to the previous number to get the next term in the sequence or it might involve multiplication. Once we discover how the sequence is created, we can then determine an equation or function for that sequence.

For example, if we had a sequence of numbers such as 2, 4, 6, 8, …, we would identify that function as \( f(x) = 2x \) because each number is two more than the previous number. The \( x \) variable indicates the particular term in the sequence. Those terms are always referred to by the set of positive integers meaning that the first term is 2, the second term is 4, and so on. Since we want to check our function to see if it is correct, we would use the set of positive integers for \( x \) and our output (the \( f(x) \) value) should equal our sequence. When we check, we can see that it is correct.

We could also create a table of values for this function. It would look like this.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) = 2x )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>
Activity 11 • Finding Functions and Their Values

When we are given a function rule, we can evaluate that function by creating a table of values. For example, given the function, \( f(x) = 3x - 5 \), what would be the values of \( f(x) \) when \( x = \{1, 2, 3, 4, 5\} \)? To solve this problem, we must substitute each value for \( x \) and determine the output of the function. When \( x = 1 \), \( f(x) = -2 \) because \( 3(1) - 5 = -2 \). The table of values would look as follows.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) = 3x - 5 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-2</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

When you examine this table of values, you can see that each time \( x \) increases by 1, the output, or \( f(x) \), increases by 3.

Problems

Complete the table and answer the question below the table.

1. 

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) = 2x + 1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

2. What is the value of \( f(x) \) when \( x = 22 \)?

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) = 3x^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

What is the value of \( f(x) \) when \( x = -10 \)?
Activity 11 • Finding Functions and Their Values

3.

<table>
<thead>
<tr>
<th>X</th>
<th>f(X) = ABS (X – 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

4. For what value of x will this function equal 0? ___________________________

<table>
<thead>
<tr>
<th>X</th>
<th>f(X) = X^2 – X</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

For what value of x will this function equal 9,900? __________________________

For the following problems, identify the function for each table of values and answer the question below each table.

5.

<table>
<thead>
<tr>
<th>X</th>
<th>f(X) =</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-3</td>
</tr>
<tr>
<td>1</td>
<td>-10</td>
</tr>
<tr>
<td>2</td>
<td>-17</td>
</tr>
<tr>
<td>3</td>
<td>-24</td>
</tr>
<tr>
<td>4</td>
<td>-31</td>
</tr>
</tbody>
</table>

What is the value of f(x) when x = 5? __________________________
### Activity 11 • Finding Functions and Their Values

6. | X | f(X) = ? |
---|---|
-2 | 8 |
-1 | 2 |
0 | 0 |
1 | 2 |
2 | 8 |

What is the value of f(x) when x = 12?  

7. | X | f(X) = ? |
---|---|
-5 | -11 |
-4 | -8 |
-3 | -5 |
-2 | -2 |
-1 | 1 |

What is the value of x when f(x) = 31?  

8. | X | f(X) = ? |
---|---|
1 | 1 |
2 | 0.5 |
3 | 0.3333 |
4 | 0.25 |
5 | 0.2 |

What is the value of x when f(x) = 0.001?  
Identify the next three numbers in each sequence.

a. 4, 7, 10, 13, 16, 19
b. -1, -8, -15, -22, -29, -36
c. 5, -10, 20, -40, 80, -160, 320
d. 0, 3, 2, 5, 4, 7, 6, 9
e. 100, 50, 25, 12.5, 6.25, 3.125

<table>
<thead>
<tr>
<th>X</th>
<th>f(X) = 2X + 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
</tr>
</tbody>
</table>

2. What is the value of f(x) when X = 22? 1,452

<table>
<thead>
<tr>
<th>X</th>
<th>f(X) = 3X²</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>12</td>
</tr>
<tr>
<td>-1</td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
</tr>
</tbody>
</table>

What is the value of f(x) when X = -10? 300

<table>
<thead>
<tr>
<th>X</th>
<th>f(X) = ABS (X - 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4</td>
<td>9</td>
</tr>
<tr>
<td>-1</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>

For what value of x will this function equal 0? 5
Solutions and Answers for Activity 11

4.  

<table>
<thead>
<tr>
<th>X</th>
<th>f(X) = X^2 – X</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>6</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
</tr>
</tbody>
</table>

For what value of x will this function equal 9,900? **100**

5.  

<table>
<thead>
<tr>
<th>X</th>
<th>f(X) = -7x – 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-3</td>
</tr>
<tr>
<td>1</td>
<td>-10</td>
</tr>
<tr>
<td>2</td>
<td>-17</td>
</tr>
<tr>
<td>3</td>
<td>-24</td>
</tr>
<tr>
<td>4</td>
<td>-31</td>
</tr>
</tbody>
</table>

What is the value of f(x) when x = 5? **-38**

6.  

<table>
<thead>
<tr>
<th>X</th>
<th>f(X) = 2x^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>8</td>
</tr>
<tr>
<td>-1</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

What is the value of f(x) when x = 12? **288**
Solutions and Answers for Activity 11

7. 

<table>
<thead>
<tr>
<th>X</th>
<th>f(X) = 3x + 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5</td>
<td>-11</td>
</tr>
<tr>
<td>-4</td>
<td>-8</td>
</tr>
<tr>
<td>-3</td>
<td>-5</td>
</tr>
<tr>
<td>-2</td>
<td>-2</td>
</tr>
<tr>
<td>-1</td>
<td>1</td>
</tr>
</tbody>
</table>

What is the value of x when f(x) = 31? 9

8. 

<table>
<thead>
<tr>
<th>X</th>
<th>f(X) = ( \frac{1}{x} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>3</td>
<td>0.3333</td>
</tr>
<tr>
<td>4</td>
<td>0.25</td>
</tr>
<tr>
<td>5</td>
<td>0.2</td>
</tr>
</tbody>
</table>

What is the value of x when f(x) = 0.001? 1,000
Activity 12
The Pythagorean Theorem

Topic Area: Geometry
NCTM Standards: Geometry, Measurement, Problem Solving, Reasoning and Proof

Objective
Students will demonstrate the ability to determine the missing side of a right triangle by using the Pythagorean Theorem. Also, students will demonstrate the ability to identify and generate a Pythagorean Triple.

Materials Needed
Casio fx-300ES Calculator, graph paper, pencil and paper

Engage
Discuss and/or review the Pythagorean Theorem with your students. Provide models and manipulatives to reinforce this theorem. Then, ask students to come up with their own measures of a right triangle that they can prove by the Pythagorean Theorem. (Note: Any multiple of all dimensions of a right triangle are acceptable as well. For example 3-4-5, 6-8-10, etc…)

Explore
1. Using the calculator, model how to use the square root key.
2. Using the calculator, model how to use the exponent key.

Explain
Have students explain how they can use the Pythagorean Theorem to determine if given measurements form a right triangle. Also, have students explain how to determine the length of a leg when the other leg and the hypotenuse are given.

Elaborate
Discuss any questions or comments with your students. Then, have students determine the special relationships between triangles whose angles measure 45-45-90 degrees and 30-60-90 degrees.

Extension
Have students derive a formula for determining the lengths of a leg and hypotenuse of a right triangle when one leg is given. You may want your students to examine a table of Pythagorean Triples in order to help them with this challenge.

Evaluate
Students will be given a series of problems for assessment. Students should be able to determine the hypotenuse when both legs are given as well as the measure of one leg when the other leg and hypotenuse are given.
Steps for Solving the Problems

How to use the square root key:

1. Press MODE and 1 to enter the COMP application.

2. Press SHIFT and SETUP followed by 1 for the Math Input/Output application.

3. Press the square root template.

4. Enter the number you want to find its square root.

5. Press =.

If your answer is not an integer, it will be expressed in square root (radical) form. To determine the decimal equivalent of your answer, press the S↔D key to find its decimal equivalent.
If you need to square a square root:

- For some of the problems, you will need to find the square of a square root.
- For example, if you are trying to find $\sqrt{32} \cdot \sqrt{32}$, you must enclose it in a set of parentheses before you can square it, like this $(\sqrt{32})^2$. You will need to press the right arrow on the replay key after you input the number underneath the square root symbol before you can correctly square it.

Helpful Hints:

- When squaring or cubing a number, there are special keys located on the keypad for those functions.
- If you do not want to use the templates on the fx-300ES, you can easily switch to the line input/output format by pressing **SHIFT** followed by **SETUP** and the number 2.
Activity 12 • The Pythagorean Theorem

Getting Started

By definition, a right triangle is a polygon composed of three sides forming one right angle. The side opposite the right angle is called the hypotenuse and is the longest side of a right triangle. The other two sides of the right triangle are called legs. According to the Pythagorean Theorem, \( \text{leg}^2 + \text{leg}^2 = \text{hypotenuse}^2 \). The Pythagorean Theorem is often seen as \( a^2 + b^2 = c^2 \).

If given a right triangle where the legs measure 3 units and 4 units, the hypotenuse measures 5 units as proven by the Pythagorean Theorem.

\[
\begin{align*}
\text{leg}^2 + \text{leg}^2 &= \text{hypotenuse}^2 \\
a^2 + b^2 &= c^2 \\
3^2 + 4^2 &= 5^2 \\
9 + 16 &= 25 \\
25 &= 25
\end{align*}
\]

To find the length of the hypotenuse when the measures of the two legs are known, substitute the measures of the legs into the Pythagorean Theorem and find the square root of the sum of the legs’ squares. For example, find the length of the hypotenuse when the legs measure 5 units and 12 units.

\[
\begin{align*}
a^2 + b^2 &= c^2 \\
5^2 + 12^2 &= c^2 \\
25 + 144 &= c^2 \\
169 &= c^2 \\
13 &= c
\end{align*}
\]
Activity 12 • The Pythagorean Theorem

However, if you know the length of one leg and the hypotenuse, you can find the length of the other leg. What is the length of the unknown leg?

\[ a^2 + b^2 = c^2 \]

\[ 8^2 + b^2 = 17^2 \]

\[ 64 + b^2 = 289 \]

\[ 64 - 64 + b^2 = 289 - 64 \]

\[ b^2 = 225 \]

\[ b = 15 \]

Problems

1. Complete the following table. Use the Pythagorean Theorem to solve.

\[ a^2 + b^2 = c^2 \]

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>26</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>29</td>
</tr>
<tr>
<td>11</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>113</td>
</tr>
</tbody>
</table>

2. Complete the table on the next page for a right triangle where the legs are congruent. Write the exact display as it appears on your calculator. Then, press the S↔D key to convert the answer to decimal form. Round your answers to the nearest hundredth.
Activity 12 • The Pythagorean Theorem

The table shows the relationship between the legs and the hypotenuse of a special right triangle called a 45-45-90 degree triangle. Do you notice any patterns involved in finding the length of the hypotenuse? Write your answer in the space provided.

____________________________________________________________________________
____________________________________________________________________________

3. Complete the following table for a right triangle where the three angles measure 30-60-90 degrees. Write the exact display as it appears on your calculator. Then, press the S→D key to convert the answer to decimal form. Round your answers to the nearest hundredth.

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$\sqrt{3}$</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>$\sqrt{12}$</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$\sqrt{27}$</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$\sqrt{48}$</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>$\sqrt{75}$</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>$\sqrt{300}$</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>$\sqrt{n}$</td>
<td></td>
</tr>
</tbody>
</table>

Do you notice any patterns involved in finding the length of the hypotenuse? What relationship is there between the three sides of the right triangle? Write your answer in the space provided.

____________________________________________________________________________
____________________________________________________________________________
Activity 12 • The Pythagorean Theorem

4. Find the missing length for each triangle. Show all of your work in the space provided.
Solutions and Answers for Activity 12

1. | a  | b  | c  |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>24</td>
<td>26</td>
</tr>
<tr>
<td>9</td>
<td>40</td>
<td>41</td>
</tr>
<tr>
<td>20</td>
<td>21</td>
<td>29</td>
</tr>
<tr>
<td>11</td>
<td>60</td>
<td>61</td>
</tr>
<tr>
<td>15</td>
<td>112</td>
<td>113</td>
</tr>
</tbody>
</table>

As the side lengths increase by 1, the length of the hypotenuse increases by the square root of 2 or 1.41 (answer is rounded to the nearest hundredth).

2. | a  | b  | c  |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>$\sqrt{2}$</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>$2\sqrt{2}$</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>$3\sqrt{2}$</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>$4\sqrt{2}$</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>$5\sqrt{2}$</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>$10\sqrt{2}$</td>
</tr>
</tbody>
</table>

The hypotenuse is double the length of the shortest leg (which is opposite the 30 degree angle). The longer leg (which is opposite the 60 degree angle) is always the smaller leg multiplied by $\sqrt{3}$.

3. | a  | b  | c  |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$\sqrt{3}$</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>$2\sqrt{3}$</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>$3\sqrt{3}$</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>$4\sqrt{3}$</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>$5\sqrt{3}$</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>$10\sqrt{3}$</td>
<td>20</td>
</tr>
<tr>
<td>N</td>
<td>$n\sqrt{3}$</td>
<td>2n</td>
</tr>
</tbody>
</table>

4. \[ C = \sqrt{107} \]
   \[ b = \sqrt{155} \]
Activity 13
Growing Polygons

Topic Area: Geometry

NCTM Standards:  Algebraic Thinking, Patterns and Functions, Spatial Sense,
Measurement, Reasoning and Proof

Objective

Students will demonstrate the ability to construct regular polygons and determine
the measure of its interior angle. Students will also demonstrate the ability to develop
an algebraic formula for determine the measure of each interior angle.

Materials Needed

Casio fx-300ES Calculator, Worksheet for Activity 13

Engage

In an exploration of polygons, it is important for students to understand that a
polygon is a closed figure made up of three or more line segments. Asking students
to provide examples of polygons and figures that are not polygons can be very help-
ful in enhancing the discovery needed for this lesson. Ask students to describe what
constitutes a polygon being a "regular" polygon. Having models or drawings of these
regular polygons can also help enhance the meaning of this lesson.

Use the worksheet provided to guide students through an activity where they
will divide each regular polygon into a series of triangles. Knowing that a triangle
has 180 degrees, guide the class through dividing each regular polygon into a series
of triangles to determine the total number of degrees for each polygon. It is impor-
tant to emphasize that in order to divide each polygon into a series of triangles, you
must move in a clockwise direction connecting the starting vertex to each vertex on
the polygon.

Explore

1. Using the calculator, model how to use the function application and create
   a table.
2. Using the calculator, model how to develop a function, enter it into the calcu-
   lator, and test to see if it is a valid function for the given problem.

Explain

Have students explain what happens to the measures of the interior angles of a
polygon as the number of sides of the polygons increase.

Elaborate

Discuss any questions, comments, and/or observations with your students.
Then, introduce an "n-gon" where "n" represents any number of sides of a particular
polygon. For example, if a polygon has 22 sides it would be referred to as a "22-gon".
Activity 13
Growing Polygons

Extension

1. Have the students use a computer program to construct various "n-gons" and label the measures of the interior angles.
2. Have students explore the sums of each polygon's exterior angles.
3. Have students use their calculators to determine the number of sides an "n-gon" must have to have an interior angle measure of 179.999.

Evaluate

Monitor the students as they complete the worksheet and as they complete the table. An important component of this lesson is to engage the class in sharing their observations and comments and this feedback should be used in evaluating a student's progress through this activity.
Steps for Solving the Problems

To Enter a Function and Create a Table of Values:

1. Press MODE.
2. Press 3 for TABLE.
3. Enter the function after \( f(x) = \).

4. Press =.
5. Set a Start Value. Press =.

7. Set a Step Value. Press =.
Activity 13 • Growing Polygons

Worksheet

Directions: Pick any vertex at the top of the polygon. Then, connect that vertex to each of the remaining vertices within that polygon. Once you connect the vertices by one line segment, go back to the vertex at the top of the polygon and connect it with another vertex on the polygon.

As a suggestion, it is easiest to move about the polygon in a clockwise direction connecting the vertices. Remember, that each triangle contains 180 degrees. The quadrilateral is completed for you and is divided into two triangles.
Activity 13 • Growing Polygons

Getting Started

A polygon is a closed geometric figure made up of at least three line segments. If you were to take a quick look around the room, you would certainly notice many different polygons. While some of these polygons are "regular" polygons, meaning they are made up of congruent line segments, polygons (depending on the number of line segments) have a total number of degrees. For example, a triangle is made up of three line segments and has a total of 180 degrees. Any quadrilateral is made up of four line segments and has a total of 360 degrees. Do you notice any particular patterns?

Use the worksheet provided to divide each polygon into a series of triangles. By following the directions, you will divide each polygon into a specific number of triangles and be able to use that information to determine the total number of degrees within each polygon. Then, use your calculator to fill in the information on the chart below.

<table>
<thead>
<tr>
<th>Polygon</th>
<th>Number of Line Segments</th>
<th>Number of Triangles</th>
<th>Total Number of Degrees</th>
<th>Measure of Each Interior Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle</td>
<td>3</td>
<td>1</td>
<td>180</td>
<td>60</td>
</tr>
<tr>
<td>Quadrilateral</td>
<td>4</td>
<td>2</td>
<td>360</td>
<td>90</td>
</tr>
<tr>
<td>Pentagon</td>
<td>5</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexagon</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Septagon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Octagon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonagon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decagon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dodecagon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-gon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-gon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Activity 13 • Growing Polygons

Problems
1. What pattern did you observe in relation to the number of line segments and the number of triangles formed?

____________________________________________________________________________
____________________________________________________________________________

2. What happens to the measure of a polygon’s interior angle as the number of line segments increase?

____________________________________________________________________________
____________________________________________________________________________

3. Does the measure of each polygon’s interior angle increase by the same amount as the number of line segments increase by 1? Explain why or why not.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

4. What is the interior angle measure of a 45-sided regular polygon?

____________________________________________________________________________

5. What is the sum of a polygon’s exterior angles?

____________________________________________________________________________

6. How many sides must a polygon have in order for your calculator to display an interior angle measure of 179.99? Explain how you obtained your answer.

____________________________________________________________________________

7. As a polygon’s line segments increase, what figure does the polygon resemble? Why does this occur?

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Name _____________________________________________ Class ________ Date ________________
1. The number of triangles formed is always two less than the number of line segment. For example, if a polygon has "n" sides, it then has "n-2" triangles.

2. As the number of line segments increase, the measure of each interior angle increases as it approaches 180 degrees. The measure of each interior angle will never equal 180 degrees.

3. The measure of each interior angle does not increase by the same amount as the number of line segments increase by 1. Even though there is a pattern between the number of line segments and the number of triangles formed, there is not a distinguishable pattern between the number of line segments and the measure of each interior angle.

4. 172 degrees

5. 360 degrees

6. 36000 sides

7. As the number of line segments increase, the polygon begins to resemble a circle. While the interior angle measurement approaches 180 degrees, it could never equal that because the angles would be straight angles and the figure would not be a polygon.
1. Find the prime factorization of 24,972. __________________

2. Write the smallest number that is divisible by 2, 3, 5 and 11. __________________

3. Evaluate: $2^5 \times 3^2 \times 7^3$ __________________

4. Find the mean of the following data set.
   78, 47, 92, 71, 83, 94, 59
   Round your answer to the nearest hundredth. __________________

5. Write 5 numbers that have a mean of 19 and a median of 16. __________________

6. Five people in Mrs. Jackson's class scored the following on their recent history test. (81, 78, 92, 72, 70). If Mrs. Jackson gave everyone an additional 5 points, what will happen to the average? __________________

7. How much will a principal investment of $5,000 be worth in 7 years if it grows at a rate of 8.25% compounded annually? Round your answer to the nearest dollar. __________________

8. A town’s population is decreasing at a rate of 3% per year. If the town has a current population of 52,000 people, what will the town's population be in 5 years? Round your answer to the nearest whole number. __________________
9. You are given a gift of $1,000 at age 12. If you invest that gift and never touch it until you are 62 and that money earns 4% interest compounded annually, how much will that investment be worth when you are 62 years old? Round your answer to the nearest penny. __________________

10. You have three pieces of string. One-piece measures 4 1/5 inches, another piece measures 2 1/8 inches, and the last piece measures 3 1/3 inches. If you put each piece of string end to end, how long would it be? __________________

11. A cookie recipe calls for 2 1/2 cups of flour. If each recipe yields 5 dozen cookies, how many cups of flour will you need to make 420 cookies? __________________

12. An 8 3/4 foot piece of wood needs to be cut into 7 equal pieces. How long is each piece of wood? __________________

13. Martha owns a screen-printing shop. She charges $25 to make the initial screen and then $3.75 for each printing. Write a function to model how much Martha would charge for "X" number of printings.

14. Refer to question 13. How much would Martha charge for 472 printings. __________________

15. Evaluate when $x = \{-3, -1, 2, 5, 11\}$
   \[f(x) = -2x^2 + 5x - 8\] __________________

16. Evaluate when $x = \{-5, -3, -1, 1, 3\}$
   \[f(x) = \text{abs}(x) + 3\] __________________
17. Evaluate when \( x = \{-5, -3, -1, 1, 3\} \)
\[ f(x) = \text{abs}(x + 3) \]

18. A car salesperson makes 2.5% commission for each car he or she sells. If this salesperson sells 5 cars with the following values \($25,950, $28,750, $19,990, $16,550, $22,900\), how much commission does this salesperson earn? Round your answer to the nearest penny.

19. A real estate agent earns 6% commission on the sale of a house. If a house sells for $350,000, how much commission does the real estate agent earn?

20. A rectangle's perimeter measures 38 inches. In order to maximize the rectangle's area, what must be the length of one of its sides?

21. What is \( \sqrt{128} \)? Express your answer in simplified radical form and in decimal form rounded to the nearest thousandth.

22. Express \( \sqrt{125} \) in simplified radical form and as a decimal rounded to the nearest thousandth.

23. What is \( \frac{3}{\sqrt{64}} \)?

24. What is \( \frac{4}{\sqrt{2401}} \)?

25. What is \( \frac{5}{\sqrt{1}} \)?

26. Charlene owns 8 shirts, 12 pairs of pants, and 5 pairs of shoes. How many different outfits can she create with these clothes?
27. A state lottery drawing uses three canisters to create a three-digit number. Each canister is filled with 10 ping-pong balls, each numbered from 0-9. During a televised drawing every night, one number is pulled from each canister to create a three-digit number. How many different numbers can be created for this drawing? __________________ 

28. Fifteen people are gathered at a meeting. If they all shake hands with each other once, how many different handshakes occur at the beginning of the meeting? __________________ 

29. What is the measure of an interior angle for a fourteen-sided regular polygon? Round your answer to the nearest tenth. __________________ 

30. Given a right triangle whose legs measure 5 inches and 15 inches, what is the measure of the hypotenuse? Express answer in radical form and in decimal form, rounded to the nearest hundredth. __________________ 

31. How many sides does a regular polygon have if its interior angle measures 162 degrees? __________________ 

32. What three consecutive integers have a sum of 699? __________________ 

33. What two consecutive integers have a product of 3,192? __________________
Solutions and Answers for Calculator Assessment

1. \(2^2 \times 3 \times 2081\)  
2. 330  
3. 98,784  
4. 74.86  
5. Answers may vary (14, 15, 16, 24, 26)  
6. The average will increase by 5 points.  
7. $8,709  
8. 44,654  
9. $7,106.68  
10. \(9 \frac{79}{120}\)  
11. \(17 \frac{1}{2}\)  
12. \(1 \frac{1}{4}\)  
13. \(f(x) = 3.75X + 25\)  
14. $1,795  
15. \([-41, -15, -6, -33, -195]\)  
16. \((8, 6, 4, 4, 6)\)  
17. \([2, 0, 2, 4, 6]\)  
18. $2,853.50  
19. $21,000  
20. 9.5  
21. \(8\sqrt{2} \approx 11.314\)  
22. \(5\sqrt{5} \approx 11.180\)