Module: Odd and Even Numbers

Objective: To investigate whole numbers and determine if they are odd or even

An even number is a whole number that has a remainder of __________ when divided by 2.

An even number always ends in __________, __________, __________, __________, or __________.

An odd number has a remainder of __________ when divided by 2.

An odd number always ends in __________, __________, __________, __________, or __________.

Problem Set:
1. What is the smallest whole number? __________

2. Write a 3-digit even number. __________

3. Write a 2-digit odd number. __________

4. Write a 4-digit odd number. __________

5. Write a 1-digit odd number. __________

6. Write a 5-digit even number. __________

7. Write a 3-digit odd number. __________

8. Write a 1-digit even number. __________

9. Write a 4-digit even number. __________

10. Write a 7-digit odd number. __________
Label each number odd or even.

11. 493 __________
12. 3,678 __________
13. 54 __________
14. 5,774 __________
15. 570 __________
16. 0 __________
17. 8,925 __________

Extension Activity:
1. Mount Everest is the highest mountain in the world. On May 5, 1999, satellite equipment measured the elevation to be 29,035 feet. Using whole numbers, could a climber divide the distance in half evenly? _______________ (Hint: Is 29,035 even or odd?)

2. The Grand Canyon begins at Lee’s Ferry and ends at the Grand Wash Cliffs. The Colorado River runs between these two points for 277 miles. Using whole numbers, could you split your journey down the river in half evenly? _______________ (Hint: Is 277 even or odd?)

3. The United States paid France $15 million for the Louisiana Territory. Using dollars only, could France split the $15 million in half evenly? _______________ (Hint: 15 million can be written as 15,000,000.)

Reflection:
Explain in your own words how to determine if a number is odd or even.
Module: Prime and Composite Numbers

Objective: To investigate whole numbers and determine if they are prime or composite

Name: _________________________ Date: ________________

- Prime numbers have exactly _______________ factors: the number itself and _______________.
- Composite numbers have more than _______________ factors.
- A number that has only two factors is called a _______________.

Problem Set:
Identify the following numbers as prime or composite. Circle your choice, and explain your answer.

Ex. 15  composite  prime  It's composite because it has more than 2 factors. I know that $3 \cdot 5 = 15$ and $1 \cdot 15 = 15$.

1. 22  composite  prime  ___________________________________________________________________

2. 17  composite  prime  ___________________________________________________________________

3. 2  composite  prime  ___________________________________________________________________

4. 140  composite  prime  ___________________________________________________________________
Course 1

**Basic Number Ideas**

5. 25 composite prime

6. 11 composite prime

7. 32 composite prime

8. 7 composite prime

9. 52 composite prime

10. 19 composite prime

**Reflection:**
Explain why 0 is neither prime nor composite.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Explain why 1 is neither prime nor composite.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Course 1  Basic Number Ideas

Module:  Exponential Form—Exponents

Objective:  To practice writing products in exponential form

Name:  ________________________  Date:  ________________

Label the exponent and the base.

Write $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$ in exponential form.  ________________

Problem Set:
Write the following expressions in exponential form in the first column. You’ll use the second column later.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>$8 \cdot 8 \cdot 8$</td>
</tr>
<tr>
<td>2.</td>
<td>$1 \cdot 1 \cdot 1 \cdot 1 \cdot 1$</td>
</tr>
<tr>
<td>3.</td>
<td>$10 \cdot 10 \cdot 10 \cdot 10 \cdot 10$</td>
</tr>
<tr>
<td>4.</td>
<td>$2 \cdot 2 \cdot 2 \cdot 2$</td>
</tr>
<tr>
<td>5.</td>
<td>$5 \cdot 5$</td>
</tr>
<tr>
<td>6.</td>
<td>$11 \cdot 11 \cdot 11 \cdot 11 \cdot 11 \cdot 11$</td>
</tr>
<tr>
<td>7.</td>
<td>$4 \cdot 4 \cdot 4$</td>
</tr>
</tbody>
</table>

Extension Activity

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Course 1

Basic Number Ideas

8. \(7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7\) _______________ _______________

9. \(13 \cdot 13 \cdot 13 \cdot 13\) _______________ _______________

10. \(9 \cdot 9 \cdot 9 \cdot 9 \cdot 9\) _______________ _______________

11. \(17 \cdot 17\) _______________ _______________

12. \(6 \cdot 6 \cdot 6 \cdot 6\) _______________ _______________

13. \(15 \cdot 15 \cdot 15\) _______________ _______________

14. \(3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3\) _______________ _______________

15. \(12 \cdot 12 \cdot 12 \cdot 12 \cdot 12\) _______________ _______________

Extension Activity:
Using a calculator, find the product for each of the expressions above. Write the answer in the Extension Activity column.

Ex. \(9 \cdot 9 \cdot 9 \cdot 9 = 6,561\)

Ex. \(3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 243\)

Reflection:
When the exponent is 1, why is it unnecessary to write it?

________________________________________________________________
________________________________________________________________

Why would you use an exponent?

________________________________________________________________
________________________________________________________________
Module: Expanded Form—Exponents

Objective: To practice writing an expanded product given the exponential form

Name: _______________________ Date: __________________

- Exponential form consists of a ____________ and an ____________.
- To change an expression from exponential form to expanded form, look at the _______________. (It tells you how many times the base appears in the product.)
- Write $2^3$ in expanded form. _____ • _____ • _____
- Write $4^2 \cdot 3^3$ in expanded form. _____ • _____ • _____ • _____ • _____

Problem Set:

Write the following expressions in expanded form in the first column. You’ll use the second column later.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>$4^5$</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>$1^8$</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>$10^5$</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>$6^4$</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>$3^3$</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>$2^4 \cdot 3^2$</td>
<td></td>
</tr>
</tbody>
</table>

 Extension Activity

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Course 1

Basic Number Ideas

7. \(5^2 \cdot 7\)  

8. \(7^3 \cdot 2 \cdot 4^2\)  

9. \(13^1\)  

10. \(7^4\)  

11. \(4 \cdot 3^2\)  

12. \(5^2 \cdot 1^3\)  

13. \(3^4 \cdot 9^2\)  

14. \(10^2 \cdot 2^2 \cdot 6\)  

15. \(3^3\)  

Extension Activity:
Using a calculator or paper and pencil, find the product of the expressions above. Write the answer in the Extension Activity column.

Reflection:
When the base is 1, why is the product always the same regardless of the exponent?

________________________________________________________________
________________________________________________________________

6^2 \cdot 8^1 \cdot 2^3 can be written 6^2 \cdot 8 \cdot 2^3. Why can the exponent 1 be removed?

________________________________________________________________
________________________________________________________________
Module: Product Rule—Exponents

Objective: To practice writing exponential products in simplest form

Name: _________________________ Date: ________________

- When multiplying or dividing two numbers written in exponential form, you can simplify the expression if the bases are the _____________.
- If the bases are not the same, the expression ____________ be simplified to an exponential form.
- You can simplify $4^2 \cdot 4^3$ in two ways:
  1. Write $4^2 \cdot 4^3$ in expanded form _____ • _____ • _____ • _____ • _____.
     Then, count how many times the base appears in expanded form. The base appears _________ times in the expanded form, so the exponential form is _________.
  2. Use the rule for multiplying two numbers with the same base.
     $4^2 \cdot 4^3 = 4^{2+3} = _________$

Problem Set:
To simplify the expression, first write it in expanded form. Using the expanded form, then write the exponential form in the next column.

<table>
<thead>
<tr>
<th>Expanded Form</th>
<th>Exponential Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $4^2 \cdot 4^3$</td>
<td>___________________</td>
</tr>
<tr>
<td>2. $3^2 \cdot 3^2$</td>
<td>___________________</td>
</tr>
<tr>
<td>3. $10^3 \cdot 10^4$</td>
<td>___________________</td>
</tr>
</tbody>
</table>
4. $5^4 \cdot 5^2$ _________________________  _______________

5. $2^6 \cdot 2^3$ _________________________  _______________

6. $7^3 \cdot 7^2$ _________________________  _______________

7. $9^2 \cdot 9^6$ _________________________  _______________

8. $6^2 \cdot 6^4$ _________________________  _______________

To simplify the expression, use the rule for multiplying or dividing numbers with the same base.

9. $2^4 \cdot 2^2$ _______________  

10. $\frac{6^4}{6^2}$ _______________  

11. $3^3 \cdot 3^2$ _______________  

12. $\frac{9^7}{9^2}$ _______________  

13. $7^2 \cdot 7^1$ _______________  

14. $\frac{8^8}{8^3}$ _______________  

15. $4^2 \cdot 4^8$ _______________  

16. $7^6 \cdot 7^3$ _______________  

17. $\frac{4^3}{4^2}$ _______________  

18. $8^2 \cdot 8^6$ _______________  

19. $\frac{5^8}{5^6}$ _______________  

20. $7^6 \cdot 7^3$ _______________  

21. $\frac{4^6}{4^2}$ _______________  

22. $6^3 \cdot 6$ _______________

Reflection:
Explain what method you use for simplifying expressions with the same base.

________________________________________________________________
________________________________________________________________
Module: Power Rule: Exponents

Objective: To practice the power rule of exponents

Name: ______________________ Date: ________________

➢ Using expanded form, write \((4^2)^3\) in simplified form.

\[ _____ \cdot _____ \cdot _____ = _____ . \]

➢ Simplify complicated expressions by using the ______________

______________ of exponents.

➢ The power rule of exponents states: To simplify an expression such as

\((4^2)^3\), _______________ the exponents. \(4^2 \cdot 3 = 4^6\)

➢ Write \((3^4)^2\) in simplified form using the power rule. \(3^{—— \cdot —} = 3^{——}\)

Problem Set:
Using the power rule, simplify the expressions.

1. \((3^5)^2\) ______________

2. \((8^4)^3 \cdot (6^3)^6\) ______________

3. \((2^2)^3\) ______________

4. \((5^5)^3 \cdot (9^6)^2\) ______________

5. \((8^4)^3\) ______________

6. \((4^8)^2 \cdot (3^4)^2 \cdot (7^5)^3\) ______________

7. \((9^2)^6\) ______________

8. \((6^2)^4\) ______________

9. \((7^4)^3\) ______________

10. \((5^6)^3 \cdot (2^2)^4 \cdot (9^7)^2\) ______________

11. \((4^4)^1\) ______________

12. \((2^3)^4 \cdot (3^7)^2\) ______________

13. \((3^2)^2\) ______________

14. \((2^4)^3 \cdot (4^3)^1 \cdot (6^6)^2\) ______________

15. \((7^1)^3\) ______________

16. \((5^2)^3 \cdot (3^3)^2 \cdot (7^2)^4\) ______________

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Course 1

17. \((5^4)^2\) ____________
18. \((6^2)^9 \cdot (9^2)^2\) ____________
19. \((2^3)^4\) ____________
20. \((2^3)^4 \cdot (5^2)^2 \cdot (3^6)^3\) ____________
21. \((8^5)^4\) ____________
22. \((7^3)^2 \cdot (6^2)^1\) ____________

Extension Activity:
Let’s try out some word art to demonstrate the power rule. Create your math art on a separate piece of paper. Use color or decorate with a theme. Be creative!

Ex. \((2^3)^2\) could be represented like this.

\[
(2^3)^2 = 2^6
\]

Reflection:
The power rule is a shortcut. What is it a shortcut for? Use the expression \((8^3)^3\) in your explanation.

________________________________________________________________
________________________________________________________________
Module: The Additive Inverse of Integers

Objective: To investigate positive and negative integers and define the additive inverse, or opposite, of a number

Name: _____________________ Date: __________________

- _______________ is called the point of origin. It is neither positive nor negative.
- Negative integers are _______________ than 0.
- _______________ _______________ are greater than 0.
- Numbers that are the same distance from 0 but in opposite directions are called _______________ _______________.
- List 5 positive integers. ______, ______, ______, ______, ______.
- List 5 negative integers. ______, ______, ______, ______, ______.

Problem Set:

Write the additive inverse of the given numbers.

1. 5 _______________ 2. 4 _______________
3. -6 _______________ 4. -14 _______________
5. -7 _______________ 6. 3 _______________
7. 9 _______________ 8. 17 _______________
9. -10 _______________ 10. -12 _______________
Extension Activity:
Write a word problem using the additive inverse of integers.

Ex. An incredible storm swept through the city today. At 11:00 in the morning, the temperature was 40°. By noon the storm had arrived and the temperature dropped 10°. As the storm cleared the temperature rose 10°

What is the current temperature? \[40 + (-10) + 10 = 40°\]

Reflection:
How do you use negative and positive integers in your life?
Objective: To practice adding positive and negative integers

Name: _________________________    Date: _________________

- The sum of two ____________ integers is positive.
- The sum of two negative integers is ____________.
- The sum of a negative integer and a positive integer can be either ____________ or ____________.

Problem Set:

Find the sum.
1. 3 + (-2) ____________
2. 2 + (-5) ____________
3. 8 + 6 ____________
4. -6 + 8 ____________
5. -2 + 7 ____________
6. -10 + (-4) ____________
7. -9 + (-4) ____________
8. 3 + (-1) ____________
9. 3 + 10 ____________
10. -1 + 2 ____________
11. -9 + 3 ____________
12. 2 + 0 ____________
13. 4 + (-6) ____________
14. -8 + 6 ____________
15. -5 + (-5) ____________
16. 4 + (-5) ____________
17. -7 + (-6) ____________
18. -12 + (-1) ____________
19. 3 + 7 ____________
20. 3 + 9 ____________
21. -2 + (-3) ____________
22. 8 + (-4) ____________
Course 1

Basic Number Ideas

23. $9 + (-2)$ _______________  

24. $5 + 2$ _______________

25. $6 + 7$ _______________  

26. $-5 + 8$ _______________

27. $9 + 0$ _______________  

28. $-1 + (-6)$ _______________

29. $-3 + 5$ _______________  

30. $-8 + 4$ _______________

31. $7 + (-1)$ _______________  

32. $-5 + (-3)$ _______________

Extension Activity:
Grab a partner and some dice to begin this game.

1. Each person begins with a die and rolls it. The person with the higher number will go first.

2. Person A rolls the die. This will be a positive integer. Then, Person B rolls the die. This will be a negative integer.

3. Person A uses the two integers to create an equation using addition. Ex. Person A rolls a 4. This will be a positive integer. Person B rolls a 2, which will be negative. Person A writes the following equation: $4 + (-2) = 2$ (If you choose to keep score, Person A would get 2 points.)

4. Now, it is Person B’s turn. Person B will roll the die. This will be a positive integer. Then, Person A rolls the die. This will be a negative integer.

5. Person B creates an equation adding the two integers. Ex. Person B rolls a 2, which will be positive, and Person A rolls a 3, which will be negative. Person B writes the following equation $2 + (-3) = -1$ (If you choose to keep score, Person B would get 1 point.)

If you choose to keep score, keep playing until one person reaches 20 points.

Reflection:
In this tutorial you saw addition examples using both the number line and marbles. Which method do you find most helpful? Explain.

________________________________________________________________
________________________________________________________________
Module: Subtracting Integers

Objective: To practice subtracting positive and negative integers

Name: ______________________ Date: ________________

➢ ___________ is used to find an integer that represents a total amount.
➢ ___________ is used to find the difference, or change, between two integers.
➢ To subtract an integer, ______________ its opposite.

Problem Set:

Find the difference. It is often helpful when subtracting an integer to add its opposite.

1. 10 – 5
2. 1 – 4
3. 2 – 4
4. -8 – (-6)
5. 6 – (-8)
6. 2 – (-1)
7. -4 – (-1)
8. 9 – 3
9. 9 – 7
10. -4 – (-2)
11. 3 – 10
12. 6 – 10
Reflection:
In mathematics, addition and subtraction are opposites. They are inverse operations. Explain how you use this fact when subtracting positive and negative numbers. In your explanation, use the following expressions:

\[ 4 \ - \ (-2) \]
\[ 4 \ + \ 2 \]

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Module: Multiplying Integers

Objective: To practice multiplying positive and negative integers

Name: ___________________________ Date: __________________

- The product of two positive numbers is a _______________ number.
- The product of two negative numbers is a _______________ number.
- The product of a positive number and a negative number is a _______________ number.

Problem Set:
Find the product.

1. 2 • 6 _______________ 2. -1 • 9 _______________
3. -9 • 5 _______________ 4. -7 • (-1) _______________
5. 3 • (-6) _______________ 6. -4 • 8 _______________
7. -3 • (-10) _______________ 8. 2 • (-7) _______________
9. -4 • (-9) _______________ 10. 8 • 3 _______________
11. 4 • 7 _______________ 12. -1 • (-7) _______________
13. -4 • 4 _______________ 14. 4 • 6 _______________
15. 9 • (-2) _______________ 16. 1 • (-3) _______________
17. 10 • (-10) _______________ 18. -8 • (-8) _______________
19. 4 • 8 _______________ 20. -1 • 1 _______________
21. 11 • (-11) _______________ 22. -4 • (-2) _______________
23. 2 • 9 _______________ 24. -6 • 6 _______________
25. 5 • (-6) _______________ 26. -2 • (-1) _______________
Course 1 Basic Number Ideas

27. \(-1 \cdot 10\) ___________  28. \(3 \cdot 4\) ___________
29. \(7 \cdot (-9)\) ___________  30. \(-4 \cdot (-6)\) ___________
31. \(0 \cdot 5\) ___________  32. \(-4 \cdot 9\) ___________

Reflection:
When you multiply two numbers with like signs the answer is always ___________. Give two examples.
________________________________________________________________
________________________________________________________________

When you multiply two numbers with unlike signs the answer is always ___________. Give two examples.
________________________________________________________________
________________________________________________________________
Course 1  Basic Number Ideas

Module:  Dividing Integers

Objective:  To practice dividing positive and negative integers

Name: ______________________  Date: __________________

- The quotient or product of two positive numbers is a ______________ number.
- The product or quotient of two negative numbers is a ______________ number.
- The quotient or product of a positive number and a negative number is a ______________ number.

Problem Set:
Find the quotient.

1. \[
\frac{6}{6} = \_
\]
2. \[
\frac{18}{6} = \_
\]
3. \[
\frac{-24}{-6} = \_
\]
4. \[
\frac{-48}{6} = \_
\]
5. \[
\frac{-14}{7} = \_
\]
6. \[
\frac{5}{-5} = \_
\]
7. \[
\frac{25}{-5} = \_
\]
8. \[
\frac{-32}{-8} = \_
\]
9. \[
\frac{-9}{-3} = \_
\]
10. \[
\frac{64}{-8} = \_
\]
11. \[
\frac{36}{6} = \_
\]
12. \[
\frac{-8}{4} = \_
\]
13. \[
\frac{56}{-7} = \_
\]
14. \[
\frac{-42}{-6} = \_
\]
Course 1

Basic Number Ideas

15. \[ \frac{-6}{2} \]  \hspace{1cm} 16. \[ \frac{-20}{10} \]

17. \[ \frac{10}{-5} \]  \hspace{1cm} 18. \[ \frac{28}{-4} \]

19. \[ \frac{-10}{2} \]  \hspace{1cm} 20. \[ \frac{-40}{-8} \]

21. \[ \frac{15}{-5} \]  \hspace{1cm} 22. \[ \frac{-18}{2} \]

23. \[ \frac{20}{10} \]  \hspace{1cm} 24. \[ \frac{16}{2} \]

25. \[ \frac{-48}{-6} \]  \hspace{1cm} 26. \[ \frac{72}{-9} \]

27. \[ \frac{18}{-9} \]  \hspace{1cm} 28. \[ \frac{0}{8} \]

29. \[ \frac{-81}{-9} \]  \hspace{1cm} 30. \[ \frac{-64}{-8} \]

31. \[ \frac{20}{-5} \]  \hspace{1cm} 32. \[ \frac{-4}{2} \]

Reflection:
How are the rules of signs for multiplication and division related?

________________________________________________________________
________________________________________________________________
________________________________________________________________
Module: Square Roots of Perfect Squares

Objective: To practice finding square roots of perfect squares

Name: ___________________________ Date: ____________________

- When a number is multiplied by itself, we call the product a _______________
- A _______________ _______________ is the number that produces squares.
- Every positive number has two square roots — one _______________ and one _______________ number.
- 0 has only one square root: _______________.

Problem Set: Find the product.

1. $2^2$ _______________ 2. $3^2$ _______________
3. $6^2$ _______________ 4. $4^2$ _______________
5. $7^2$ _______________ 6. $8^2$ _______________
7. $10^2$ _______________ 8. $5^2$ _______________
9. $9^2$ _______________ 10. $12^2$ _______________
11. $11^2$ _______________ 12. $1^2$ _______________
Course 1

Basic Number Ideas

Find the two square roots of each number.

13. 16 _______________ 14. 36 _______________
15. 25 _______________ 16. 9 _______________
17. 100 _______________ 18. 49 _______________
19. 64 _______________ 20. 4 _______________
21. 1 _______________ 22. 81 _______________

Find the square root.

23. $\sqrt{100}$ _______________ 24. $\sqrt{36}$ _______________
25. $\sqrt{64}$ _______________ 26. $\sqrt{25}$ _______________
27. $\sqrt{81}$ _______________ 28. $\sqrt{49}$ _______________
29. $\sqrt{1}$ _______________ 30. $\sqrt{16}$ _______________
31. $\sqrt{9}$ _______________ 32. $\sqrt{1}$ _______________

Reflection:
List some everyday examples of perfect squares. Think of things that can be found in your home or school.

________________________________________________________________
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________________________________________________________________

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Module: Square Roots of Imperfect Squares

Objective: To practice estimating square roots of imperfect squares

Name: __________________    Date: ________________

- Squares of integers are called ______________ ______________.
- The square of an integer is also an ______________. However, the square root of an integer is not always an integer.
- If an integer is not a perfect square, then its square root is between two ______________ ______________.

Problem Set:
Estimate the square root. Write the two consecutive integers that the square root falls between. (Remember: First, think of the greatest perfect square that is less than the number. Next, think of the smallest perfect square that is more than the number.)

1. \(\sqrt{14} \) < _______ < _______
2. \(\sqrt{38} \) < _______ < _______
3. \(\sqrt{57} \) < _______ < _______
4. \(\sqrt{94} \) < _______ < _______
5. \(\sqrt{29} \) < _______ < _______
6. \(\sqrt{3} \) < _______ < _______
7. \(\sqrt{73} \) < _______ < _______
8. \(\sqrt{34} \) < _______ < _______
Course 1

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9. ☐ <√33 < ☐ __________     __________
10. ☐ <√26 < ☐ __________     __________
11. ☐ <√85 < ☐ __________     __________
12. ☐ <√52 < ☐ __________     __________
13. ☐ <√30 < ☐ __________     __________
14. ☐ <√6 < ☐ __________     __________
15. ☐ <√13 < ☐ __________     __________
16. ☐ <√27 < ☐ __________     __________
17. ☐ <√67 < ☐ __________     __________
18. ☐ <√99 < ☐ __________     __________
19. ☐ <√75 < ☐ __________     __________
20. ☐ <√5 < ☐ __________     __________
21. ☐ <√55 < ☐ __________     __________
22. ☐ <√39 < ☐ __________     __________

Reflection: Why do you think it would be helpful to estimate a square root?

________________________________________________________________
________________________________________________________________
________________________________________________________________
Module: Multiplying Common Fractions

Objective: To investigate common fractions and how to multiply them

Name: _____________________  Date: __________________

- Label the denominator and the numerator.

\[
\begin{array}{c}
\text{\underline{\quad}}} \\
3 \\
\text{\underline{\quad}}} \\
5 \\
\end{array}
\]

- The product of two fractions is the product of the ______ over the ______ of the denominators.

- A fraction can be _______ if there is an integer that is a factor of both its numerator and its denominator.

Problem Set:
Find the product. Simplify your answer.

1. \[\frac{2}{3} \cdot \frac{1}{4} \]
2. \[\frac{2}{7} \cdot \frac{5}{6} \]
3. \[\frac{3}{5} \cdot \frac{2}{3} \]
4. \[\frac{3}{6} \cdot \frac{2}{8} \]
5. \[\frac{6}{7} \cdot \frac{4}{5} \]
6. \[\frac{4}{7} \cdot \frac{8}{9} \]
7. \[\frac{6}{8} \cdot \frac{3}{9} \]
8. \[\frac{2}{4} \cdot \frac{3}{5} \]
9. \[\frac{8}{9} \cdot \frac{2}{5} \]
10. \[\frac{2}{4} \cdot \frac{2}{6} \]
11. \[\frac{6}{8} \cdot \frac{3}{5} \]
12. \[\frac{2}{8} \cdot \frac{1}{4} \]
13. \[\frac{3}{8} \cdot \frac{2}{5} \]
14. \[\frac{4}{8} \cdot \frac{2}{4} \]
15. \( \frac{3}{9} \cdot \frac{1}{7} \)  
16. \( \frac{5}{9} \cdot \frac{3}{5} \)  
17. \( \frac{2}{6} \cdot \frac{3}{9} \)  
18. \( \frac{1}{5} \cdot \frac{5}{6} \)  
19. \( \frac{7}{8} \cdot \frac{1}{7} \)  
20. \( \frac{8}{9} \cdot \frac{3}{4} \)  

Extension Activity:
Draw a picture to represent the fraction. Write a related question.

Ex. \( \frac{2}{4} \)

3 \( \frac{3}{5} \)

4 \( \frac{4}{7} \)

How many pieces of fruit in the bowl are bunches of grapes?

3 \( \frac{3}{8} \)

2 \( \frac{2}{5} \)

3 \( \frac{3}{7} \)

Reflection:
Explain the importance of simplifying your answer.
Module: Adding and Subtracting Fractions

Objective: To practice adding and subtracting fractions

Name: ______________________  Date: __________________

➢ To add or subtract fractions with **like** denominators, add or subtract the ________________.

➢ To add or subtract fractions with **unlike** denominators, find a ________________ _______________. Then, convert the fractions to the same denominator. Add or subtract the numerators.

➢ Always write your answer in ________________ terms.

**Problem Set:**
Add or subtract. Simplify your answer.

1. \( \frac{2}{4} + \frac{1}{4} \) ________________  2. \( \frac{3}{5} + \frac{1}{5} \) ________________

3. \( \frac{4}{6} - \frac{2}{6} \) ________________  4. \( \frac{8}{9} - \frac{2}{9} \) ________________

5. \( \frac{1}{7} + \frac{2}{3} \) ________________  6. \( \frac{2}{3} - \frac{2}{9} \) ________________

7. \( \frac{1}{4} + \frac{2}{6} \) ________________  8. \( \frac{3}{4} + \frac{1}{5} \) ________________

9. \( \frac{8}{9} - \frac{2}{5} \) ________________  10. \( \frac{5}{6} - \frac{2}{9} \) ________________

11. \( \frac{2}{5} + \frac{1}{3} \) ________________  12. \( \frac{2}{8} - \frac{1}{7} \) ________________

13. \( \frac{3}{4} - \frac{6}{8} \) ________________  14. \( \frac{2}{6} + \frac{3}{9} \) ________________

15. \( \frac{2}{4} + \frac{1}{8} \) ________________  16. \( \frac{3}{6} + \frac{2}{9} \) ________________
## Course 1  

### Basic Number Ideas

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<td>$\frac{5}{8} + \frac{6}{7}$</td>
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<td>$\frac{6}{9} - \frac{2}{3}$</td>
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<td>$\frac{11}{8} + \frac{1}{2}$</td>
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<td>$\frac{5}{7} - \frac{1}{2}$</td>
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<td>$\frac{5}{7} + \frac{8}{9}$</td>
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<td>26.</td>
<td>$\frac{4}{8} + \frac{1}{6}$</td>
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<td>$\frac{5}{6} - \frac{5}{9}$</td>
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<td>27.</td>
<td>$\frac{1}{4} + \frac{2}{5}$</td>
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<td>$\frac{5}{6} + \frac{1}{5}$</td>
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### Reflection:

\[
\begin{align*}
\frac{12}{12} &= 1 & \frac{18}{18} &= 1 & \frac{24}{24} &= 1 & \frac{32}{32} &= 1
\end{align*}
\]

How does this fact help you when you’re working with fractions?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Module: Adding and Subtracting Mixed Numbers

Objective: To practice adding and subtracting mixed numbers

Name: _______________________ Date: __________________

➢ Mixed numbers are numbers that have two parts: a ________________ ________________ and a ________________.

➢ To add mixed numbers, follow these steps:
1. Add the ________________ numbers.
2. Write the fractions so they have a ________________ ________________.
3. ________________ the fractions.

➢ To subtract mixed numbers, follow these steps:
1. Subtract the ________________ numbers.
2. Write the fractions so they have a ________________ ________________.
   If the fraction to be subtracted is the larger of the two, rewrite the smaller fraction.
3. ________________ the fractions.

Problem Set:
Add or subtract. Simplify your answer.

1. \(7 \frac{2}{3} - 3 \frac{4}{6}\) ________________
2. \(3 \frac{3}{5} + 7 \frac{1}{3}\) ________________
3. \(3 \frac{1}{2} + 5 \frac{2}{3}\) ________________
4. \(1 \frac{2}{3} - 1 \frac{1}{2}\) ________________
Course 1

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5. \[5 \frac{1}{4} - 2 \frac{1}{8}\]  
6. \[\frac{3}{4} + 2 \frac{3}{6}\]

7. \[7 \frac{5}{6} + 1 \frac{2}{3}\]  
8. \[\frac{5}{4} - 1 \frac{1}{6}\]

9. \[6 \frac{3}{6} - 4 \frac{1}{3}\]  
10. \[\frac{2}{5} - 2 \frac{1}{4}\]

11. \[\frac{5}{6} + 6 \frac{2}{3}\]  
12. \[3 \frac{2}{5} - 3 \frac{2}{5}\]

13. \[4 \frac{3}{4} - 3 \frac{2}{6}\]  
14. \[\frac{4}{7} + 2 \frac{3}{8}\]

15. \[\frac{2}{3} - 3 \frac{4}{7}\]  
16. \[\frac{8}{9} + 2 \frac{2}{3}\]

17. \[5 \frac{2}{5} + 3 \frac{1}{3}\]  
18. \[9 \frac{3}{5} - 3 \frac{2}{6}\]

19. \[1 \frac{3}{4} + 6 \frac{1}{3}\]  
20. \[9 \frac{4}{8} - 7 \frac{1}{2}\]

Extension Activity:
Have a friend tell you a number between 2 and 10. Try to recite as many multiples of that number in order as you can. Then choose a number for your friend to try.

Ex. If your friend says the number 4, you would respond with 4, 8, 12, 16, 20, 24.

Why do you think knowing the multiples of different numbers will be helpful for adding and subtracting fractions?

________________________________________________________________
________________________________________________________________
Module: Dividing Fractions

Objective: To practice dividing fractions

Name: ______________________ Date: ______________

1. Label the divisor and the dividend.

\[
\frac{3}{4} \div \frac{1}{2}
\]

\[
\frac{3}{4} \quad \frac{1}{2}
\]

2. To solve a division problem involving fractions, _______________ the divisor and _______________.

Problem Set: Find the quotient. Simplify your answer. Write it as a mixed number if necessary.

1. \[
\frac{2}{4} \div \frac{6}{8}
\]

2. \[
\frac{7}{8} \div \frac{1}{2}
\]

3. \[
\frac{1}{3} \div \frac{4}{6}
\]

4. \[
\frac{3}{5} \div \frac{6}{8}
\]

5. \[
\frac{2}{9} \div \frac{1}{3}
\]

6. \[
\frac{1}{2} \div \frac{2}{3}
\]
Reflection:
Explain why it is possible to invert the divisor and multiply.

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
To multiply or divide mixed numbers, follow these steps.

1. Rewrite the mixed numbers as \( \frac{(\text{whole number} \times \text{denominator}) + \text{numerator}}{\text{denominator}} \).

2. Simplify, then multiply or divide as usual.

Problem Set:

Find the product or quotient. Simplify your answer.

1. \( \frac{2}{3} \times \frac{5}{6} \)

2. \( \frac{1}{3} \div \frac{1}{6} \)

3. \( \frac{1}{5} \div \frac{2}{5} \)

4. \( \frac{3}{5} \times \frac{4}{6} \)

5. \( \frac{2}{4} \times \frac{3}{3} \)

6. \( \frac{2}{5} \div \frac{3}{5} \)

7. \( \frac{1}{5} \times \frac{2}{6} \)

8. \( \frac{3}{6} \times \frac{2}{3} \)

9. \( \frac{5}{6} \div \frac{3}{4} \)

10. \( \frac{7}{9} \div \frac{3}{3} \)
Course 1

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11. \( \frac{9}{6} \div \frac{3}{4} \)

12. \( \frac{1}{6} \cdot \frac{2}{3} \)

13. \( \frac{6}{9} \div \frac{7}{3} \)

14. \( \frac{2}{6} \div \frac{5}{3} \)

15. \( \frac{8}{3} \cdot \frac{1}{5} \)

16. \( \frac{4}{6} \cdot \frac{3}{4} \)

17. \( \frac{3}{6} \div \frac{5}{8} \)

18. \( \frac{3}{8} \cdot \frac{3}{5} \)

19. \( \frac{1}{9} \div \frac{2}{8} \)

20. \( \frac{3}{8} \cdot \frac{4}{7} \)

21. \( \frac{6}{8} \cdot \frac{3}{6} \)

22. \( \frac{3}{6} \cdot \frac{1}{3} \)

23. \( \frac{2}{6} \div \frac{4}{8} \)

24. \( \frac{2}{5} \div \frac{5}{3} \)

Reflection:

Why do you think it is helpful to convert mixed numbers into fractions before multiplying or dividing?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Why is it beneficial to simplify before multiplying or dividing?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
There are five basic steps to solving practical problems.

1. _______________ the problem carefully.

2. Analyze the problem and set up a _______________.

3. Estimate the _______________.

4. Set up strategy sentences. Use them to set up and solve the math sentences.

5. Make sure you have answered the right _______________. Then _______________ your work.

Problem Set:

1. List three key words that are associated with the following mathematical operations:

<table>
<thead>
<tr>
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<th>Multiplication</th>
<th>Division</th>
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2. List three approaches to setting up a strategy.

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

3. Why is it beneficial to estimate the answer?

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

4. List three things you can do to check your answer.

________________________________________________________________
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________________________________________________________________

Reflection:

Is there only one way to solve practical problems? Explain.

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
Course 1  Basic Number Ideas

Module: Mental Math with Whole Numbers and Decimals

Objective: To practice adding, subtracting, multiplying, and dividing whole numbers and decimals in your head

Name: _____________________  Date: ________________

➢ _______________ math strategies help you add, subtract, multiply, or divide a group of numbers when you don’t have a calculator or pencil handy.

➢ Mental Math Strategies

1. Look for shortcuts.

2. Cancel or add _______________.

3. Add or subtract _______________ to right.

4. Break down the problem into _______________ ones.

5. Round any of the numbers and make up the _______________ later.

Problem Set:

Use mental math to solve these problems.

1. \[ \frac{75,000}{5,000} \quad \text{________} \]

2. \[ \frac{450,000}{3,000} \quad \text{________} \]

3. \[ 32,000 \times 200 \quad \text{________} \]

4. \[ 270,000 \times 1000 \quad \text{________} \]

5. \[ 632 + 57 \quad \text{________} \]

6. \[ 40 + 344 \quad \text{________} \]
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7. 40 + 344  
8. 62 – 31  

9. 72 • 3  
10. 37 • 5  

11. \[
\frac{72}{6} 
\]  
12. \[
\frac{96}{8} 
\]  

13. 28 + 42 + 68 + 72  
14. 49 + 51 + 61 + 20  

15. 98 + 157 + 3 – 57  
16. 99 + 72 + 1 – 19  

17. \[
\frac{6030}{30} 
\]  
18. \[
\frac{4,860}{60} 
\]  

19. 600 • 40  
20. 8,000 • 500  

Reflection:
Think about the strategies that were discussed in this tutorial. Which were helpful to you? Which were not very easy for you to use? Explain your answer.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Why is it important to be able to do math mentally?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Module: Mental Math with Fractions and Percents

Objective: To investigate how to mentally add, subtract, multiply, and divide two fractions, and find the percentage of a whole number when the percent ends in 0 or 5

Name: _______________________ Date: _________________

➢ Mental math depends on ________________.

➢ Adding and subtracting fractions:
  1. Fractions must have the same _______________ before you can add or subtract them.
  2. Once the denominators are equal, just add or subtract the ________________.
  3. A mixed number is the same as the ________________ plus the fraction.

➢ To divide fractions: turn the division problem into a _______________ problem by flipping the ________________.

➢ To multiply fractions: ________________ fractions first, if it’s helpful. ________________ the numerators together and the denominators together.

Problem Set:
1. List three ways to find an easy common denominator to work with.

_________________________________________________________
_________________________________________________________
_________________________________________________________
Write the lowest common denominator.

2. \( \frac{3}{4} + \frac{1}{8} \)  
3. \( \frac{1}{3} + \frac{4}{5} \)

4. \( \frac{2}{3} + \frac{1}{4} \)  
5. \( \frac{2}{3} + \frac{5}{6} \)

6. \( \frac{4}{16} + \frac{3}{4} \)  
7. \( \frac{6}{9} + \frac{1}{3} \)

8. \( \frac{2}{3} + \frac{7}{9} \)  
9. \( \frac{1}{2} + \frac{3}{8} \)

10. List several strategies for using mental math to find percents.

11. What is 10% of 64.20? ____  
12. What is 15% of 30? ____

13. What is 20% of 50? ____  
14. What is 25% of 48? ____

15. What is 50% of 82.8? ____  
16. What is 10% of 74.60? ____

Reflection:
Some problems can be too hard to do as mental math. Give an example of a problem that would be too hard and explain why.

________________________________________________________________
________________________________________________________________

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Module: Order of Operations

Objective: To practice using the order of operations to simplify expressions

Name: _______________________  Date: __________________

➢ According to the _______ of ______________, which phrase describes

  \[3 \cdot 4 + 5?\]  □ "5 more than 3 times 4" or □ "3 times the sum of 4 and 5"

➢ Fill in the operation that begins with each letter.

P_________________  E_________________  M__________________

D_________________  A_________________  S__________________

➢ You perform addition and subtraction, as well as multiplication and division, from ______ to ______ so you won't mix up the operations.

➢ Name two grouping symbols. _________________, _________________

Problem Set:
Simplify the expressions.

1.  \[(3 \cdot 4)^2 \cdot 2 - 5(9 - 7)^2 + 1\]          2.  \(\frac{10}{5} \cdot 4 + (9 - 6) - 3^2\)

3.  \([(2 \cdot 3) + 4]^2 - 5\]          4.  \(\frac{3}{4} + (70 - 14) - 6^2\)
5. \[
\frac{4(7 + 5)}{4}
\]

6. \[
\frac{10 - 2}{(4 - 2)^2}
\]

Extension Activity:
1. "Please Excuse My Dear Aunt Sally" is one phrase people use to remember the order of operations. Think of your own, and share it with someone else.

P_________________     E__________________     M__________________
D_________________     A__________________     S__________________

2. Create and solve two problems that require using the order of operations.

______________________________    ______________________________
______________________________    ______________________________
______________________________    ______________________________

Reflection:
If you don't work left to right while performing a set of addition and subtraction operations, what kinds of errors might you make? How can you avoid these errors, besides working left to right?

______________________________________________________________
______________________________________________________________

What about multiplication and division? Are there any different errors that you might make? What are some different ways to avoid them?

______________________________________________________________
Module: Expressions in 1 Variable

Objective: To practice evaluating an expression with one variable

Name: _______________________  Date: __________________

➤ A _________________ can represent any number in its domain.
➤ The words "twice" and "double" indicate you will _______________ a number by something.
➤ The words "more than" and "longer" indicate you will _________________ something to a number.
➤ The phrase "a fourth of" indicates you will _________________ a number by something.
➤ The expression \( n - 4 \) represents 4 _________ _________ a number.
➤ To evaluate an expression for a certain value of a variable, first you _______________ that value, then you _______________ the expression.

Problem Set:

A. Circle the expression that describes each situation.

1. A picture frame is three times higher than it is wide. If the width is \( w \), what is the height?
   \[
   \frac{1}{3}w \quad w + 3 \quad w - 3 \quad 3w
   \]

2. A baseball team has won four more games than it has lost. It has lost \( n \) games; how many has it won?
   \[
   \frac{1}{4}n \quad n + 4 \quad n - 4 \quad 4n
   \]

3. One kind of bug has 10 more than twice as many legs as a spider. If the spider has \( x \) legs, how many does the bug have?
   \[
   \frac{1}{10}x \quad 2x + 10 \quad 2x - 10 \quad 2x
   \]
B. Evaluate the expression for the given value of the variable.

1. \(14p\), when \(p = 4\) ______
2. \(3n - 5\), when \(n = 13\) ______
3. \(\frac{h}{2} + 5\), when \(h = 12\) ______
4. \(\frac{1}{4}q - 16\), when \(q = 40\) ______
5. \(6a + 10\), when \(a = 5\) ______
6. \(b + 9\), when \(b = 0.2\) ______
7. \(14q\), when \(q = \frac{1}{2}\) ______
8. \(\frac{1}{5}p - 14\), when \(p = 100\) ______

Extension Activity:
Make up a situation that can be described in algebra with each expression.
You may look at Problem Set A for examples.

1. \(5x\) __________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

2. \(x - 10\) _________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

3. \(2x + 3\) _________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

Reflection:
In your own words, describe what a variable is and how it's different from a specific number.

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

Why do you think mathematicians use variables and represent them with letters?
__________________________________________________________________
__________________________________________________________________
When two things vary separately, you can use two different
_____________ to represent them.

Sometimes you need to follow the ___________ ____ _______________
to evaluate an expression accurately.

The expression \(n - 4o + 2p - 5q^2\) has _____ different variables.

Say you are evaluating this expression: \(3x + 2y\), when \(x = 5, y = 10\).

What is your first step? ______________________________________

What step comes next? ______________________________________

What will be the last step? ____________________________________

If you have exponents in an expression, do you simplify them before or
after doing what is in parentheses? _________

Do you simplify exponents before or after multiplication and division?
_________

Problem Set:
Evaluate the expression for the given values of the variables.

1. When \(a = 4, b = -3, c = -1, d = 6\)
   \[a + b - c + d\]

2. When \(x = 5, y = 2, z = 10\)
   \[x(y + 2z)\]
3. When \( w = 3, \ l = 5 \)
\[ 2(w + 4) + 4(l + 5)^2 \]

4. When \( a = 5, \ b = 4, \ c = 3 \)
\[ 4a - 3b + 2c \]

5. \( a = 2, \ b = 3 \)
\[ (a + 5)^2 + 25b^2 \]

6. \( x = 3, \ y = 4, \ z = 6 \)
\[ 5(x + y) - 4z \]

7. \( x = 3, \ y = 14 \)
\[ \frac{x + 5}{y - 10} \]

8. \( p = -2, \ q = 2 \)
\[ \frac{10[2(p + 5)]^2 + 25}{3 + q} \]

**Extension Activity:**
The order of operations gives the correct order in which to perform mathematical operations. But what happens when you have a lot of different kinds of grouping symbols, as with the problem below? Describe or demonstrate the steps you would take to move between grouping symbols while following the order of operations. (You need not work the problem out to a final answer.)

When \( x = 2, \ y = 3 \)
\[ \frac{4[(5 + 3x)^2 + 2] + 13^3}{5x + y} \]
Module: Determining the Truth Value of a Statement

Objective: To practice finding values for a variable or pair of variables that will make an equation a true statement

Name: ________________________ Date: __________________

If \(20h = 40\), which value is \(h\)? (circle one)  2  5  10

The solution of an equation with two variables is an __________ ______.

An ordered pair (4,5) gives the value of __, a comma, then the value of __.

An equation with two variables may have _______________ ordered pairs as solutions. (many, only two, exactly three)

Problem Set:
A. Circle the replacement for \(x\) that will make the equation true.

1. \(2x + 15 = 95\)
   \[x = \begin{array}{c}30 \quad 40 \quad 75\end{array}\]

2. \(\frac{x}{5} - 12 = 4\)
   \[x = \begin{array}{c}50 \quad 90 \quad 80\end{array}\]

3. \(\frac{x}{30} = 9\)
   \[x = \begin{array}{c}270 \quad 300 \quad 180\end{array}\]

4. \(\frac{1}{3}x - 15 = 18\)
   \[x = \begin{array}{c}42 \quad 66 \quad 99\end{array}\]

5. \(3x + 13 = 43\)
   \[x = \begin{array}{c}5 \quad 7 \quad 10\end{array}\]

6. \(9x + 22 = 94\)
   \[x = \begin{array}{c}8 \quad 10 \quad 11\end{array}\]

7. \(4x + 5 = 41\)
   \[x = \begin{array}{c}7 \quad 8 \quad 9\end{array}\]

8. \(5x = 650\)
   \[x = \begin{array}{c}130 \quad 120 \quad 190\end{array}\]

B. Circle the ordered pair \((x,y)\) that is a solution of the equation.

1. \(2x + 3y = 40\)
   \((4,10)\) \((3,15)\) \((5,10)\)

2. \(15x + y = 50\)
   \((4,5)\) \((2,10)\) \((3,5)\)
### Math Sentences

<table>
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<tr>
<th></th>
<th>3. (\frac{1}{2}x + \frac{1}{4}y = 12)</th>
<th>4. (\frac{1}{2}x + 3y = 21)</th>
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<td></td>
<td>(8,32) (10,24) (24,12)</td>
<td>(24,3) (10,5) (8,6)</td>
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<td>5.</td>
<td>(x + 5y = 66)</td>
<td>6. (3x - 15y = 90)</td>
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<td>(0,30) (10,12) (11,11)</td>
<td>(0,30) (60,6) (45,2)</td>
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<td>7.</td>
<td>(5x = 3y)</td>
<td>8. (2x + 7y = 21)</td>
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<td></td>
<td>(0,5) (9,15) (5,3)</td>
<td>(0,3) (3,0) (10,0)</td>
</tr>
</tbody>
</table>

### Reflection:

1. If you have the equation \(3x = 15\), and no replacement for \(x\) to choose from, how could you figure out what \(x\) is? Why would that work?

2. Given the equation \(p + 33 = 50\), how could you figure out what \(p\) is if you are not given choices to try? Why would your answer work?

3. Many equations with two variables have multiple solutions. For example, the equation \(2x + 5y = 100\) has these ordered pairs as solutions: \((25,10)\) \((10,16)\) \((35,6)\). Why do you think these equations have more than one solution?

4. Find another ordered pair that is a solution for \(2x + 5y = 100\) besides the ones given above.
Course 2 Math Sentences

Module: Adding Monomials

Objective: To practice adding monomials

Name: _______________________ Date: ________________

Fill in the blanks. Use one of the words in parentheses, when given.

- A monomial is an expression that has exactly _______________ term.

Add to these examples: $3t^2$, $5a^3$, $2a^4$, $10a^2b$, __________, __________

- A _______________ is an expression that has exactly two terms.

(binomial, polynomial)

Add to these examples: $2n^3 + 4n^2$, $3xy + 11x$, __________, __________

- To add monomials, add the coefficients of _______________ terms.

- Like terms are terms that have the same _______________ raised to the same exponent. (equation, variable)

Problem Set:
Identify the expressions as monomial, binomial, or neither.

1. $3y^2 + 2$ monomial binomial neither

2. $3x^2 + 2x + 2$ monomial binomial neither

3. $5xy^2z$ monomial binomial neither

Write the numerical coefficient.

4. $-7yh$ ___________________________________________

5. $x^2y$ ___________________________________________

6. $12rst^2$ _________________________________________

7. $-6y^3$ _________________________________________
Simplify the expression.

Ex. 3y + 2y

\[(3 + 2)y = 5y\]

8. \(-9y^3 + 2y^3\) __________________

9. \(4x + 9x\) __________________

10. \(7w^4 + 9w^4\) __________________

11. \(8r + (-7r)\) __________________

12. \(-2b^6 + 2b^6\) __________________

13. \(7x^8 + 12x^8\) __________________

14. \(4w^3 + (-w^3)\) __________________

15. \(9p + 9p\) __________________

16. \(xy^2 + 3xy^2\) __________________

17. \(-2t^5 + 8t^5\) __________________

18. \(-3k + (-8k)\) __________________

19. \(7x^2 + 10x^2\) __________________

20. \(5g^6 + 9g^6\) __________________

21. \(6b^2c + (-b^2c)\) __________________

22. \(-y^3 + 7y^3\) __________________

23. \(16x + 2x\) __________________

24. \(-5w^3 + 9w^3\) __________________

25. \(4p^2 + 3p^2\) __________________

Reflection:
In this activity, you added monomials. Explain why it is only possible to add terms that have the same variable raised to the same exponent.

________________________________________________________________

________________________________________________________________

What word do you think is used to describe an expression with exactly three terms? Explain your choice.

________________________________________________________________

________________________________________________________________
Module: Subtracting Monomials

Objective: To practice subtracting monomials

Name: _________________________  Date: __________________

- Polynomials that contain only one term are called _____________.
- Expressions with two monomials can be simplified as a monomial only if they contain _____________ terms.
- _____________ _____________ are terms that have the same variable(s) raised to the same exponent(s).
- To find the difference of two monomials with the same variable raised to the same exponent, _____________ the coefficients.

Problem Set:
Simplify. If the expression can’t be simplified, write in the word simplified.

Ex. $8w - 3w = (8 - 3)w = 5w$

1. $6y - (-5y)$ ________________  2. $13x - 10x$ _____________

3. $-6r - (-2r)$ ________________  4. $18t^2 - 2t^2$ ________________

5. $-9g^2 - 4g^2$ ________________  6. $23m - 15n$ ________________

7. $-17xy - xy$ ________________  8. $-5s^3t - (-s^3t)$ ________________

9. $11u - (-7u)$ ________________  10. $16y^4 - 3y^4$ ________________
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<td>11.</td>
<td>$2x^2 - 7x^2$</td>
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<td>13.</td>
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<td>$9w - 23w$</td>
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<td>17.</td>
<td>$y - 18y$</td>
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<td>19.</td>
<td>$-7a - (-5a)$</td>
</tr>
<tr>
<td>21.</td>
<td>$bc^2 - bc$</td>
</tr>
<tr>
<td>23.</td>
<td>$22y - 4y$</td>
</tr>
<tr>
<td>25.</td>
<td>$-6t^6 - 5t^6$</td>
</tr>
</tbody>
</table>

**Reflection:**
Neither of these binomials can be written as a monomial. Explain why.

3x – 2y

________________________________________________________________________

3x^2 – 2x

________________________________________________________________________
Module: Multiplying Monomials
Objective: To practice multiplying monomials

Name: _______________________  Date: __________________

Fill in the blanks. Use one of the words in parentheses, when given.

➢ When multiplying monomials, the variables and the exponents of the variable ____________ need to be the same. (do, do not)

➢ If the variables are the same, multiply the _____________ first. Then multiply the _____________ by adding the exponents.

➢ Example 4x^2 • 3x^6 = 4 • x^2 • 3 • x^6
  = 4 • 3 • ____ • x^6
  = 12 • x^2 • —
  = ____x^8

➢ Give the product of different variables in _______________ form.

  5ab • 4cd (expanded, factored)

Problem Set:
Write the product in its simplest form.

1. 3y • 6y __________________ 2. 6c • (-7c^2) __________________

3. m • (-3n) __________________ 4. 4ab^2 • 5bc __________________

5. 2x^2y • 3xy __________________ 6. 5m • 5m __________________

7. 4a • (-5a^3) __________________ 8. 2p • (-4q) __________________

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9. \(2n \cdot 8n\) ________________ 10. \(-7xy \cdot x^2y^2\) ________________

11. \(pq \cdot (-p^2q)\) ________________ 12. \(6x \cdot (-8y)\) ________________

13. \(-3b \cdot (-c^4)\) ________________ 14. \(4x \cdot 6x\) ________________

15. \(3s \cdot (-t)\) ________________ 16. \(m^6 \cdot (-6m^2)\) ________________

17. \(-5xy \cdot x^2y^2\) ________________ 18. \(7r \cdot (-8s)\) ________________

19. \(3w \cdot 2w\) ________________ 20. \((-x) \cdot (-6x^2)\) ________________

Reflection:
Explain how finding the sum or difference of monomials is different from finding the product of monomials.

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Module: Dividing Monomials

Objective: To practice dividing monomials

Name: _______________________  Date: __________________

Fill in the blanks. Use one of the words in parentheses, when given.

- Polynomials that contain only one term are called _______________.
  (binomials, monomials)

- Monomials can be added, ________________, multiplied, or ________________ to simplify an expression.

- When we add or subtract monomials, the variable and the exponent of the variable must be ________________. (different, the same)

- When we multiply or divide monomials, the variables and the exponents ________________ need to be the same. (do, do not)

- To divide monomials, divide the coefficients and subtract the ________________ of the variable. (exponents, factors)

- Ex. \( \frac{21x^5}{3x} = \frac{21}{3} \cdot \frac{x^5}{x} \)
  
  \[ = \frac{7x^5}{3} \]
  
  \[ = 7x^4 \]

Problem Set:
Simplify the following expressions as monomials.

1. \( \frac{5n^6}{-n^4} \)

2. \( \frac{3n^2}{-n} \)
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3. \( \frac{3x^2y^3}{xy^2} \) 
4. \( \frac{-32xy^2}{8x} \)

5. \( \frac{-10xy}{5xy} \) 
6. \( \frac{12mn^2}{9mn} \)

7. \( \frac{15a^2b^3}{3ab^2} \) 
8. \( \frac{3p^2q^3}{6pq^2} \)

9. \( \frac{21bc^2}{-7c} \) 
10. \( \frac{4xy}{2x} \)

11. \( \frac{8x^3y^2z}{16xyz} \) 
12. \( \frac{c^2d^4}{cd^2} \)

13. \( \frac{24a^2b}{3ab} \) 
14. \( \frac{-x^3y}{-xy} \)

15. \( \frac{32g^4h^3}{4g^3h} \) 
16. \( \frac{3mn^2}{-mn} \)

17. \( \frac{36x^2y}{6xy} \) 
18. \( \frac{4xy}{2x} \)

19. \( \frac{56a^2b^3}{7a} \) 
20. \( \frac{18r^3s^2}{9rs^2} \)

Reflection:
Compare how you add and subtract monomials to how you multiply and divide monomials. Explain how these processes are similar and how they are different.

________________________________________________________________
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Module: Adding Binomials and Monomials

Objective: To practice adding binomials and monomials

Name: _______________________  Date: __________________

We can find the sum of a monomial and a binomial that have like terms, just as we can add two binomials that have ____________ terms. The sum is often a binomial.

To find the sum of a monomial and a binomial or two binomials, combine like terms: add the coefficients of terms that have the same variable(s) raised to the same ____________.

Example: \((4x + 5) + (2x + 9) = _____ + 2x + _____ + 9 = 6x + _____

Problem Set:
Find the simplest form of the sum.

1. \((3x + 2) + (4x + 8)\) ______________________
2. \((8x − 2y) + (9x + 2y)\) ______________________
3. \((15x + 7y) + (-4x + 8y)\) ______________________
4. \((7x + 5) + (9x − 3)\) ______________________
5. \((3x + 2) + (9x + 8)\) ______________________
6. \((4x − 15) + (10x + 7)\) ______________________
7. \((2x + 1) + (x + 1)\) ______________________
8. \((2x + 2) + (5x − 10)\) ______________________
9. \((6x + 8) + (4x + 3)\) ___________________

10. \((5x - 4) + (6x - 6)\) ___________________

11. \((8x + 9) + (7x + 2)\) ___________________

12. \((x + 1) + (3x - 1)\) ___________________

13. \((5x + 7) + (4x + 3)\) ___________________

14. \((2x - 8) + (9x + 1)\) ___________________

15. \((8x + 7y) + (7x + 6y)\) ___________________

16. \((2x + 2) + (3x + 2)\) ___________________

17. \((3x + 2) + (3x - 1)\) ___________________

18. \((8x + 1) + (7x + 1)\) ___________________

19. \((5x - 3y) + (2x + y)\) ___________________

20. \((4x + 1) + (6x - 2)\) ___________________

**Reflection:**
\[(4x + 7) + (2x + 1) = 4x + 7 + 2x + 1\]

\[= 2x + 7 + 4x + 1\]

\[= 4x + 1 + 2x + 7\]

\[= 4x + 7 + 1 + 2x\]

\[= 7 + 4x + 2x + 1\]

Regardless of how you choose to write the monomials to add them, the answer will always be \(6x + 8\). Explain why this is correct.
Fill in the blanks. Use one of the words in parentheses, when given.

➢ To ______________ a monomial, look for the like term in the binomial and carry out the subtraction.

➢ Like terms are those that have the same ______________ raised to the same exponent. (variable, equation)

➢ To subtract a binomial, you must remove the ______________ before you can combine like terms. (sign, parentheses)

➢ You can think of subtraction as ______________ the opposite. Change the signs of the terms inside the parentheses. Then remove the parentheses and combine like terms. (multiplying, adding)

➢ Example: \((3a + 5) – (6a + 1) = (3a + 5) + (-6a + -____)\)

\[= 3a + _____ + 5 + -1\]
\[= -3a + _____\]

Problem Set:
Find the simplest form of the difference.

1. \((6x – 1) – (2x + 3)\) ______________________

2. \(6x – (5x + 3y)\) ______________________

3. \((2x + 1) – (2x – 3)\) ______________________

4. \((3x + 5) – (7x + 4)\) ______________________
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5. \(2x - (8x - y)\) _________________________

6. \((2x - 5) - (4x + 4)\) _________________________

7. \((10x + 7) - (9x + 8)\) _________________________

8. \((7x - 2) - (5x - 9)\) _________________________

9. \(10x - (5x + 3y)\) _________________________

10. \(4x - (5x - 11y)\) _________________________

11. \((8x + 7) - (5x + 3)\) _________________________

12. \((2x + 10) - (7x - 6)\) _________________________

13. \((5x - 3) - (4x + 7)\) _________________________

14. \((8x + 2) - (7x + 3)\) _________________________

15. \(9x - (8x + 5y)\) _________________________

16. \((4x + 1) - (5x - 7)\) _________________________

17. \((8x + 3) - (6x + 4)\) _________________________

18. \(8x - (5x - 3y)\) _________________________

19. \(7x - (6x + 3y)\) _________________________

20. \((x - 4) - (8x + 2)\) _________________________

Reflection:
You are the teacher. Decide what the student did wrong, and explain how to fix the mistake. \((5x + 2) - (3x + 8) = 2x + 10\)
Fill in the blank. Use one of the words in parentheses, when given.

- Monomials and binomials can be added or subtracted to ______________ an expression, and they can also be multiplied. (divide, simplify)

- To multiply a monomial by a binomial, multiply the monomial by each term in the binomial.

  Example: \(6x \cdot (x + 2) = (6x \cdot x) + (6x \cdot 2)\)
  
  \[= 6x^2 + 12x\]

- To multiply two binomials, ______________ each term in the first expression by each term in the second. One method is to multiply the first two terms, followed by the outside terms, then the inside terms, and finally, the last two terms. Then add the resulting terms.

  Example: \((x + 2) \cdot (8x – 3) = 8x^2 + -3x + 16x – 6\)
  
  \[= 8x^2 + 13x – 6\]

Problem Set:
Multiply.

1. \((3x + 2) \cdot 5x\) ______________________________

2. \(-3y \cdot (4y – 7)\) ______________________________

3. \((z + 7) \cdot (5z – 1)\) ______________________________
Course 2

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4. \((y + 4) \cdot (y + 3)\) ___________________

5. \((7r + 2) \cdot 8r\) ___________________

6. \((5p - 3) \cdot (2p + 4)\) ___________________

7. \((6x + 2) \cdot (-x - 3)\) ___________________

8. \((8t + 2) \cdot (t - 1)\) ___________________

9. \((6p + 3) \cdot 2p\) ___________________

10. \(-5r \cdot (5r + 2)\) ___________________

11. \((7x + 7) \cdot (-x - 8)\) ___________________

12. \((4x + 2) \cdot (2x - 3)\) ___________________

13. \((z - 2) \cdot (z + 5)\) ___________________

14. \((x + 1) \cdot (x + 1)\) ___________________

15. \((8z - 2) \cdot 6z\) ___________________

16. \((5z - 3) \cdot (5z + 2)\) ___________________

17. \((y + 3) \cdot (y + 2)\) ___________________

18. \(2t \cdot (3t - 1)\) ___________________

Reflection:
The tutorial demonstrated several methods used to multiply a pair of binomials. Explain which method you found most useful.

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Module: Dividing Binomials by Monomials

Objective: To practice dividing binomials

Name: _______________________  Date: __________________

Fill in the blanks. Use one of the words in parentheses, when given.

- Monomials and binomials can be multiplied to ________________ an expression. They can also be divided. (add, simplify)
- To divide a binomial by a monomial, divide each term of the binomial by the monomial. One way to do this is to rewrite the expression, then ________________ each term. (divide, multiply)
- Example: \( \frac{18x^3 + 9x^2}{3x} = \frac{18x^3}{3x} \cdot \frac{9x^2}{3x} \)
  \[
  = 6x^2 + 3x
  \]
- When dividing a term with the same variable, ________________ the exponent. (add, subtract)
- Check your answer by ________________. (dividing, multiplying)

Problem Set:
Find the quotient. Simplify.

1. \( \frac{12x^3 + 8x^2}{4x} \) ________________________________

2. \( \frac{4s^3 + 4s^2}{2s^2} \) ________________________________

3. \( \frac{6y^5 + 9y^3}{3y^2} \) ________________________________
4. \( \frac{4z^3 - 2z^2}{2z} \) 

5. \( \frac{25x^7 - 15x^4}{5x^3} \) 

6. \( \frac{21r^3 + 14r^2}{7r} \) 

7. \( \frac{12s^4 + 16s^3}{4s^2} \) 

8. \( \frac{4p^3 + 16p^2}{4p^2} \) 

9. \( \frac{6t^2 + 2t}{2t} \) 

10. \( \frac{21s^3 - 7s^2}{7s^2} \) 

11. \( \frac{5x^4 - 25x^3}{5x^3} \) 

12. \( \frac{24r^5 - 16r^2}{8r^2} \) 

Reflection:
How can you check your answer? Use this example in your explanation.

\( \frac{36x^4 - 18x^3}{6x} = 6x^3 - 3x^2 \)
Fill in the blank with one of the words in parentheses.

- Any number that replaces a variable and makes the equation true is a ______________ of the equation. (set, solution)
- We solve an equation by finding all of the solutions that make the equation ______________. (false, true)

The inspection method requires these steps:

- 1. Covering the variable with a box that holds a place for the ______________. (equation, variable)
- 2. Asking yourself the question: What number makes the equation ______________? (false, true)
- Checking your work by substituting your ______________ back into the original equation. (solution, variable)

Problem Set:
Solve the equation.

1. 3 + x = 14 ______________ 2. 3w = 15 ______________
3. -4 + y = 7 ______________ 4. \( \frac{1}{3}z = 4 \) ______________
Course 2  
Math Sentences

5. \( w - 5 = 6 \)  
6. \( -3a = 9 \)  

7. \( \frac{1}{2} y = 3 \)  
8. \( y - 9 = 7 \)  

9. \( -5s = 25 \)  
10. \( -5b = 15 \)  

Part 1: To solve for the term:  
1) Cover the term.  
2) What number makes the equation true?  

Part 2: To find the variable:  
1) Cover the variable.  
2) Ask what number makes the equation true.  

Remember to check your answer.  

11. \( -5 - 11b = 6 \)  
12. \( 7 - \frac{1}{3} b = 10 \)  

13. \( 3y + 2 = 5 \)  
14. \( 4n - 12 = 0 \)  

15. \( 5 + \frac{1}{2} z = 8 \)  
16. \( -4s - 15 = 5 \)  

Reflection:  
Make a set of three problems like those above for a partner to solve. Be sure you have solved them first!

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Course 2  Math Sentences

Module: Linear Equations in 1 Variable: Isolating the Variable

Objective: To practice solving more difficult linear equations by isolating the variable

Name: _______________________  Date: ________________

Fill in the blanks. Use one of the words in parentheses, when given.

➢ When you isolate the variable, you change the equation so that the variable appears on ______________ side. (only one, neither)

➢ An axiom is a rule that is known to be _______________. (false, true)

➢ Check your work by replacing the variable in the ______________ equation. (new, original)

➢ Remember the key: Whatever you do to one side of an equation, you must do to the ______________ ______________.

Problem Set:
Solve the equation for x.

1. 3x + 7 = -14 ______________

2. -5x – 7 = 8 ______________

3. \( \frac{1}{3} \) x + 10 = 18 ______________

4. 5x = -7x – 12 ______________
5. \(7x = 2x - 15\) _____________  
6. \(-8x - 2 = 6x + 5\) _____________  

7. \(3x - 8 = -x + 4\) _____________  
8. \(-16x - 15 = 1\) _____________  

9. \(5x - 7 = 3x + 3\) _____________  
10. \(\frac{1}{2}x + 7 = -17\) _____________  

**Reflection:**  
Compare using inspection with isolating the variable. Which method do you prefer? What are the benefits of isolating the variable and solving for \(x\)?  
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Fill in the blank. Use one of the words in parentheses, when given.

➢ An inequality is a math statement in which one side of the statement is ______________ to the other side. (equal, unequal)

➢ When graphing on a number line, a(n) ______________ circle means that the number is not a solution. (filled, open)

➢ A filled circle means that the number ______ a solution. (is, isn’t)

➢ Use this property to solve inequalities: If you add or subtract the same ______________ from both sides of an inequality the solution set stays the same.

Problem Set:
Solve the inequality. Graph the solution set.

1. \( x - 4 \leq 0 \)
2. \( x - 9 < -3 \)
3. \( x - 0 \geq -2 \)
4. \( x + (-5) > 2 \)
Course 2

Math Sentences

5. \(x + (-3) \leq -8\)

6. \(-6 + x < -4\)

7. \(2 + x \geq -4\)

8. \(x + (-5) > 3\)

9. \(x + 15 \leq 10\)

10. \(x + (-2) < 0\)

11. \(x - 9 \geq -3\)

12. \(6 + x > 1\)

Extension Activity:
It’s true that many different equations have this solution set. Write three of these equations.

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Module: Linear Inequalities in 1 Variable, Part 2

Objective: To practice solving linear inequalities for which multiplication and division are required

Name: _______________________ Date: ______________

Fill in the blanks with one of the words in parentheses.

➢ When you multiply or divide both sides of an inequality by a positive number, the direction of the inequality stays the same. The inequality has ______ ______ solution set. (a different, the same)

➢ When you multiply or divide both sides of an inequality by a negative number, you must __________ the direction of the inequality. Only then, will the inequality have the same solution set. (not change, reverse)

Problem Set:
Solve the inequality. Graph the solution set.

1. \[2x > 6\]
2. \[4x < 16\]
3. \[-8x \geq 16\]
4. \[-\frac{1}{6}x \geq 1\]
Course 2

Math Sentences

5. \(\frac{1}{3}x \leq 1\)

6. \(5x < -20\)

7. \(3x \geq -21\)

8. \(\frac{1}{4}x > -2\)

9. \(\frac{1}{2}x \leq -3\)

10. \(-x < 3\) (Hint: Watch the signs.)

Reflection:
Think of an example in your day-to-day life that could be represented by an inequality. Then, write and graph the inequality.
Fill in the blanks. Use one of the words in parentheses when choices are given.

- Sometimes solving inequalities requires you to use several steps in order to isolate the variable. You can isolate the variable without changing the inequality’s solution set by using properties of inequalities. You can:
  
  1. Add or subtract __________ number from both sides of the inequality. (a different, the same)
  
  2. Multiply or divide both sides by a positive number.

  3. Multiply or divide both sides by a negative number. Then switch the direction of the __________. (inequality, operation)

  - In general, it is best to use __________ and subtraction first, and then use multiplication and division. (addition, multiplication)

Problem Set:
Solve the inequality, then graph the solution set.

1. \( \frac{1}{2}x + 4 \leq 2 \)

2. \( 4x + 3 < 15 \)
Course 2

Math Sentences

3. \( \frac{1}{4}x - 2 \geq -1 \)

4. \( 3x - 3 > 6 \)

5. \( \frac{1}{2}x - 2 \leq 1 \)

6. \( 2x + 4 < -4 \)

7. \( 5x + 3 \geq -22 \)

8. \( \frac{1}{4}x - 5 > -4 \)

9. \( \frac{1}{2}x - 6 \leq -8 \)

10. \( -x + (-3) < 3 \)

Reflection:
Why do you think it is easiest to add or subtract before multiplying?

________________________________________________________________
________________________________________________________________
Module: Special Quadratic Equations, Part 1

Objective: To investigate quadratic equations that are perfect squares

Name: _______________________  Date: __________________

➢ One kind of quadratic equation is when both sides are _______________ squares.

➢ To solve the equation \( x^2 = 25 \), ask yourself, "What number _______________ by itself equals 25?"

➢ A negative number multiplied by a negative number equals a _______________ number.

➢ To solve \( x^2 - 64 = 0 \), _______________ the variable on one side by _______________ 64 to/from both sides.

Problem Set:

What is the value of the variable?

1. \( x^2 = 81 \) _______ or ________
2. \( m^2 = 49 \) _______ or ________
3. \( y^2 = 16 \) _______ or ________
4. \( b^2 = 4 \) _______ or ________
5. \( n^2 = 36 \) _______ or ________
6. \( x^2 = 64 \) _______ or ________

What is the value of the variable?

7. \( y^2 - 25 = 0 \) ____________________ or __________________
8. \( a^2 - 9 = 0 \) ____________________ or __________________
9. \( m^2 - 100 = 0 \) ____________________ or __________________
Math Sentences

10. \(n^2 - 49 = 0\) __________________ __  or __________________

11. \(h^2 - 64 = 0\) __________________ __  or __________________

12. \(x^2 - 4 = 0\) __________________ __  or __________________

13. \(b^2 - 144 = 0\) __________________ __  or __________________

14. \(z^2 - 121 = 0\) __________________ __  or __________________

15. \(4c^2 - 36 = 0\) __________________ __  or __________________

16. \(9d^2 - 81 = 0\) __________________ __  or __________________

Extension Activity:
Find \(x^2\) for these larger numbers. Use a calculator or write out the multiplication problem.

\[x = 15 \quad x^2 = \underline{\quad} \]
\[x = 20 \quad x^2 = \underline{\quad} \]
\[x = 25 \quad x^2 = \underline{\quad} \]
\[x = 50 \quad x^2 = \underline{\quad} \]

Reflection:
Some of the problems in this activity were more difficult than others. Which ones were you able to do in your head? Which ones were more difficult and why?

I did these problems in my head. ______________________________

I worked these problems out on paper (or with a calculator).

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Course 2  

Math Sentences

Module: Special Quadratic Equations, Part 2

Objective: To investigate factoring quadratic equations

Name: _______________________  Date: __________________

- Factoring means finding two or more expressions that can be ________ to give the __________________ expression.
- The first step in factoring is rewriting the equation with __________ on one side and all other __________________ on the other side.
- If the product of two terms is 0, you know that one of the terms has to be ____________.

Problem Set:
Solve for the variable and check your solutions.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Check your solutions!</th>
</tr>
</thead>
</table>
| $x^2 + 4x = 0$
$x(x + 4) = 0$
We know that one solution is $x = 0$
For $(x + 4)$, add -4 to both sides
\[ x + 4 + (-4) = 0 + (-4) \]
\[ . \]
\[ . \]
Solutions: $x = 0$ and $x = -4$
| $x = 0$
$x^2 + 4x = 0$
\[ 0^2 + 4(0) = 0 \]
\[ 0 + 0 = 0 \]
| $x = -4$
$x^2 + 4x = 0$
\[ (-4)^2 + 4(-4) = 0 \]
\[ 16 + (-16) = 0 \]
\[ 0 = 0 \]
| $x^2 + 7x = 0$
Solutions: |
## Problem Check the solutions!

<table>
<thead>
<tr>
<th>Problem</th>
<th>Check the solutions!</th>
</tr>
</thead>
<tbody>
<tr>
<td>( a^2 - 9a = 0 )</td>
<td></td>
</tr>
<tr>
<td>Solutions:</td>
<td></td>
</tr>
<tr>
<td>( n^2 + 4n = 0 )</td>
<td></td>
</tr>
<tr>
<td>Solutions:</td>
<td></td>
</tr>
<tr>
<td>( m^2 - 15m = 0 )</td>
<td></td>
</tr>
<tr>
<td>Solutions:</td>
<td></td>
</tr>
</tbody>
</table>

**Reflection:**
One of your friends needs help factoring quadratic equations. What steps would you tell him or her to take?

________________________________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________
Module: Using Linear Equations to Solve Problems

Objective: To practice using linear math sentences in one variable for solving practical problems

Name: _______________________  Date: __________________

There are five steps to help you solve practical problems:

- Step 1: Read the _______________ carefully.
- Step 2: Analyze the problem and set up a _______________.
- Step 3: _______________ the answer.
- Step 4: Set up strategy sentences. Use them to set up and _______________ mathematical equations.
- Step 5: Make sure you’ve answered the right question. Then _______________ your work.

Problem Set:
Read the problem carefully.

Jane addresses twice as many envelopes as Lois in the same amount of time. Together, they address 450 or more envelopes each day. Jane addresses at least how many envelopes in a day?

Analyze the problem and set up a strategy.

________________________________________________________________
________________________________________________________________

Estimate the answer. __________________________________________________________________

Set up strategy sentences. Use them to set up and solve mathematical equations.

________________________________________________________________
Make sure you’ve answered the right question. Then check your work.

Jane addresses at least how many envelopes a day? ________________

Sharita does typing jobs for scientists. She charges $10 for the first three pages and $3 for each additional page of scientific typing. Sonia, a biologist, paid $97 to have a research paper typed. How many pages long was Sonia’s paper?

The formula for the perimeter of a rectangle (the distance around) is $p = 2l + 2w$, where $l$ = length and $w$ = width. Cindy has 14 meters of fencing. She plans to fence in a rectangular dog run that is 2 meters wide. How long can she make the run?

Extension Activity:
Look over the problems that you worked on. Now, try to create a practical problem of your own, and try it out on a friend!
Module: Using Quadratic Equations to Solve Problems
Objective: To practice using quadratic equations in one variable to solve practical problems

Name: _______________________  Date: __________________

There are five steps to help you solve practical problems:

➢ Step 1: _______________ the problem carefully.
➢ Step 2: Analyze the _______________ and set up a strategy.
➢ Step 3: Estimate the _______________.
➢ Step 4: Set up strategy _______________. Use them to set up and solve mathematical equations.
➢ Step 5: Make sure you’ve answered the right _______________. Then check your work.

Problem Set:

Read the problem carefully.

Pablo Martinez bought a house. It is a square and is in the center of a square plot that is 40 meters on a side. He has 1,311 square meters of lawn. How long is a side of the house?

Analyze the problem and set up a strategy.

________________________________________________________________
________________________________________________________________
________________________________________________________________

Estimate the answer. ____________________________________________
Course 2

Math Sentences

Set up strategy sentences. Use them to set up and solve mathematical equations.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Make sure you’ve answered the right question. Then check your work.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

How long is the side of the house? ________________________________

The area of a pizza is 154 square centimeters. What is the radius of the pizza?
Use this equation: Area = \( \pi r^2 \). Use \( \pi = \frac{22}{7} \).

__________________________________________________________________________

__________________________________________________________________________

Larry wants to buy some carpeting for his living room. The length of the room is 3 times the width and the total area of the room is 75 square meters. What is the length of the living room?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Reflection:
Solving practical problems can be challenging. What is the most challenging part for you? Explain.

__________________________________________________________________________

__________________________________________________________________________
Module: Coordinate Plane

Objective: To practice finding the coordinates of a given point on a coordinate plane

Name: _______________________  Date: ________________

➢ Each of the number lines is called an _________________.

➢ The horizontal line is referred to as the _____ - axis, and the vertical line is referred to as the _____ - axis.

➢ You can locate any point on the coordinate plane by giving it two numbers.

Always write the _____ - ____________ first (followed by a comma)

and the _____ - ____________ second.

Problem Set:
Write the coordinates of the point shown on the graph.

1. ______________

2. ______________

3. ______________

4. ______________
Reflection:
Being able to identify coordinates on a coordinate plane is important in many professions. Write down two professions that use coordinates as well as how the coordinates are used.

1. ______________________________________________________________
   __________________________________________________________________

2. ______________________________________________________________
   __________________________________________________________________
Module: Identifying Points on a Coordinate Plane

Objective: To practice identifying points on a coordinate plane

Name: _______________________  Date: __________________

➢ To graph an ordered pair: First, locate the $x$-coordinate on the ________ axis using the first number. Next, locate the $y$-coordinate on the vertical axis using the ________ number.

➢ Example: Graph the ordered pair (6,-1).

1. Start at the ________.
2. Since the first number is +6, move 6 positions to the ________.
3. Since the second number is -1, move 1 position ________.

Problem Set:
Graph the ordered pair.

1. (-5,3)  
   ![Graph of (-5,3)](image)

2. (8,-2)  
   ![Graph of (8,-2)](image)

3. (-4,0)  
   ![Graph of (-4,0)](image)

4. (5,-3)  
   ![Graph of (5,-3)](image)
Course 3

5. (-1,2)

6. (0,-3)

7. (-2,2)

8. (8,-2)

9. (-6,-2)

10. (1,-3)

Extension Activity:
Draw the x-axis & y-axis on a piece of graph paper. Choose five coordinates on the graph and mark them with a point. Now, connect the points to make a closed, five-sided figure. To create a new figure, add 2 to each coordinate—both x and y. Graph the new points and connect the points. What things do you notice? How are the figures similar and how are they different?

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

The solution of an equation with two variables is the set of all ordered pairs that makes the equation _______________.

To find solutions (ordered pairs) to an equation with two variables, do the following:
1. Select any replacement for one of the _______________.
2. Substitute the replacement, and then _______________ the equation for the other variable.

Problem Set:

1. Is (1,1) a solution of the equation $x + y = 2$? _______________
2. Is (2,0) a solution of the equation $2x + y = 4$? _______________
3. Is (1,2) a solution of the equation $x + 7y = 13$? _______________
4. Is (2,-3) a solution of the equation $5x + y = 7$? _______________
5. Is (0,1) a solution of the equation $4 – 3xy = 5$? _______________
6. Is (1,4) a solution of the equation $7x – y = 3$? _______________
7. Is (2,7) a solution of the equation $x + y = 8$? _______________
8. Is (-2,4) a solution of the equation $6x – 2y = 3$? _______________
9. Is (-2,3) a solution of the equation 5 + x = y? _______________

10. Is (2,2) a solution of the equation 3x + 2y = 10? _______________

11. \( x + y = 22 \)
    Let \( x = 10 \). What is \( y \)? _______________

12. \( x + y = 15 \)
    Let \( x = -5 \). What is \( y \)? _______________

13. \( 3x + y = 4 \)
    Let \( x = -1 \). What is \( y \)? _______________

14. \( -2x - y = 2 \)
    Let \( x = 7 \). What is \( y \)? _______________

15. \( 5x + 2y = 15 \)
    Let \( x = 5 \). What is \( y \)? _______________

16. \( 2x + 4y = 32 \)
    Let \( x = 0 \). What is \( y \)? _______________

17. \( -5x + 7y = 9 \)
    Let \( x = 1 \). What is \( y \)? _______________

18. \( 15x - y = 10 \)
    Let \( x = 2 \). What is \( y \)? _______________

19. \( -x + y = 2 \)
    Let \( x = 4 \). What is \( y \)? _______________

20. \( 2x - 3y = -4 \)
    Let \( x = -4 \). What is \( y \)? _______________

**Reflection:**
Write down as many different ordered pairs as you can think of that are solutions of this equation: \( 7x + y = 10 \).

________________________________________________________________
________________________________________________________________
To graph a linear equation, follow these two steps:

1. Make a table of values of three ordered pairs by selecting three values for $x$, and then solving for _____ for each value.
2. Plot the three points and draw a ____________ line joining the points.

Only two points are necessary to draw a straight line. The third point is plotted as a ____________ that you found the ordered pairs correctly.

Problem Set:
1. Graph the line for the equation $3x - y = 2$. Use the table to choose three points.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Graph the line for the equation $5x + 2y = 2$. Use the table to choose three points.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Course 3

Graphing Basics

3. Graph the line for the equation \( x + 4y = 8 \). Use the table to choose three points.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Graph the line for the equation \( 6x - 3y = 9 \). Use the table to choose three points.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Graph the line for the equation \( 4x + 8y = 24 \). Use the table to choose three points.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reflection:
Two students are graphing the line for the same equation. They both graphed the same line and they are both correct. However, they each used different ordered pairs to graph the line. Explain how they both got the answer correct.

________________________________________________________________
________________________________________________________________
________________________________________________________________
Module: Solving and Graphing Systems of Equations

Objective: To practice solving and graphing systems of linear equations

Name: _______________________  Date: __________________

➢ Two or more linear equations are called a _______________ of linear equations.

➢ The solution of a system of linear equations is the _______________ _______________ that is common to all the linear equations.

➢ The solution of a system of linear equations can be found by graphing.

Problem Set:

1. Graph the lines to find the solution of the system.
   System:
   \[ 6x + 3y = 33 \]
   \[ 2x + 9y = 3 \]

   \[
   \begin{array}{|c|c|}
   \hline
   x & y \\
   \hline
   0 & \\
   \hline
   \end{array}
   \]

   The solution is _______________.

2. Graph the lines to find the solution of the system.
   System:
   \[ 2x + 4y = 4 \]
   \[ 3x + 2y = 6 \]

   \[
   \begin{array}{|c|c|}
   \hline
   x & y \\
   \hline
   0 & \\
   \hline
   \end{array}
   \]

   The solution is _______________.

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The solution is _______________.

3. Graph the lines to find the solution of the system.

\[
\begin{align*}
4x + 2y &= 10 \\
2x + 3y &= 7
\end{align*}
\]

The solution is _______________.

Solve the system of linear equations by adding or subtracting.

4. System:
\[
\begin{align*}
2x + 3y &= 9 \\
5x + 6y &= 12
\end{align*}
\]

The solution is _______________.

5. System:
\[
\begin{align*}
2x - 3y &= 4 \\
-2x + y &= -12
\end{align*}
\]

The solution is _______________.

6. System:
\[
\begin{align*}
-x + 2y &= 1 \\
2x + 3y &= 12
\end{align*}
\]

The solution is _______________.

**Reflection:**
How can you check your solution?

________________________________________________________________
________________________________________________________________
Module: Solving Problems with Systems of Linear Equations

Objective: To practice solving practical problems with two variables

Name: _______________________  Date: __________________

➢ Practical problems in mathematics are problems that allow you to apply
  the mathematical skills you have learned to _______________
  _______________.
➢ Step 1: _______________ the problem carefully.
➢ Step 2: Analyze the problem and set up a _______________.
➢ Step 3: _______________ the answer.
➢ Step 4: Set up the strategy sentences. Use them to set up and
  _______________ mathematical equations.
➢ Step 5: Make sure you have answered the right question. Then
  _______________ your work.

Problem Set:
Solve the problem.
1. Antonio is building a display for a local competition. He will use 2 wooden
dowels. He knows that one dowel must be 32 cm longer than the other.
He also knows that the combined length of the rods is 52 cm. Find the
length of each rod.

Antonio will use____________________________________________.
2. The perimeter of Angela’s pool is 25 meters. Its dimensions are such that the width is one-half its length. What is the width of the pool?

The width of the pool is ________________________________.

3. Cynthia works at a grocery store. She knows that for every 2 cans of tomato soup she sells, she will sell 4 cans of chili beans. This week she ordered a total of 12 cans. How many cans of chili beans did she order?

She ordered ________________________________.

4. Tomas is making various pieces of pottery to sell at the local carnival. His initial costs for creating the pieces and buying the supplies are $100. It costs him $5 for materials to make each piece. He can sell them for $25 each. How many pieces of pottery must he sell to break even?

He must sell ________________________________.

Reflection:
You worked on several different practical problems. What are some tips you could give your friends to help them solve practical problems?

________________________________________________________________

________________________________________________________________

________________________________________________________________

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There are three basic steps to writing a formula.

1. Consider the available _______________.
2. Assign _________________ to the unknown quantities.
3. Think about how the variables are related. Use them to set up a _________________.

Problem Set:

1. You're throwing a party for a friend. Write down 3 things you'll have to buy for the party. Assign each expense a variable.

<table>
<thead>
<tr>
<th>Expenses</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. You have $75 to spend on the party. Write a formula that will help you determine how much money you'll have left after your expenses. Use the variables from the previous question.
3. Paula wants to buy a CD from the music store. She's not sure if she has enough money to cover the price of the CD. Her total will equal the price of the CD plus the tax. The tax is 7% in her state.

Assign each piece of information a variable.

Total: _________________________
Price of the CD: _________________________
Tax: _________________________

Use the variables to write a formula.

Extension Activity:
Formulas are useful for converting measurements. But it's important to write the formula correctly. Write a formula for converting miles to kilometers.

1 km = .62 miles
Let x = number of kilometers
Let y = number of miles

Reflection:
What are some advantages to using a formula?

How can you test your formula to see if it works?

Is there only one formula for each problem you encounter? Explain.
Course 4  
Equations and Formulas

Module:  Adapting and Using Formulas

Objective:  To practice adapting and using formulas to solve math problems

Name:  _______________________  Date:  __________________

➢ There are three basic steps to solving math problems that involve a formula.

1. Decide which _______________ you need to solve for.

2. _______________ the variable.

3. Replace the other variables with _______________.

Problem Set:

1. You can use a formula to determine how much money you'll make each week.
   
   Let’s let
   
   \( n \) = number of hours worked
   
   \( h \) = hourly wage
   
   \( t \) = total amount of money earned in one week

   A formula describing this scenario is \( t = hn \).

   Rewrite the formula to find your hourly wage.

   Rewrite the formula to find the number of hours you worked.

2. The formula for converting ounces to grams is \( o = 28.35g \).

   In this formula,
   
   \( g \) = grams
   
   \( o \) = ounces

   Rewrite the formula to solve for grams.
3. The following formula helps you find the distance a person or object travels:
   If we let
   
   \[ t = \text{time}, \]
   \[ d = \text{distance}, \]
   \[ r = \text{rate}, \]
   
   then \[ d = rt. \]

   You're on a road trip and you want to know how long it will take to get to your destination. Which variable will you solve for?

   Rewrite the formula to isolate the variable you want to solve for.

4. There are two routes you can take to get to your destination. Route A runs along the highway, but it's longer than Route B. Route B is shorter, but it runs through the city streets. Use the formula to determine how long each route will take.

   \[
   \begin{array}{cccc}
   & \text{Distance} & \text{Rate} & \text{Time} \\
   \hline
   \text{Route A} & 340\text{km} & 80 \text{ km/hour} & \underline{} \\
   \text{Route B} & 200 \text{ km} & 50 \text{ km/hour} & \underline{}
   \end{array}
   \]

   How do you decide which variable you want to solve for?

   ________________________________________________________________
   ________________________________________________________________

   **Reflection:**
   You're given the following formula: \( a = \frac{bc}{d} \). How do you isolate the variable \( b \)?

   ________________________________________________________________
   ________________________________________________________________

   If your data change, do you have to change your formula? Explain.
The word percent means part of _________________.

Our money system uses 100 cents to the dollar. If you found a penny (1 cent coin) you’d have ______% of a dollar.

This grid has 100 sections. One of the sections from the grid is partly shaded as shown here.

Looking at the section that is partly shaded, what portion of the whole grid is shaded?

a) more than 1%  b) less than 1%  c) 1%?  Answer: ______________

Problem Set:
Each section represents 1% of the larger grid. Shade the small section to match the fraction.

Shade $\frac{5}{8}$% of this section.
Shade $\frac{2}{3}$% of this section.
Shade $\frac{3}{4}$% of this section.
Shade $\frac{9}{10}$% of this section.
Extension Activity:
Each section is 1% of the larger grid. What percent of the total area does the shading in each section represent?

Reflection:
Draw or describe an object that is less than 1% of something larger. Think BIG! Is the tree in the front yard less than 1% of all the trees on the block? Is a bucket of sand less than 1% of all the sand on the beach? What can you think of? If you can think of more than one thing, be sure to draw it, too!
Course 5

Special Topics

Module:  Converting Percents Less than 1% to Decimals

Objective:  To practice converting percents less than 1% using decimals

Name:  _______________________  Date:  __________________

- Fractions less than 1%, such as $\frac{2}{3}$%, are converted to decimal form by
  first dividing the numerator by the __________________.
- Then, __________________ the quotient by 100.  This moves the decimal
  point ____________________ places to the __________________.
- Last, omit the ____________________ sign.

Problem Set:
Convert the fractions of a percent to decimals.  Use a calculator and round off the numbers to four decimal places.

1. $\frac{2}{5}$%  _______________________________________
2. $\frac{3}{4}$%  _______________________________________
3. $\frac{5}{6}$%  _______________________________________
4. $\frac{1}{3}$%  _______________________________________
5. $\frac{3}{5}$%  _______________________________________
6. $\frac{9}{10}$%  _______________________________________
7. $\frac{1}{2}$%  _______________________________________
8. $\frac{1}{5}$%  _______________________________________
Extension Activity:

Two hundred ants came marching by, headed for my picnic pie.
I told them all to go away; they'd have to eat another day.
One little ant got juicy bits; the other ants just called it quits.

Write the fraction showing how many ants had something to eat. _____________
What is that fraction in decimal form? ________________________________
What percent of the ants ate juicy bits? ______________________________
How many ants didn't get any juicy bits? ______________________________
Write the fraction showing how many ants went hungry. _________________
What is that fraction in decimal form? ________________________________
What percent of the ants didn't get any juicy bits? ____________________
Module: Converting a Decimal to a Fraction of a Percent

Objective: To practice converting a decimal to a percent when the value is less than 1%

Name: _______________________  Date: __________________

➢ To change a decimal to a percent, ____________________ by 100. This moves the decimal point __________________ spaces to the ______________. Then, add the percent sign.

➢ To convert a decimal to a fraction, determine the number’s place value.

   Place the number over the correct ______________.

➢ The fraction may need to be ________________.

Problem Set:
Convert these decimals to a fraction of a percent.

1. .0075 ____________________________
2. .001 ____________________________
3. .0025 ____________________________
4. .003 ____________________________
5. .0015 ____________________________
6. .004 ____________________________
7. .007 ____________________________
8. .008 ____________________________
9. .0006 ____________________________
10. .0035 ____________________________
Course 5

11. .0001

12. .004

13. .0048

14. .009

15. .006

Extension Activity:
Use your calculator for these problems. Use what you know about setting up a fraction and converting to a decimal. Then, write your answer in a fraction of a percent.

Problem 1: The Washington Monument in Washington, D.C., is 550 feet tall. A tourist, who is 5.5 feet tall, stands at the base. If she were to mark her height on the side of the monument, her height would represent what part of the monument’s height?
Write the answer in decimal form. _______________
Write the answer in a fraction of a percent. _______________

Problem 2: At the 2002 Winter Olympics the total number of tickets available for all the events was 13,650,000. A few weeks before the Olympics started, 68,250 tickets were not sold. The unsold tickets represent what part of all tickets sold?
Write the answer in decimal form. _______________
Write the answer in a fraction of a percent. _______________
Module: Finding the Amount with Percents Less than 1%

Objective: To practice finding a percent that is less than 1%

Name: _______________________ Date: __________________

Sometimes a percent of a whole number is not based on 100, but less than 100. To convert a fraction of a percent of a whole number, first change the fractional percent to a ________________ by dividing the ________________ by the denominator. Then divide by 100. To change the decimal % to a decimal, multiply the decimal by the ________________ number.

Problem Set:
Find the fractional percent of the whole number. Use your calculator. You may need to round your answer to the nearest whole number.

1. \( \frac{2}{5} \% \) of 8,000
2. \( \frac{3}{4} \% \) of 4,400
3. \( \frac{5}{6} \% \) of 3,600
4. \( \frac{1}{3} \% \) of 600
5. \( \frac{2}{7} \% \) of 4,900
6. \( \frac{2}{3} \% \) of 6,000
7. \( \frac{3}{8} \% \) of 2,040
Course 5

8. \( \frac{1}{2} \)\% of 2,000

9. \( \frac{2}{3} \)\% of 3,000

10. \( \frac{5}{8} \)\% of 800

Extension Activity:
Working with decimals means knowing place values. Label the place values for this number.

\[ 4,523.798 \]

Reflection:
Find examples around you that show a fractional percent less than 100. Here's an example. How many students are in your school and how many have on yellow sweaters? Let's say 400 students are in the school and \( \frac{3}{4} \)\% of the students are wearing yellow sweaters. How many students is that? _________

Make up your own problem and write it here. Work out the problem, too.
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
Course 5  Special Topics

Module: Visualizing Percents Greater than 100%

Objective: To investigate quantities greater than 100%

Name: _______________________ Date: __________________

➢ To convert a percent to a decimal, ______________________ the number by 100. This moves the __________________ two places to the left. Add the __________________ ________________.

Problem Set:
1) 125% of 80 is __________________ 5) 120% of 30 is __________________
2) 150% of 20 is __________________ 6) 100% of 23 is __________________
3) 300% of 36 is __________________ 7) 400% of 25 is __________________
4) 250% of 42 is __________________ 8) 175% of 60 is __________________

Extension Activity:
Here are word problems where the final number is greater than 100%. The first problem is done for you.
1. Mr. Nguyen budgeted $40 for his January heating bill. January was very cold, and when the bill came Mr. Nguyen told a friend, "My bill was 150% of what I thought it would be!" How much was the bill?

\[
\frac{150\%}{100} = 1.5 \quad \text{or} \quad 40 \cdot 1.5 = 60 \quad \text{The bill for January was $60.}
\]

2. Jenna had a birthday party for Mutsy, her dog. Jenna invited 6 friends. Some additional people showed up and Jenna’s party was 133% bigger than she planned. How many people came? You will need to round your answer.

___________________________ people
3. Harry fixes cars and needs lots of garage space. His current garage is 800 square feet. He has rented a new place that is 170% bigger. How many square feet does the new garage have? ______________ square feet

4. The community education program offered an income tax workshop. The sign-up list had 30 people on it, but at the first session the attendance was 110%. How many people attended? _____________ people

Reflection Activity:
Think of a space that you use and would like to make bigger. It could be your bedroom, kitchen, or yard. Sketch a picture or floor plan of how it looks now. Sketch a second picture or floor plan of how you would make it bigger. About what percent bigger will it be? Use another sheet of paper if you need more space.
Module: Converting Percents Greater than 100% to Decimals

Objective: To practice changing percents greater than 100% to decimals

Name: _______________________  Date: ________________

➢ Percents greater than 100% can be written in decimal form. When converting percents to decimals, the decimal point moves two places to the ______________. Moving the decimal this way is the same as ______________ by 100. Then, drop the __________ sign.

Problem Set: Convert the percent to its decimal equivalent.

1. 110% _________________  2. 150% _________________
3. 134% _________________  4. 255% _________________
5. 335% _________________  6. 750% _________________
7. 888% _________________  8. 433% _________________
9. 175% _________________  10. 1,168% _________________
11. 212% _________________  12. 890% _________________
13. 235% _________________  14. 2,775% _________________
15. 835% _________________  16. 523% _________________
17. 3,000% _________________  18. 6,655% _________________
19. 444% _________________  20. 9,123% _________________

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Extension Activity:

Take your knowledge of converting percents to decimals a little further! These problems require a step beyond finding the decimal number. Remember to label your answer.

1. Maya is a successful potter and her business requires a larger studio. She rents a new space that is 150% bigger than her old studio. The old studio was 500 square feet, how big is her new space?

\[
\frac{150\%}{100} = 1.5 \quad \text{500 sq. ft. • 1.5 = 750 sq. ft.}
\]

2. Washington High's 300 students were registered to start the school year. On opening day, 110% of those registered showed up. How many students came to school on the first day?

3. Greenville decided to hold a citywide flea market and rummage sale. The city council estimated 40 families would have things to sell. The council was very surprised to discover their estimate was off by 220%! How many people asked for space at the flea market?

4. The Learys from Winnipeg, Manitoba, decided to see Canada's national capital in Ottawa, Ontario. They thought they'd drive about 600 miles the first day, but actually drove 135% of that distance. How far did they drive?
Module: Converting a Number Greater than 1 to a Percent

Objective: To practice converting numbers greater than 1 to a percent

Name: _______________________  Date: __________________

Numbers greater than 1 can also be written as percents. When converting whole numbers to percents, the decimal point moves two places to the ______________. Moving the decimal this way is the same as ______________ by 100. When moving the decimal, you may have to add ______________. Then, add the ____________ sign.

Problem Set:
Find the percent equivalent to the decimal numbers.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Percent equivalent</th>
<th>Problem</th>
<th>Percent equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 34.5</td>
<td>__________________</td>
<td>2) 27.42</td>
<td>__________________</td>
</tr>
<tr>
<td>3) 2.73</td>
<td>__________________</td>
<td>4) 7.75</td>
<td>__________________</td>
</tr>
<tr>
<td>5) 8.89</td>
<td>__________________</td>
<td>6) 44.50</td>
<td>__________________</td>
</tr>
<tr>
<td>7) 75.03</td>
<td>__________________</td>
<td>8) 31.98</td>
<td>__________________</td>
</tr>
<tr>
<td>9) 3.5</td>
<td>__________________</td>
<td>10) 43.5</td>
<td>__________________</td>
</tr>
<tr>
<td>11) 89.75</td>
<td>__________________</td>
<td>12) 5.9</td>
<td>__________________</td>
</tr>
<tr>
<td>13) 12.86</td>
<td>__________________</td>
<td>14) 6.22</td>
<td>__________________</td>
</tr>
<tr>
<td>15) 56.87</td>
<td>__________________</td>
<td>16) 85.5</td>
<td>__________________</td>
</tr>
<tr>
<td>17) 4.32</td>
<td>__________________</td>
<td>18) 7.7</td>
<td>__________________</td>
</tr>
<tr>
<td>19) 37.45</td>
<td>__________________</td>
<td>20) 12.12</td>
<td>__________________</td>
</tr>
</tbody>
</table>

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Extension Activity:
How flexible are you with **decimals** and **percents**? Can you go back and forth, changing one to the other? Fill in the missing blanks below.

<table>
<thead>
<tr>
<th>Decimals</th>
<th>Percents</th>
</tr>
</thead>
<tbody>
<tr>
<td>55.4</td>
<td></td>
</tr>
<tr>
<td>23.89</td>
<td></td>
</tr>
<tr>
<td></td>
<td>456%</td>
</tr>
<tr>
<td></td>
<td>849%</td>
</tr>
<tr>
<td></td>
<td>7875%</td>
</tr>
<tr>
<td>357.43</td>
<td></td>
</tr>
<tr>
<td>459.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>785%</td>
</tr>
<tr>
<td></td>
<td>600%</td>
</tr>
<tr>
<td>333.3</td>
<td></td>
</tr>
</tbody>
</table>

Reflection:
Repeating a sequence of events helps us learn. In your own words, describe the sequence of events for the extension activity.

When I changed a decimal to a percent I had to take these steps:

_________________________________________________________________
_________________________________________________________________

When I changed a percent to a decimal I had to take these steps:

_________________________________________________________________
Module: Mean, Median, and Mode

Objective: To investigate how to find mean, median, and mode of a set of data

Name: _______________________  Date: __________________

➢ Another name for mean is ___________________. To find the mean, add all the values. Then _______________ by however many values are in that data set.
➢ The number that occurs most frequently in a data set is called the ____________________. 
➢ The middle value in a data set when written in ascending or descending order is called the ____________________. If there is an even number of data, find the ____________________ of the middle two values.

Problem Set:

1. What is the average miles per gallon for Ralph’s car for the last six months?
   31, 30, 32, 29, 34, 30 __________ mpg  What is the mode? _________ mpg

2. Here are the sandwich prices at Greta’s Grill.
   - Turkey ......... $3.20
   - Tuna & cheese .......$3.75
   - Ham............. $4.50
   - Veggie ....................$3.00
   - Chicken ....... $3.50
   - Bologna ..................$2.50

   What is the mean price? ____________________

   Organize the values to find the median price. ____ _____ ____ ____ ____ _____

   What is the median price of the sandwiches? ____________________

3. The scores on the math exam were 93, 86, 90, 77, 90, 88, 76, 66, 98, 73, 65.

   What is the mean score for the class? ____________________ points
Extension Activity:
It's easy to find statistics—they're everywhere! **Weather** statistics are very common, as are statistics about **sports** (baseball is a good example). The nature of **populations**—whether they're people or animals—is often represented with statistics. The **prices** of items we buy such as gas, food, and clothing, can be described with statistics, too.

Let's collect data. Here are a few suggestions, but you may use your ideas, too.

- How many points did your team score per game during its season?
- Find or estimate the daily temperatures in the last two weeks.
- Do a pet survey. How many pets live in each home in your neighborhood?
- Measure the height of your classmates.
- Find out the prices of a variety of soups. Pick at least 5 of your favorites.

First, define the data. **Who** is being measured? **What** is being measured? **How many** measurements will you collect? Here's an example.

**Who:** my basketball team. **What:** number of points scored in each game. **How many:** the team played 10 games. Now, define your problem.

**Who:** ___________________________  **What:** ___________________________

**How many:** ______________________

After you’ve gathered the data, list the numbers in order. This will make the data easier to work with. Use as many of the lines as you need to.

____,  _____, _____, _____,  _____,  _____,  _____,  _____,  _____,  _____

What is the average or mean? _____________________________________

Find the median. _____________   What is the mode (if any)? ____________

Data often tell a story — what else were you able to learn from your data?

________________________________________________________________

________________________________________________________________
Module: Probability and Possible Outcomes

Objective: To investigate the probability an outcome will occur

Name: _______________________ Date: __________________

- The set of outcomes in an experiment is called a ____________________ since it contains all possible outcomes.
- When you flip a coin, it has ____________________ possible outcomes.
- If a multiple-choice test has four answer choices for each question, what is your chance of guessing the right answer for a question? _____ in _____.

Problem Set
This board game uses cards of 4 different colors with 10 different pictures.

1. How many cards are in the deck? __________
2. How many purple cards are there? __________
3. You are first to take a card. Circle the sample space showing the pictures you could get if you drew a purple card.

<table>
<thead>
<tr>
<th>Blue</th>
<th>Green</th>
<th>Red</th>
<th>Purple</th>
</tr>
</thead>
<tbody>
<tr>
<td>dog</td>
<td>dog</td>
<td>dog</td>
<td>dog</td>
</tr>
<tr>
<td>cat</td>
<td>cat</td>
<td>cat</td>
<td>cat</td>
</tr>
<tr>
<td>horse</td>
<td>horse</td>
<td>horse</td>
<td>horse</td>
</tr>
<tr>
<td>cow</td>
<td>cow</td>
<td>cow</td>
<td>cow</td>
</tr>
<tr>
<td>dolphin</td>
<td>dolphin</td>
<td>dolphin</td>
<td>dolphin</td>
</tr>
<tr>
<td>whale</td>
<td>whale</td>
<td>whale</td>
<td>whale</td>
</tr>
<tr>
<td>seaweed</td>
<td>seaweed</td>
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</tr>
<tr>
<td>man</td>
<td>man</td>
<td>man</td>
<td>man</td>
</tr>
<tr>
<td>woman</td>
<td>woman</td>
<td>woman</td>
<td>woman</td>
</tr>
<tr>
<td>baby</td>
<td>baby</td>
<td>baby</td>
<td>baby</td>
</tr>
</tbody>
</table>

4. Circle the sample space showing the possible outcomes for cards with pictures of four-legged animals.

5. How many cards have a picture of a four-legged animal? __________

6. Circle the sample space showing the possibility of picking a seaweed card.

7. How many cards are seaweed cards? __________

8. Circle the sample space for picking blue or green cards and having a picture of a person.

9. How many cards make up the sample space for question 8? __________

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Course 5

Special Topics

Extension Activity:

When you flip a coin there are only two outcomes: heads or tails. For this exercise, let's use three coins and chart all the possible outcomes. Actually, you don't have to flip the coins – just pretend you have a penny (1-cent coin), a nickel (5-cent coin), and a dime (10-cent coin). Write the 8 possible combinations in the chart below. H represents heads, T represents tails.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>penny</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>nickel</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>dime</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
</tbody>
</table>

Reflection:
Looking at possible outcomes of an event helps us make decisions about what to do. For example, next week there will be a history test. We might think about the questions that may, or may not, be on the test. Determining the questions that are most likely to occur helps us focus on what material to study. Describe a situation where you had to think about possible outcomes. What did you do?
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
Course 5 Special Topics

Module: Probability of an Event

Objective: To investigate the probability of an event

Name: _______________________ Date: ________________

➢ Probability is the measure of how likely it is that an event will __________.
➢ The sample space is the set of ___________________ ____________________.
➢ The event space is a ___________________ of the possible outcomes.
➢ The sample space of a die is 6. What is the event space of rolling an odd number? _____ out of _____. In lowest terms? _____ out of _____.
➢ What is the chance of rolling a 4 with a die? _____ out of _____.

Problem Set:
Our board game uses cards of 4 different colors with 10 different pictures (the same deck of cards as found in the previous off-line activity). Let’s determine the probability of drawing certain cards.

1. How many cards are in the deck? __________  
2. How many red cards are there? ____________  
3. Write the formula for finding the probability of drawing a red card.  
\[ P(\text{event}) = \frac{e}{n} = ____ \]

<table>
<thead>
<tr>
<th>Blue</th>
<th>Green</th>
<th>Red</th>
<th>Purple</th>
</tr>
</thead>
<tbody>
<tr>
<td>dog</td>
<td>dog</td>
<td>dog</td>
<td>dog</td>
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<tr>
<td>cat</td>
<td>cat</td>
<td>cat</td>
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<tr>
<td>horse</td>
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<td>man</td>
<td>man</td>
<td>man</td>
</tr>
<tr>
<td>woman</td>
<td>woman</td>
<td>woman</td>
<td>woman</td>
</tr>
<tr>
<td>baby</td>
<td>baby</td>
<td>baby</td>
<td>baby</td>
</tr>
</tbody>
</table>

4. Draw a circle around creatures that swim in the ocean. How many cards represent those creatures that swim in the ocean? __________

What’s the probability of getting one of these cards?

\[ P(\text{event}) = \frac{e}{n} = ____ \] In simplest terms? ____
5. Sara is playing the board game with Ted using the same deck of cards that you saw on page 1. Sara thinks she has a better chance of drawing a "four-legged animal" card than Ted does of drawing a "people" card. Is she right? Show your work and explain why Sara thinks she has a better chance.

______________________________________________________________
______________________________________________________________
______________________________________________________________

6. Taylor isn’t sure she can win the board game. She needs to draw a “things that live in the ocean” card before Jordan can draw a "people" card. Find the probability of each. How might this game turn out…that is, who has a better chance of getting the card he or she needs? Show your work and explain your answer.

______________________________________________________________
______________________________________________________________
______________________________________________________________

Extension Activity:
Dr. Johnson, the local baby doctor, was very busy yesterday. Three babies were born in one morning. If he had predicted that one boy and two girls would be born, what were his chances of being right?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baby A</td>
<td>G</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baby B</td>
<td>G</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baby C</td>
<td>G</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How many events occurred having one baby boy and two baby girls? _________

What were Dr. Johnson’s chances of making a correct prediction? _____ in _____

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Course 5 \hspace{1cm} \textbf{Special Topics}

\textbf{Module:} \hspace{1cm} Solving Problems with Percents

\textbf{Objective:} \hspace{1cm} To practice solving everyday problems involving percents

\textbf{Name:} \hspace{1cm} \textbf{Date:} \\

- When working with practical problems, it’s important to read the problem carefully, analyze it, and set up a \underline{______________________}.
- Then, you may be able to \underline{______________________} an answer.
- Label the parts of this problem. \hspace{1cm} \hspace{1cm} 25\% \hspace{1cm} 412 \hspace{1cm} 103

\textbf{Problem Set:}
\textit{Read each problem to understand what part of the problem is missing. The missing piece could be the base, the percent, or the percentage. Then solve for that number.}

1. Lara lost 25\% of her tomato plants to bugs. She had planted 48 plants. How many plants did she lose?

2. Jared borrowed $2000 from his parents (interest free!) to help with a down payment on a house. He and has to repay it at the rate of $125 a month. What percent is $125 of the total loan?

3. The quality inspectors at Acme Industries tested a batch of electrical parts. They found 180 bad parts, which was 24\% of the entire supply. How many total parts were in the batch that the inspectors tested?
4. Gloria saw a coat at the department store and put it on lay-away (or lay-by). The coat costs $75 and she will pay $15 every other week. Her payment is what percent of the total cost?

5. Tiffany is 62 inches tall. Her little brother is 50% of her height. How tall is he?

6. Helen signed up for a bus tour, but she had to cancel. The refund policy stated that anyone who cancelled would get 90% of his or her money back. She received a check for $540. How much was the original cost of the trip?

7. Sofia ordered T-shirts for a community walk-a-thon. The first part of the order arrived containing 249 T-shirts, or 60% of the requested amount. The company said the rest would arrive in a few days. How many shirts had Sofia originally ordered?

8. There are 420 students attending the junior high. During one of the weeks of flu season 63 students were out sick. What percent of the population was ill?

9. Robby ordered a cookbook costing $36. The offer said that he had to pay only 33% of the cost at a time – three easy payments! How much was each payment? Round the answer to the nearest dollar.
We've talked about three ways to describe data. The value that occurs most often in a data set is called the _________________.

A second description is the center value called the _______________. If there is an odd number of values in a data set, this center point will be the ________________ number. If there is an even number of values, the center point will be _________________.

A third way to describe data is the average or _________________.

Problem Set:
The Johnsons' home in Chicago, Illinois, uses gas for the furnace, the water heater, and the stove. Here are the gas bills for last year.

<table>
<thead>
<tr>
<th>Month</th>
<th>Gas bill</th>
<th>Month</th>
<th>Gas bill</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>$102</td>
<td>July</td>
<td>$12</td>
</tr>
<tr>
<td>February</td>
<td>$106</td>
<td>August</td>
<td>$10</td>
</tr>
<tr>
<td>March</td>
<td>$89</td>
<td>September</td>
<td>$39</td>
</tr>
<tr>
<td>April</td>
<td>$54</td>
<td>October</td>
<td>$52</td>
</tr>
<tr>
<td>May</td>
<td>$46</td>
<td>November</td>
<td>$76</td>
</tr>
<tr>
<td>June</td>
<td>$32</td>
<td>December</td>
<td>$90</td>
</tr>
</tbody>
</table>

What is the average gas bill for the first half of the year? __________ What is the average for the last half of the year? __________ What is the average for the two most expensive months? __________

For the next two questions, round your answer to two decimals.
What is the average for the colder months, October through March? __________
What is the average for the warmer months, April through September? __________
The gas company sent a letter to the Johnsons asking if they want to pay on the budget plan. The gas company offered a monthly rate of $70, which would make the payment the same each month. Let’s look at the data to see if this is a good offer for the Johnsons.

1. For how many months is the budget amount greater than the real cost? _____
   On average, how much more is it? ___________________

2. How many months is the budget amount less than the real cost? __________
   On average, how much less is it? _________________

3. Graph the Johnsons' gas bill by month to show the cost.

   What does this darker double line mean? _________________

Reflection:
Would you recommend that the Johnsons pay their gas bill on the budget plan?
Why or why not? ______________________________________
________________________________________________________________________

What are the advantages and disadvantages? ___________________________
________________________________________________________________________
Course 5  Special Topics

Module: Solving Problems with Probability

Objective: To investigate common events that involve probability

Name: _______________________  Date: __________________

➢ Probability is a measure of how likely it is that an __________________ will occur.

➢ The sample space is a collection of all possible ____________________.

➢ The formula for the probability of an event is:  P(event) = ______

➢ One of the steps for working with a word problem is to analyze it and then set up a ____________________.

➢ Strategy steps can be ____________________ to fit a particular situation.

Problem Set:

There are only two outcomes on a coin toss: heads or tails. This chart shows us the sample space if a coin is tossed twice.

How many possible outcomes are in this sample space? __________________

1. What is the probability of getting only heads on the two tosses? ________________

2. What is the probability of getting tails on the first toss, and heads on the second toss? ________________

3. If we’re not concerned about the order of events (as in question 2) what is the probability of getting heads one time and tails one time as outcomes? ________

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Extension Activity:
Ben and Shayla are playing a game with three colored chips. One chip is blue on one side and yellow on the other. The second is blue and red, the third is red and yellow. When the chips are tossed, Ben gets a point if two chips show the same color. Shayla gets a point if each chip shows a different color. Let's determine the fairness of this game.

This chart shows the sample spaces. Let's look at possible outcomes — the first outcome is done for you. Follow the lines and you'll see: 1st chip blue, 2nd chip blue, 3rd chip red. Use the first letter of each color to record the outcome in the Outcome column: B, B, R. The second outcome is done for you, too. What colors appear in the second outcome? __________, __________, __________. Record the outcome in the chart.

<table>
<thead>
<tr>
<th>1st chip</th>
<th>2nd chip</th>
<th>3rd chip</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>blue</td>
<td>blue</td>
<td>red</td>
<td>B, B, R</td>
</tr>
<tr>
<td>blue</td>
<td>yellow</td>
<td>red</td>
<td></td>
</tr>
<tr>
<td>blue</td>
<td>red</td>
<td>yellow</td>
<td></td>
</tr>
<tr>
<td>red</td>
<td>yellow</td>
<td>red</td>
<td></td>
</tr>
<tr>
<td>blue</td>
<td>red</td>
<td>yellow</td>
<td></td>
</tr>
<tr>
<td>blue</td>
<td>yellow</td>
<td>red</td>
<td></td>
</tr>
</tbody>
</table>

Draw the remaining lines and record the outcomes.

✓ How many possible outcomes are there? _________________
✓ In how many outcomes do two chips match? _______________
✓ In how many outcomes are all the chips different? ___________
✓ Who has the best chance to score points? Ben  Shayla
✓ Is this game fair? Yes  No
Module: Estimation Basics

Objective: To practice estimating

Name: _______________________  Date: __________________

- Estimating is when you use rounded numbers to work out an
  ______________________ answer. (approximate, exact)

- Estimating is helpful when you need to work something out
  ______________________. (on a calculator, in your head, on paper)

- ______________________ is important if you need to make sure that you
  don’t run out of something. (Overestimating, Underestimating)

- ______________________ is important when you may need to add more.
  (Overestimating, Underestimating)

Problem Set:
Estimate the answer by rounding to a whole number.

Sarah wants to lay decorative stones along the edges of her rectangular pond. The pond is 186.8 cm long and 157.2 cm wide. Each stone is 10 cm long. How many stones does she need? ____________________
Justin is buying candy bars for his classmates. He can buy bags of 12 candy bars. There are 22 people in his class including the teacher. How many bags should he buy? ____________________

Thomas is taking his brother to see a movie. Tickets cost $4.95 each. His brother wants popcorn and they both want sodas. The popcorn costs $3.89 and the sodas cost $1.07 each. How much money should Thomas bring if he plans to pay for everything? ____________________

**Extension Activity:**
In each of the following cases should you overestimate, underestimate, or not estimate at all?

The baking time needed for a pizza: ________________

The amount of paint needed for your house: ________________

Launching a space shuttle: ________________

**Reflection:**
Think of a situation where you would not want to estimate. Why shouldn’t you estimate in this situation?

________________________________________________________________
________________________________________________________________
________________________________________________________________
Module: Estimation by Clustering

Objective: To practice estimating by clustering

Name: _______________________ Date: ________________

➢ When numbers are similar, a way to make a quick estimation is called _________________.

➢ If one number isn’t close to the others, deal with it at the _______________.

➢ When numbers are close together, use a number in the _______________.

➢ The number you choose ________________ (does, does not) have to be a number on the list.

➢ Whole numbers can help if the number you choose is easy to ________________ or ________________.

➢ What would be a good number to use to estimate the total of the numbers 274, 291, 316, and 330? ________________

Problem Set:
Estimate by using clustering.
1. Erin and Rachel are buying decorations for a birthday party. They are going to split the cost, but Erin pays for everything at the store. How much should Rachel pay Erin if these are the items that they bought?

   $3.09   balloons
   $2.99   streamers
   $3.25   birthday sign
   $2.70   birthday candles
2. Tim's cart will hold a maximum weight of 100 kilograms. He has boxes with the following weights in kilograms: 26.8, 24.5, 25.7, 26.2, and 25.9. Can he carry all of the boxes in one load without going over the maximum weight?

3. Estimate how much Laura has spent on groceries in the past month. Here is a list of what she has spent:

- July 6: $32.40
- July 13: $28.77
- July 20: $30.89
- July 27: $29.24

4. Dan counts the number of shrubs he sells at the greenhouse every day. Here is a list for one week: 19, 21, 22, 20, 18. Estimate how many shrubs he sold that week.

Extension Activity:
Add the actual dollar amounts in problem 3. What is the difference between the actual amount and your estimation?

________________________________________________________________
________________________________________________________________

Reflection:
Explain the process of estimating by clustering.

________________________________________________________________
________________________________________________________________

What should you do if one number is not close to the others?

________________________________________________________________
________________________________________________________________

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Module: Scaling and Proportion, Part 1

Objective: To investigate scaling and proportion

Name: _______________________  Date: __________________

➢ A ______________ _____________ can be used for showing items that are too big or too small to be shown as their actual size.

➢ Actual distances can be calculated by using the scale or ______________ of a scale drawing.

➢ Everything in a scale drawing is ______________. (estimated, proportional, smaller, bigger)

➢ If 1 centimeter represents 50 centimeters, the ratio is ______________.

➢ A representational diagram ______________ show objects in proportion or drawn to scale. (does, does not)

Problem Set:

Answer the following questions about the scale drawing of the gift.

Scale: 1 cm : 10 cm

1. All sides of this gift are in proportion. True or False? ______________

2. What is the ratio? ______________

What does this mean? _________________________________________

____________________________________________________________
3. What are the dimensions of the real gift?

__________________
__________________
__________________

4. Jenny bought this gift for her sister’s birthday. Could she hide it on her closet shelf if the shelf measured 40cm X 10cm X 10cm? Yes or no? ______________

Extension Activity:
Use the space provided to make your own scale drawing of an object in the room. Include the scale.

Reflection:
Why is a scale drawing better than a representational diagram?
________________________________________________________________
________________________________________________________________
________________________________________________________________

In what kind of situation would it make more sense to use a representational diagram instead of a scale drawing?
________________________________________________________________
________________________________________________________________
________________________________________________________________
Module: Scaling and Proportion, Part 2

Objective: To practice using ratios to find the actual size of an object

Name: _______________________  Date: __________________

- Scale drawings are very useful for determining the ________________ ________________ of objects.
- The ratio of 1:50 means that 1 centimeter represents ________________ centimeters.
- If the ratio on a drawing is 1:30, everything is ________________.
  (scaled up, scaled down, actual size)
- If the ratio on a drawing is 30:1, everything is ________________.
  (scaled up, scaled down, actual size)

Problem Set:
Jim wants to plant a vegetable garden in the spring. He has decided to create a scale drawing to help him plan. Answer the following questions about his drawing.

1. Jim decides to use a ratio of 1:50 (centimeters). If his drawing is 12 X 12 centimeters, how big is his garden in centimeters? ________________
   In meters? ________________
Extension Activity:
Use the space below to make a scale drawing of Jim’s garden. Plant five evenly spaced rows of vegetables in the garden. Show the scale and answer the questions:

How far apart are the rows on his drawing?  ____________________________

How far apart are the rows in the actual garden?  ____________________________

Reflection:
Why do you think it is important to work with units that match the units being used by the scale drawing? What would happen if you didn’t match the units?

________________________________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________
Course 6  Introduction to Functions

Module:  Patterns and Sequences

Objective:  To study patterns and to practice predicting what comes next

Name: _______________________  Date: __________________

➢ A _____________ is a sequence or series of items that is determined by a set of rules.

➢ Here are three strategies that can help you find the rule of a pattern. Use each strategy once to fill in the blanks below next to the situation when it is most useful.

   Make a table
   Label items with letters
   Write down the differences between items

1. _____________________________ to help see the repeating pattern. Use this strategy when a pattern has a set of items that repeat, like patterns in jewelry, or a tile floor.

2. _____________________________ to help see patterns such as growth patterns, in which items increase or decrease in a regular way.

3. _____________________________ so that it’s easier to see how adjacent items are related. Use this strategy for mathematical patterns and some repeating patterns.

Problem Set:

1. You decide to design a bracelet for your friend. Use the bracelet below to create a pattern by coloring in some of the spaces. Leave the last two columns blank and have your friend complete your pattern.
2. Aidan is starting a new exercise program. He plans to follow this schedule:

Predict the number of minutes he will run during week 5.

<table>
<thead>
<tr>
<th>Week</th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>29</td>
</tr>
<tr>
<td>4</td>
<td>36</td>
</tr>
<tr>
<td>5</td>
<td>?</td>
</tr>
</tbody>
</table>

3. The mayor is concerned about the growing population in her small town. She has been tracking the population in her town every 2 years.

Predict the population for year 9.

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>500</td>
</tr>
<tr>
<td>3</td>
<td>1000</td>
</tr>
<tr>
<td>5</td>
<td>2000</td>
</tr>
<tr>
<td>7</td>
<td>4000</td>
</tr>
<tr>
<td>9</td>
<td>?</td>
</tr>
</tbody>
</table>

**Extension Activity:**
On a separate piece of paper, create your own pattern. Make a table to describe the pattern. In the space provided, write a question to ask a friend about your pattern.

________________________________________________________________________

Now ask your friend to solve it.

**Reflection:**
Describe how you created your pattern.

________________________________________________________________________

What strategies did your friend use to predict the next element in your pattern?

________________________________________________________________________
A function is a particular kind of relationship where each input leads to exactly one output.

One set of numbers determines the other. Input determines ______________. Or you could say that what comes out depends upon what goes in.

The rule for the function describes how what goes in leads to what comes ______________.

Problem Set:

1. Grandma’s Attic bookstore charges a standard delivery charge for each order and an extra fee for each pound. Samantha needs to determine her delivery charge. This table shows the pattern:

<table>
<thead>
<tr>
<th>Pounds (p)</th>
<th>Cost in Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6.00</td>
</tr>
<tr>
<td>5</td>
<td>8.50</td>
</tr>
<tr>
<td>10</td>
<td>11.00</td>
</tr>
<tr>
<td>15</td>
<td>13.50</td>
</tr>
<tr>
<td>20</td>
<td>16.00</td>
</tr>
</tbody>
</table>

Describe your observations of the table. ______________________________

______________________________

Write the rule that describes Grandma’s Attic’s delivery charge. Let \( p \) represent pounds.

______________________________
2. In this table, the input and output values are related. If you know the input, you can predict the output.

<table>
<thead>
<tr>
<th>Input (x)</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
</tr>
</tbody>
</table>

Describe your observations of the table. _________________________

___________________________________________________________

Write the rule that describes how the output depends on the input. Let \( x \) represent input.

3. The local factory has a deadline to meet. The manager knows that the number of packages ready to ship relates to the number of people working on the project. This table shows the pattern:

<table>
<thead>
<tr>
<th>People (p)</th>
<th>Packages</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>25</td>
<td>50</td>
</tr>
</tbody>
</table>

Describe your observations of the table. _________________________

___________________________________________________________

Write the rule. Let \( p \) represent people.

**Extension Activity:**
Create a table using this rule: \( 2s + 5 \). Generate data, and create a word problem that would fit this rule and generated data. Use an extra sheet of paper if you need more space.
You can use functions to describe many daily situations.

A function can be represented by three different tools:

1. ____________________   3.   ____________________
2. ____________________

Problem Set:

1. Alex has 200 picture books in her classroom. She wants to build a bookcase to hold all of her books. She has 15 shelves, and she knows that each shelf can hold a maximum of 20 books. She makes a set of function tools so she can predict the number of books she’ll have left as she adds each shelf. She describes the function as:
   **Remaining books (y) is a function of the number of shelves (x).**

   Use the equation tool to answer the question: \( y = 200 - 20(x) \)

   How many books will remain after she has built 5 shelves?

2. Alex creates a table.
   **Remaining books (y) is a function of the number of shelves (x).**

   Use the table to answer the question:

   How many books will remain after she has built 8 shelves?

<table>
<thead>
<tr>
<th>Number of shelves (x)</th>
<th>Remaining books (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>160</td>
</tr>
<tr>
<td>4</td>
<td>120</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
</tr>
</tbody>
</table>
3. Alex makes a graph to help her decide how many shelves she wants to build. Use the graph to complete the table.

<table>
<thead>
<tr>
<th>Number of shelves ((x))</th>
<th>Remaining books ((y))</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>160</td>
</tr>
<tr>
<td>4</td>
<td>120</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

Check her work.  
Do the table and the graph represent the same function?

**Reflection:**  
Depending on the information you need, you may choose to represent a function with an equation, a table, or a graph. Think about the three different tools. Write one reason why each tool is uniquely helpful.

**Equation:** ____________________________________________________________  
________________________________________________________________  
________________________________________________________________  
________________________________________________________________  

**Table:**  ______________________________________________________________  
________________________________________________________________  
________________________________________________________________  

**Graph:**  ______________________________________________________________  
________________________________________________________________  
________________________________________________________________  

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Module: Linear Patterns

Objective: To practice identifying linear functions from a graph, a table, or an equation

Name: _______________________  Date: __________________

The graph of a linear function is a ______________ line.

A table that has regular differences between inputs and ______________ differences between outputs describes a linear function.

In a linear equation, you can ______________ x by a number and ______________ a number to that product.

The coefficient of x in a linear equation can be which of the following? (Check all that apply.)

____ zero  ____ a fraction  ____ positive  ____ negative
____ a variable  _____ a whole number

The number you add to that product in a linear equation can be which of the following? (Check all that apply.)

____ zero  ____ a fraction  ____ positive  ____ negative
____ the variable squared  _____ a whole number

In a linear equation, x is raised to the power of _______.

Problem Set:
Label each graph "linear" or "nonlinear."

1. ___________  2. ___________  3. ___________  4. ___________
Write the differences between the $x$-values and the differences between the $y$-values in the tables below. Then label each table "linear" or "nonlinear."

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$x$</td>
<td>$y$</td>
<td>$x$</td>
<td>$y$</td>
<td>$x$</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
<td>3</td>
<td>33</td>
<td>-5</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>7</td>
<td>39</td>
<td>-6</td>
</tr>
<tr>
<td>5</td>
<td>26</td>
<td>11</td>
<td>41</td>
<td>-7</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
<td>15</td>
<td>50</td>
<td>-8</td>
</tr>
</tbody>
</table>

5. _________  6. _________  7. _________  8. _________

If necessary, rewrite the equations in the form $y = □x + □$. Then label each equation "linear" or "nonlinear."

9. $y = 15$  10. $y = (3 + x)(x - 4)$

11. $y = 14x^2 - 14$  12. $y + 3 = 2x$

13. $y = 1.5x + x$  14. $y + 5 = \sqrt{x}$

Reflection:
You've seen examples of several functions, often in a context from everyday life. Find a situation from your own life from which you can gather data. Describe the situation and include the data. Then tell whether you think it is a linear function or not and why. Use an extra sheet of paper if needed.

______________________________________________________________
______________________________________________________________
______________________________________________________________
______________________________________________________________
______________________________________________________________
______________________________________________________________
To find the ______ of a linear graph, you need to find this quotient:
\[
\frac{\text{change in } y}{\text{change in } x}
\]

The y-intercept is the value for _____ at the point on the graph where ____ = 0.

The slope of a line can be which of the following? (Check all that apply.)

____ zero      ____ positive      ____ negative      ____ undefined

A horizontal line has what type of slope? ______________

A vertical line has what type of slope? ______________

A line with a positive slope rises/falls as you move to the right on the graph (circle one).

A line with a negative slope rises/falls as you move to the right on the graph (circle one).

Problem Set:
Write the slope and y-intercept of each graph.

1. slope: _____  y-intercept: _____  
2. slope: _____  y-intercept: _____
Course 6  

Introduction to Functions

3. slope: ____  y-intercept: ____  

4. slope: ____  y-intercept: ____

5. slope: ____  y-intercept: ____  

6. slope: ____  y-intercept: ____

Extension:
On the grids, draw and label the x- and y-axes. Then use the y-intercept and slope given below to plot two points and draw the line.

1. slope: 1, y-intercept: 0
2. slope: \(-\frac{1}{3}\), y-intercept: -2
3. slope: \(\frac{3}{4}\), y-intercept: 3
4. slope: -2, y-intercept: -1

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The coefficient of $x$ in a linear equation in the form $y = ax + b$ is the __________ of the graphed line, and the constant is the __________.

If the slope is 3 and the $y$-intercept is -2, the equation is $y = \underline{________}.$

If the slope is $-\frac{3}{5}$ and the $y$-intercept is 0, the equation is $y = \underline{________}.$

If the slope is 1 and the $y$-intercept is 0.5, the equation is $y = \underline{________}.$

The steps for writing a linear equation from a graph are the following:
• Find the __________.
• Count the number of units you move up or down and to the right to arrive at a second point. This tells you the __________ of the line.
• Use those values to write the equation.

The steps for graphing a linear function from its equation are the following:
• Plot the __________.
• Use the __________ to plot a second point.
• Draw a line connecting the two points.

Problem Set:
Find the slope and $y$-intercept of each graph; then write the equation.
1. slope: ___  $y$-intercept: ___  equation: _______________  
2. slope: ___  $y$-intercept: ___  equation: _______________
Determine the $y$-intercept and slope from each equation. Then use those values to draw the graph.

5. $y = 2x - 3$

6. $y = -\frac{2}{3}x$

Reflection:
You've seen that a table like the one below, with regular differences between inputs and outputs, represents a linear function. Think about what you know about slope and explain why you think the outputs are regularly spaced in a linear function when the inputs are also regularly spaced.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>5</td>
<td>26</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
</tr>
</tbody>
</table>
Module: Interpreting Graphs to Solve Problems

Objective: To practice solving problems and answering questions based on linear graphs that represent real-life situations

Name: _______________________  Date: __________________

- With a graph, you can use a value on the $x$-_______ to find a corresponding value on the $y$-_______, such as time and ________.
- With a system of graphs, the point at which two or more graphed lines ________________ is called the break-even point. One example of the break-even point is the point where two or more products or services cost the ________ amount.
- A graph can help you plot your progress toward a goal. To do this, you compare your actual performance at a given time to the _____________ line that represents your goal over time. Then you determine if you are above, ___________, or at your goal.
- List two everyday situations in your life that you might graph.
  __________________________________________________________,
  __________________________________________________________

Problem Set:
Franklin and Maitlin are participating in a walkathon and they are gathering sponsors. They each hope to raise $15 a week for the next 6 weeks. The graphed line below represents their goal. Look at the graph and answer the questions.
1. At week 5, how many dollars does Franklin hope to have raised? _____
2. At week 2, how many dollars does Maitlin hope to have raised? _____
3. Suppose Maitlin raises $15 during week 1. Plot the point on the graph that represents her progress and write in the point's coordinates. Then tell whether she is at her goal or how far above or below she is from her goal.
   _________________________________________________________________
4. Suppose Franklin has raised $47 at week 4. Plot the point on the graph that represents his progress and write in the point's coordinates. Tell whether he is at his goal or how far above or below he is from his goal.
   _________________________________________________________________
5. Suppose Maitlin has raised $79 at week 5. Plot the point on the graph that represents her progress and write in the point's coordinates. Tell whether she is at her goal or how far above or below she is from her goal.
   _________________________________________________________________

Reflection:
If you used a table instead of a graph to plot a goal, such as the one showing Maitlin and Franklin's fundraising goal, would it be as helpful? Explain why.
   _________________________________________________________________
   _________________________________________________________________
   _________________________________________________________________
   _________________________________________________________________

Describe a situation that you might graph from your own life that would have a break-even point.
   _________________________________________________________________
   _________________________________________________________________
   _________________________________________________________________
   _________________________________________________________________