Packet Directions for Students

Week 3
- Read through the Instruction and examples on Graphing Quadratic Functions while completing the corresponding questions on the 11.4.1 Study: Graphs of Quadratic Functions worksheet

- Complete 11.4.2 Study: Graphs of Quadratic Functions
  - Check and revise solutions using the 11.4.2 Study: Graphs of Quadratic Functions Answer Key

- Complete Quiz – Graphs of Quadratic Functions

Week 4
- Read through the Instruction and examples on Solving Multi-Step Linear Equations while completing the corresponding questions on the 2.1.1 Study: Solving Multi-Step Linear Equations worksheet

- Complete 2.1.2 Study: Solving Multi-Step Linear Equations
  - Check and revise solutions using the 2.1.2 Study: Solving Multi-Step Linear Equations Answer Key

- Complete Quiz – Solving Multi-Step Linear Equations
Graphs of Quadratic Functions
The word *quadratic* comes from the Greek word for "square." But when you graph a quadratic function, you don't draw a square — or anything straight, for that matter.

Graphing quadratic equations can help solve real problems. Why not? All quadratic functions are parabolas. That means their graphs are curves. So why does anyone want to graph quadratic functions? For the same reason they want to solve quadratic equations — to solve real problems. In fact, some problems are easier to solve with a graph than with an equation. The curve can lead you straight to the answer!

In this lesson, you'll learn how to do it.

**Objectives**
- Find the vertex and intercepts of the graph of a quadratic function from an equation.
- Use the quadratic formula to find the vertex of a given function.
- Identify the vertex of a graph from vertex form.
- Sketch the graph of a quadratic equation.
- Write a quadratic equation from its graph.
- Compare properties of two quadratic functions, one represented algebraically, and one represented graphically.

The graphs of quadratic functions are parabolas. One way to sketch the graph of a quadratic function is to plot some points and connect them. It's usually helpful to plot the vertex of a parabola, the $y$-intercept, and the $x$-intercepts.

**Identifying the $y$-Intercept**
While plotting points will always help in graphing, you may need to plot quite a few points before you see a pattern. It's usually easier to use an equation to identify key points on the graph. These include:
- vertex of a parabola
- $x$-intercepts
- $y$-intercept

The $y$-intercept is the point where the graph crosses the $y$-axis. The $x$-value of the $y$-intercept is always 0. To find the $y$-value, substitute $x = 0$ into the equation.
Example: Graph \( y = x^2 - 2x - 3 \). (Identify the \( y \)-intercept.)

\[
\begin{align*}
y &= x^2 - 2x - 3 \\
y &= 0^2 - 2 \cdot 0 - 3 \\
y &= -3
\end{align*}
\]

The \( y \)-intercept is (0, –3). Plot this point on the graph.

**Identifying the \( x \)-Intercepts**

The points where the graph crosses the \( x \)-axis are the \( x \)-intercepts. The \( y \)-value of these points is 0. The \( x \)-value of an \( x \)-intercept is called a zero of the function.

The zeros of a function are related to the roots, or solutions, of a related equation (one that shows 0 in place of \( y \)). To find the zeros of a quadratic function (if they exist), set \( y \) equal to 0, factor the quadratic expression, and then solve for \( x \).

**Example:** Graph \( y = x^2 - 2x - 3 \). (Identify the \( x \)-intercepts.)

\[
\begin{align*}
y &= x^2 - 2x - 3 \\
0 &= x^2 - 2x - 3 \\
0 &= (x + 1)(x - 3)
\end{align*}
\]

\[
\begin{align*}
x + 1 &= 0 \Rightarrow x = -1 \\
x - 3 &= 0 \Rightarrow x = 3
\end{align*}
\]

The solutions, –1 and 3, are the zeros of the function. So, the \( x \)-intercepts are (–1, 0) and (3, 0). Plot these points on the graph.
Algebra 1:  Weeks 3-4, April 20 – May 1

Finding the Vertex
The vertex of a parabola is halfway between the x-intercepts, which makes it easy to find its x-coordinate. In fact, the x-coordinate of the vertex is the average of the x-coordinates of the x-intercepts.

Example: Graph \( y = x^2 - 2x - 3 \). (Identify the vertex.)
As you saw on the previous page, the x-intercepts of \( y = x^2 - 2x - 3 \) are \((-1, 0)\) and \((3, 0)\). To find the x-value of the vertex, find the average of the x-coordinates.

\[
\frac{-1 + 3}{2} = \frac{2}{2} = 1
\]

The x-coordinate of the vertex is 1. Now you need to find the y-coordinate. Substitute the x-coordinate into the original equation and solve for y.

\[
y = x^2 - 2x - 3
y = 1^2 - 2 \cdot 1 - 3
y = 1 - 2 - 3 = -4
\]

The y-coordinate of the vertex is -4. So the vertex is \((1, -4)\). Plot this point on the graph.

Sketching the Graph
Now that you have identified the vertex and the x- and y-intercepts, you can sketch the graph of \( y = x^2 - 2x - 3 \). Draw a smooth curve through all of the plotted points. Like all quadratic functions, it will be in the shape of a parabola. The vertex will be the minimum or maximum point.

Example: Graph \( y = x^2 - 2x - 3 \). (Sketch the graph.)
Quadratic Formula and the x-Value of the Vertex

You just saw how to factor quadratic trinomials to find x-intercepts. You were then able to use those x-intercepts to find the vertex of a parabola. But what happens if you cannot factor a trinomial? Another way to find the solutions of a quadratic equation is to use the quadratic formula. You can rewrite the formula to show two parts.

\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \rightarrow \quad \frac{-b}{2a} \pm \frac{\sqrt{b^2 - 4ac}}{2a} \]

<table>
<thead>
<tr>
<th>( \frac{-b}{2a} )</th>
<th>The first part of the formula gives you the x-coordinate of the vertex.</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \pm \frac{\sqrt{b^2 - 4ac}}{2a} )</td>
<td>The second part of the formula gives you the horizontal distance of each x-intercept from the vertex.</td>
</tr>
</tbody>
</table>

Remember, the vertex of a parabola is located exactly halfway between the parabola's x-intercepts. If you know the x-coordinate of the vertex, you can add and subtract the same amount to find the location of the x-intercepts.

**Example:** \( y = x^2 - 10x + 16 \)

**Use the Quadratic Formula to Find the Vertex**

Now you can find the x-coordinate of the vertex without having to find the x-intercepts first.

\[ x = \frac{-b}{2a} \]

To find the y-coordinate of the vertex, substitute the x-coordinate into the original equation and solve for \( y \).

**Example:** \( y = x^2 - 10x + 16 \)

\[ x = \frac{-b}{2a} = \frac{-(-10)}{2 \cdot 1} = \frac{10}{2} = 5 \]

Substitute \( x = 5 \) into the original equation.

\[
y = 5^2 - 10(5) + 16 = -9
\]

The vertex is (5, -9).
Using the Quadratic Formula to Graph a Function

To graph a quadratic function, you need at least three points. If you can't factor the quadratic expression, you can use the quadratic formula to approximate the x-intercepts.

**Example:** \( y = x^2 - 2x - 5 \)

To factor the quadratic expression, you need to find two numbers that have a product of \(-5\) and a sum of \(-2\). There aren't any such numbers.

- Use the quadratic formula to find the zeros of the function.

\[
x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-5)}}{2(1)} = \frac{2 \pm \sqrt{24}}{2} = \frac{2 \pm 2\sqrt{6}}{2} = 1 \pm \sqrt{6}
\]

\( x = 1 + \sqrt{6} \approx 3.45 \quad \text{OR} \quad x = 1 - \sqrt{6} \approx -1.45 \)

The x-intercepts are located at approximately \((3.45, 0)\) and \((-1.45, 0)\).

- Use the first part of the quadratic formula to find the vertex of the function.

\[
x = -\frac{b}{2a} = -\frac{-2}{2 \cdot 1} = 1 \quad y = x^2 - 2x - 5
\]

\[
y = 1^2 - 2 \cdot 1 - 5 = -6
\]

The vertex is located at \((1, -6)\).

- Plot these points and sketch the parabola.

\[
y = x^2 - 2x - 5
\]
Use Vertex Form to Find the Vertex
It's easy to identify the vertex of a parabola, \((h, k)\), when the function is in vertex form. 
\[ y = a(x - h)^2 + k \]
Be careful with signs. The value of \(k\) will have the same sign shown in the equation. The value of \(h\) will have the opposite sign.
For example, the vertex of \(y = (x + 2)^2 - 1\) is \((-2, -1)\).

Graphing from Vertex Form
After you identify the vertex from vertex form, you need to find a couple more points before sketching the graph. An easy point to plot is the \(y\)-intercept.
The \(x\)-value of the \(y\)-intercept is \(0\). Substitute \(x = 0\) into your equation to find the \(y\)-value of the \(y\)-intercept.
**Example:** \(y = (x - 3)^2 + 7\)
- The vertex is \((3, 7)\).
- The \(y\)-coordinate of the \(y\)-intercept is \(y = (0 - 3)^2 + 7 = 2\).
- The \(y\)-intercept is \((0, 16)\).

You now have two points. Plot these on a graph.
Notice that the side of the parabola containing the \(y\)-intercept is to the left of the vertex. To sketch the parabola, you also need a point on the right side of the vertex. To find a point on the right, choose an \(x\)-value that is greater than 3 (the \(x\)-value of the vertex) to substitute into the equation.

Try an \(x\)-value of \(6\). Find the \(y\)-coordinate.
When \(x = 6\), \(y = (6 - 3)^2 + 7 = 16\). So, another point on the parabola is \((6, 16)\). Plot this point and sketch a parabola through the three points.
Writing a Function from a Graph

Not only can you use an equation to find the $x$-intercepts of a quadratic function, but you can also use the $x$-intercepts to find an equation.

Remember, the zeros are the values where the function is equal to 0. So if $(a, 0)$ is an $x$-intercept, then $(x - a)$ is a factor of the quadratic function.

For example, the graph shows zeros of 2 and 6. The factors of the function that represent the graph must be $(x - 6)$ and $(x - 2)$, and the function, in factored form, is $y = (x - 6)(x - 2)$.

To write the function in standard form, multiply the binomials.

Compare Graphs and Functions

Marc stands at the top of a 5 m building and throws a ball up into the air. The equation representing his ball's height ($y$) over time ($x$) is $y = -5x^2 + 5x + 10$.

Marcy stands at the top of a taller building and throws her ball up twice as fast. The graph shows the height of Marcy's ball over time.

The maximum height of each ball can be identified from the vertex of the parabola. Compare the maximum heights of the two balls.
11.4.1 Study: Graphs of Quadratic Functions

Name:
Date:

Use the questions below to keep track of key concepts from this lesson's study activity.

Key Terms
In your own words, write a definition for each key term listed below.

x-intercepts:

vertex of a parabola:

1) Fill in the blanks.
To sketch the graph of a quadratic function, plot some points and connect them. The graph will be in the shape of a(n) ____________.
You can use the function’s equation to identify key points on the graph. These key points include the ____________, ____________, and ____________.
Main idea The x-coordinate of the y-intercept is 0.

2) Use the given steps to complete the example.

<table>
<thead>
<tr>
<th>How to Find the y-Intercept</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Parabola: $y = x^2 - 6x + 8$</td>
</tr>
<tr>
<td>Substitute 0 for x. Solve for y.</td>
<td>y-intercept: ________</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
</tr>
<tr>
<td>Write the results as an ordered pair, (0, y).</td>
<td></td>
</tr>
</tbody>
</table>

Main idea The y-coordinate of any x-intercept is zero.

3) Use the given steps to complete the example.

<table>
<thead>
<tr>
<th>How to Find the x-Intercepts of a Parabola</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Parabola: $y = x^2 - 6x + 8$</td>
</tr>
<tr>
<td>Start with an equation in standard form: $y = ax^2 + bx + c.$</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
</tr>
<tr>
<td>Substitute 0 for y.</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
</tr>
</tbody>
</table>
**Factor the trinomial.**

**Step 4**
Use the zero product rule to solve for $x$.

**Step 5**
Write the results from Step 4 as ordered pairs $(x, 0)$.

$x$-intercepts: _______ and _______

**Main idea** The $x$-coordinate of the vertex is the average of the $x$-coordinates of the $x$-intercepts.

4) Use the given steps to complete the example.

<table>
<thead>
<tr>
<th>How to Find the Vertex of a Parabola</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Parabola: $y = x^2 - 6x + 8$</td>
</tr>
<tr>
<td>Find the average of the $x$-coordinates of the $x$-intercepts to find $x$.</td>
<td>$x$-intercepts: $(2, 0)$ and $(4, 0)$</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
</tr>
<tr>
<td>Substitute that $x$-value into the parabola's equation to find $y$.</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
</tr>
<tr>
<td>Write the results from Steps 1 and 2 as an ordered pair, $(x, y)$.</td>
<td></td>
</tr>
<tr>
<td>Vertex: __________</td>
<td></td>
</tr>
</tbody>
</table>
Algebra 1: Weeks 3-4, April 20 – May 1

5) Sketch the graph of a quadratic function.
Sketch the graph of \( y = x^2 - 6x + 8 \). Start by identifying and plotting the points you found in questions 2 – 4.

\[ y \text{-intercept: } \quad \text{x-intercepts: } \}
\[ \text{vertex: } \]

Main idea You can use the first part of the quadratic formula to find the vertex of a parabola.

6) Use the given steps to complete the example.

<table>
<thead>
<tr>
<th>How to Find the Vertex of a Parabola</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 Identify ( a ) and ( b ) in the function.</td>
<td>Parabola: ( y = 3x^2 + 12x + 1 )</td>
</tr>
<tr>
<td>Step 2 Find the x-value of the vertex: ( \frac{-b}{2a} )</td>
<td></td>
</tr>
<tr>
<td>Step 3 Substitute the result from Step 2 into the parabola equation and solve for ( y ).</td>
<td></td>
</tr>
<tr>
<td>Step 4 Write the results from Steps 2 and 3 as an ordered pair.</td>
<td>Vertex: ( )</td>
</tr>
</tbody>
</table>
7) Fill in the blanks.

To graph a parabola from vertex form, start by identifying and plotting the _______.
The vertex of $y = a(x - h)^2 + k$ is _______.
The vertex of $y = -4(x + 2)^2 - 7$ is _______.
Main idea If $a$ is the $x$-coordinate of an $x$-intercept, then $(x - a)$ is a factor of the quadratic equation.

8) Use the given steps to complete the example.

<table>
<thead>
<tr>
<th>How to Use $x$-Intercepts to Write the Equation for a Parabola</th>
<th>Example</th>
</tr>
</thead>
</table>
| Step 1  
Start with the $x$-coordinates of the $x$-intercepts.  
Step 2  
Write them as factors: $(x - a)$.  
Step 3  
Use FOIL to multiply the factors.  
Step 4  
Write the product in an equation equal to $y$. | $x$-intercepts: $(2, 0)$ and $(4, 0)$  
Equation: ___________________________ |
11.4.1 Study: Graphs of Quadratic Functions

**ANSWER KEY**

**Key Terms**

In your own words, write a definition for each key term listed below.

- **x-intercepts:**
  Points where the graph of a function crosses or touches the x-axis. A function may have 0, 1, 2, or more x-intercepts.

- **vertex of a parabola:**
  The point on a parabola where it changes directions. The vertex is the point where the parabola intersects its axis of symmetry.

1) Fill in the blanks. (Pages 1 – 2)

To sketch the graph of a quadratic function, plot some points and connect them. The graph will be in the shape of a(n) **parabola**.

You can use the function's equation to identify key points on the graph. These key points include the **vertex**, **x-intercepts**, and **y-intercept**.

**Main idea** The x-coordinate of the y-intercept is 0. (Page 2)

2) Use the given steps to complete the example.

<table>
<thead>
<tr>
<th>How to Find the y-Intercept</th>
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<tbody>
<tr>
<td><strong>Step 1</strong> Substitute 0 for x. Solve for y.</td>
<td><strong>Parabola</strong>: ( y = x^2 - 6x + 8 )</td>
</tr>
<tr>
<td><strong>Step 2</strong> Write the results as an ordered pair, (0, y).</td>
<td>( y = 0^2 - 6(0) + 8 = 8 )</td>
</tr>
</tbody>
</table>

**y-intercept**: \( (0, 8) \)

**Main idea** The y-coordinate of any x-intercept is 0.

3) Use the given steps to complete the example. (Page 3)

<table>
<thead>
<tr>
<th>How to Find the x-Intercepts of a Parabola</th>
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<tbody>
<tr>
<td><strong>Step 1</strong> Start with an equation in standard form: ( y = ax^2 + bx + c ).</td>
<td><strong>Parabola</strong>: ( y = x^2 - 6x + 8 )</td>
</tr>
<tr>
<td><strong>Step 2</strong> Substitute 0 for y.</td>
<td>( 0 = x^2 - 6x + 8 )</td>
</tr>
<tr>
<td><strong>Step 3</strong> Factor the trinomial.</td>
<td>( 0 = (x - 4)(x - 2) )</td>
</tr>
<tr>
<td><strong>Step 4</strong> Use the zero product rule to solve for x.</td>
<td>( x - 4 = 0 \quad \quad \quad x - 2 = 0 )</td>
</tr>
<tr>
<td></td>
<td>( x = 4 \quad \quad \quad x = 2 )</td>
</tr>
</tbody>
</table>

**x-intercepts**: \( (4, 0) \) and \( (2, 0) \)
Step 5
Write the results from Step 4 as ordered pairs \((x, 0)\).

**Main idea** The \(x\)-coordinate of the vertex is the average of the \(x\)-coordinates of the \(x\)-intercepts.

4) Use the given steps to complete the example. (Page 4)

<table>
<thead>
<tr>
<th>How to Find the Vertex of a Parabola</th>
<th>Example</th>
</tr>
</thead>
</table>
| **Step 1** Find the average of the \(x\)-coordinates of the \(x\)-intercepts to find \(x\). | **Parabola**: \(y = x^2 - 6x + 8\)  
**x-intercepts**: \((2, 0)\) and \((4, 0)\)  
\[\text{Average} = \frac{2 + 4}{2} = 3\]  
\[y - (3)^2 - 6(3) + 8\]  
\[y = 9 - 18 + 8\]  
\[y = -1\]  
**Vertex**: \((3, -1)\) |
| **Step 2** Substitute that \(x\)-value into the parabola's equation to find \(y\). |
| **Step 3** Write the results from Steps 1 and 2 as an ordered pair, \((x, y)\). |

5) Sketch the graph of a quadratic function. (Pages 6 – 7)
Sketch the graph of \(y = x^2 - 6x + 8\). Start by identifying and plotting the points you found in questions 2 – 4.

- \(y\)-intercept: \((0, 8)\)
- \(x\)-intercepts: \((4, 0)\), \((2, 0)\)
- vertex: \((3, -1)\)

**Main idea** You can use the first part of the quadratic formula to find the vertex of a parabola.
6) Use the given steps to complete the example. (Pages 9 – 10)

**How to Find the Vertex of a Parabola**

<table>
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<tr>
<th>Step</th>
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<tr>
<td><strong>Step 1</strong></td>
<td>Identify $a$ and $b$ in the function.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Find the $x$-value of the vertex: $\frac{-b}{2a}$.</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Substitute the result from Step 2 into the parabola equation and solve for $y$.</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Write the results from Steps 2 and 3 as an ordered pair.</td>
</tr>
</tbody>
</table>

**Example**

Parabola: $y = 3x^2 + 12x + 1$
- $a = 3$
- $b = 12$
- $\frac{-b}{2a} = \frac{-12}{6} = -2$
- $y = 3(-2)^2 + 12(-2) + 1$
- $y = 12 - 24 + 1$
- $y = -11$

Vertex: $(-2, -11)$

7) Fill in the blanks. (Pages 13 – 15)

To graph a parabola from vertex form, start by identifying and plotting the vertex.

The vertex of $y = a(x - h)^2 + k$ is $(h, k)$.

The vertex of $y = -4(x + 2)^2 - 7$ is $(-2, -7)$.

**Main idea** If $a$ is the $x$-coordinate of an $x$-intercept, then $(x - a)$ is a factor of the quadratic equation.

8) Use the given steps to complete the example. (Pages 17 – 18)

**How to Use $x$-Intercepts to Write the Equation for a Parabola**

<table>
<thead>
<tr>
<th>Step</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Start with the $x$-coordinates of the $x$-intercepts.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Write them as factors: $(x - a)$.</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Use FOIL to multiply the factors.</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Write the product in an equation equal to $y$.</td>
</tr>
</tbody>
</table>

**Example**

$x$-intercepts: (2, 0) and (4, 0)
- $x$-coordinates: 2 and 4
  - factors $= (x - 2)(x - 4)$
  - $(x - 4)(x - 2) = x^2 - 6x + 8$
  - $y = x^2 - 6x + 8$

Equation: $y = x^2 - 6x + 8$
Quiz: Graphs of Quadratic Functions

Question 1a of 10
What are the vertex and x-intercepts of the graph of \( y = (x - 4)(x + 2) \)? Select one answer for the vertex and one for the x-intercepts.

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>x-intercepts: (4, 0), (−2, 0)</td>
</tr>
<tr>
<td>B.</td>
<td>x-intercepts: (−4, 0), (2, 0)</td>
</tr>
<tr>
<td>C.</td>
<td>Vertex: (−1, −5)</td>
</tr>
<tr>
<td>D.</td>
<td>Vertex: (1, −9)</td>
</tr>
<tr>
<td>E.</td>
<td>Vertex: (1, 9)</td>
</tr>
<tr>
<td>F.</td>
<td>x-intercepts: (−4, 0), (−2, 0)</td>
</tr>
</tbody>
</table>

Question 2a of 10
What are the x-intercepts of the graph of the function below?
\( y = x^2 + 3x - 28 \)

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>(7, 0) and (−4, 0)</td>
</tr>
<tr>
<td>B.</td>
<td>(7, 0) and (4, 0)</td>
</tr>
<tr>
<td>C.</td>
<td>(−7, 0) and (4, 0)</td>
</tr>
<tr>
<td>D.</td>
<td>(−7, 0) and (−4, 0)</td>
</tr>
</tbody>
</table>
### Question 3a of 10
What is the vertex of the graph of the function below?
\[ y = x^2 - 8x + 12 \]

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>(2, -4)</td>
</tr>
<tr>
<td>B.</td>
<td>(4, -4)</td>
</tr>
<tr>
<td>C.</td>
<td>(2, 0)</td>
</tr>
<tr>
<td>D.</td>
<td>(4, 0)</td>
</tr>
</tbody>
</table>

### Question 4a of 10
What are the vertex and x-intercepts of the graph of \( y = x^2 - 2x - 24 \)? Select one answer for the vertex and one for the x-intercepts.

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Vertex: (1, 23)</td>
</tr>
<tr>
<td>B.</td>
<td>Vertex: (1, -25)</td>
</tr>
<tr>
<td>C.</td>
<td>x-intercepts: (4, 0), (-6, 0)</td>
</tr>
<tr>
<td>D.</td>
<td>x-intercepts: (-4, 0), (6, 0)</td>
</tr>
<tr>
<td>F.</td>
<td>x-intercepts: (1, 0), (-7, 0)</td>
</tr>
</tbody>
</table>
Question 5a of 10
Which graph is defined by the function given below?
\[ y = (x - 1)(x + 4) \]

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Graph A</td>
</tr>
<tr>
<td>B.</td>
<td>Graph B</td>
</tr>
<tr>
<td>C.</td>
<td>Graph C</td>
</tr>
<tr>
<td>D.</td>
<td>Graph D</td>
</tr>
</tbody>
</table>
Question 6a of 10
Sketch the graph of \( y = (x - 3)^2 - 25 \), then select the graph that corresponds to your sketch.

A. Graph A
B. Graph B
C. Graph C
D. Graph D

Question 7a of 10
Which of the following graphs is described by the function given below?
\[ y = 2x^2 + 6x + 3 \]
A. Graph A
B. Graph B
C. Graph C
D. Graph D
**Question 8a of 10**
Which function describes this graph?

![Graph](image)

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>$y = (x - 2)(x - 6)$</td>
</tr>
<tr>
<td>B.</td>
<td>$y = x^2 - 2x + 6$</td>
</tr>
<tr>
<td>C.</td>
<td>$y = (x - 4)(x - 4)$</td>
</tr>
<tr>
<td>D.</td>
<td>$y = x^2 + 8x + 12$</td>
</tr>
</tbody>
</table>
Question 9a of 10
Which of the following functions best describes this graph?

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>$y = x^2 + x - 12$</td>
</tr>
<tr>
<td>B.</td>
<td>$y = x^2 - 5x + 6$</td>
</tr>
<tr>
<td>C.</td>
<td>$y = x^2 + 9x + 18$</td>
</tr>
<tr>
<td>D.</td>
<td>$y = x^2 - 9x + 18$</td>
</tr>
</tbody>
</table>
Question 10a of 10
Jacob and Jackson are on a hill by a river. Jacob throws an acorn into the river. His acorn’s path is described by the equation \( y = -3x^2 + 6x + 6 \).
Jackson is higher on the hill than Jacob. He also throws an acorn into the river. The path of his acorn is shown in the graph.

In each function, \( x \) is the acorn’s horizontal distance from the hill and \( y \) represents its height. Both are measured in feet. Whose acorn reached a higher point above the river?

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Jackson’s acorn reached a higher point.</td>
</tr>
<tr>
<td>B</td>
<td>The two acorns reached the same height.</td>
</tr>
<tr>
<td>C</td>
<td>Jacob’s acorn reached a higher point.</td>
</tr>
</tbody>
</table>
Solving Multistep Linear Equations

How long will it take to shingle the roof?
Imagine that you're building your dream home and need someone to put the shingles on the roof. You'd probably want to know how one contractor compared with another, right? In other words, which person can do the work fastest and save you the most money?
Many real-world problems can be represented by equations that take more than one operation to solve. In this section, you will learn how to handle these more complicated equations by combining the methods you have already learned.
Begin by reading the objectives you will cover in this section.

Objectives
- Isolate the variables in an equation by identifying the operations involved.
- Collect like terms to simplify the equation.
- Remember the order of operations for solving an equation in one variable.
- Identify equations that have no solution or an infinite number of solutions.
- Turn real-life problems into mathematical sentences and equations in one variable, and then solve the problem.

Solving Multistep Linear Equations

To solve 2-step algebraic equations, isolate the variable, or get it alone on one side of the equation. To do that, undo the operations on the variable in the reverse of the order of operations. Use the opposite operation, or inverse operation, to undo an operation. To solve $ax + b = c$ or $ax - b = c$:

<table>
<thead>
<tr>
<th>Step</th>
<th>Why you do it</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Add or subtract $b$ from both sides</td>
<td>To isolate the variable, $ax$</td>
</tr>
<tr>
<td>2. Divide both sides by $a$</td>
<td>To isolate the variable, $x$</td>
</tr>
</tbody>
</table>

Collecting Like Terms
As you begin to work with equations that are more complex, you will need to collect like terms before you can isolate the variable.
To *collect like terms* is to group all terms whose variables are the same. You should also group any constants. Then you can solve the equations as before.
Using the Distributive Property

Often you will need to simplify an equation before you can collect like terms. This sometimes means using the distributive property.

Here is a problem where you need to use the distributive property.

### Steps for Solving \(3(x + 4) - 2x = 5\)

<table>
<thead>
<tr>
<th>Step #</th>
<th>English Description</th>
<th>Math Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1:</td>
<td>Start with the original equation.</td>
<td>(3(x + 4) - 2x = 5)</td>
</tr>
<tr>
<td>Step 2:</td>
<td>Use the distributive property.</td>
<td>(3x + 12 - 2x = 5)</td>
</tr>
<tr>
<td>Step 3:</td>
<td>Collect like terms.</td>
<td>((3x - 2x) + 12 = 5)</td>
</tr>
<tr>
<td>Step 4:</td>
<td>Simplify.</td>
<td>(x + 12 = 5)</td>
</tr>
<tr>
<td>Step 5:</td>
<td>Use the subtraction property of equality.</td>
<td>(x + 12 - 12 = 5 - 12)</td>
</tr>
<tr>
<td>Step 6:</td>
<td>Simplify.</td>
<td>(x = -7)</td>
</tr>
</tbody>
</table>

### Variables on Both Sides of the Equation

Some equations have variable terms on both sides of the equal sign.

To solve an equation like this, you need to add or subtract a variable term on both sides of the equation so that only one side contains variables. Then you can solve the equation just like before.

### Putting It All Together

Now you can combine all the methods you’ve seen so far to solve

\[
2x + 2 = x + 2 - 3\left(x - \frac{8}{3}\right)
\]

\[
2x + 2 = x + 2 - 3x + 8
\]

\[
2x + 2 = (x - 3x) + (2 + 8)
\]

\[
2x + 2 = -2x + 10
\]

\[
4x + 2 = 10
\]

\[
x = \frac{8}{4}
\]

\[
x = 2
\]

### Problems with No Solutions

Some equations with variables on both sides of the equal sign have no solution, and others have an infinite number of solutions. If you try to solve an equation that has no solution, you will end up with an expression that is never true, no matter what the value of \(x\) is.

\[
x = x + 7
\]

\[
\downarrow \text{ subtract } x
\]

\[
0 = 7
\]
Problems with Infinite Solutions
If you try to solve an equation that has an infinite number of solutions, you will end up with an equation that is always true, no matter what the value of $x$ is.

$$3(x + 2) = 3x + 6$$

$$3x + 6 = 3x + 6$$

$$6 = 6$$

**Rule:** Linear equations with no solutions
When does a linear equation have no solution?
A linear equation has no solution when it cannot be true, no matter the value of $x$.
Example:

$$4x - 3x + 2 = x + 1$$

$$x + 2 = x + 1$$

$$0 = -1$$

**Rule:** Linear equations with infinite solutions
When do linear equations have infinite solutions?
A linear equation has infinite solutions when it is true for any value of $x$.
Example:

$$3x + 4 + x = 4(x + 1)$$

$$4x + 4 = 4x + 4$$

$$4 = 4$$

The Roof Problem
Remember the roof problem from the beginning of the lesson? You can use what you've learned in this lesson to solve it. First, let's look more closely at the problem.

You should start your work on this problem by asking some important questions. Click the icon on the right to see the problem again.

<table>
<thead>
<tr>
<th>What do you want to find out?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The rate at which Bill puts shingles on a roof.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What do you know?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bill and Chip each finished half the roof.</td>
</tr>
<tr>
<td>Bill needs 7 hours to put the same number of shingles on the roof that Chip does in 4 hours.</td>
</tr>
<tr>
<td>For each worker, the time multiplied by the rate equals the number of shingles.</td>
</tr>
<tr>
<td>Chip's rate is 30 shingles more per hour than Bill's rate.</td>
</tr>
</tbody>
</table>
The Roof Problem — Writing and Solving an Equation
The basis of the equation for the roof problem is that Bill and Chip each finished half the roof. That means they each put the same number of shingles on the roof.

\[
\text{Bill's shingles} = \text{Chip's shingles}
\]

\[
\text{Bill's time} \times \text{Bill's rate} = \text{Chip's time} \times \text{Chip's rate}
\]

\[
7 \text{ hours} \left( \frac{b \text{ shingles}}{\text{hour}} \right) = 4 \text{ hours} \left( \frac{b + 30 \text{ shingles}}{\text{hour}} \right)
\]

\[
7b = 4(b + 30)
\]

\[
7b = 4b + 120
\]

\[
3b = 120
\]

\[
b = 40
\]

Bill's rate is 40 shingles per hour.
Algebra 1:  Weeks 3-4, April 20 – May 1

2.1.1 Study: Solving Multistep Linear Equations

Study Guide
Name:  
Date:  
Use the questions below to keep track of key concepts from this lesson's study activity.

Key Terms
In your own words, write a definition for each key term listed below.

distributive property:

infinite:

like terms:

1) Practice: Organizing Information
Fill in the blanks to complete the steps.

How to Solve Equations in the Form $ax + b = c$

<table>
<thead>
<tr>
<th>Step</th>
<th>Example: $3x + 4 = 10$</th>
</tr>
</thead>
</table>
| 1. _____ $b$ from both sides. | $3x + 4 - 4 = 10 - 4$  
$3x = 6$ |
| 2. _____ both sides by $a$. | $\frac{3x}{3} = \frac{6}{3}$  
$x = ____$ |

How to Solve Equations in the Form $ax - b = c$.

<table>
<thead>
<tr>
<th>Step</th>
<th>Example: $2x - 7 = 3$</th>
</tr>
</thead>
</table>
| 1. _____ $b$ to both sides. | $2x - 7 + 7 = 3 + 7$  
$2x = 10$ |
| 2. _____ both sides by $a$. | $\frac{2x}{2} = \frac{10}{2}$  
$x = ____$ |
Algebra 1:  Weeks 3-4, April 20 – May 1

2) Practice: Organizing Information
Fill in the blank to complete the steps and examples.

How to Collect Like Terms

<table>
<thead>
<tr>
<th>Step</th>
<th>Example: $7 + 3x + x + 4 + 2x = 9$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Group all terms with the same variable parts.</td>
<td>$7 + 4 + (3x + x + 2x) = 9$</td>
</tr>
<tr>
<td>2. Group all constants.</td>
<td>$(7 + 4) + (3x + x + 2x) = 9$</td>
</tr>
</tbody>
</table>

3) Practice: Summarizing

1. What is the distributive property?

2. When should you use the distributive property?

3. When should you use the distributive property when solving an equation?

4) Practice: Organizing Information
Write 1, 2, or 3 in the blanks to show the correct order of steps in the process.
How to Solve Multistep Linear Equations

_____ Collect like terms on each side of the equation.

_____ Use inverse operations to isolate the variable.

_____ Use the distributive property to get rid of parentheses.
Algebra 1:  Weeks 3-4, April 20 – May 1

5) Practice: Monitoring and Applying Fix-Up Strategies
Solve each equation for \( x \). Show your work. Then check your answer by substituting it back into the equation.

<table>
<thead>
<tr>
<th>Solve</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 5(x - 1) + 3 = 13 )</td>
<td>1.</td>
</tr>
<tr>
<td>( -2x + (12 - 9) = 2 + 9 + 2x )</td>
<td>2.</td>
</tr>
</tbody>
</table>

6) Practice: Number of solutions
Write no solution or infinite solutions in each blank.

1. An equation that has ____________________ is never true, no matter what the value of \( x \) is.
2. An equation that has ____________________ is always true, no matter what the value of \( x \) is.
3. \( x = x + 7 \) has ____________________.
4. \( 3(x + 2) = 3x + 6 \) has ____________________.

7) Practice: Using Text Features and Visual Cues
Complete the steps for the roof problem.
Step 1: Understand the problem.
1. What do you want to know?

________________________________________________________________________
2. What do you know?
   - To do the same number of shingles, Bill needs _____ hours and Chip needs _____ hours.
   - Chip's rate:
     - _________ is faster than __________.

3. What variable will you use? Explain your choice. ____________________

4. What are the units for your variable? ____________________

Step 2: Gather your resources.
Write equations for the problem.
Sentence: Chip's rate is _____ more than Bill's rate.

Equation: Chip's rate = b + _____

Sentence: Bill's rate multiplied by _____ hours equals Chip’s rate multiplied by _____ hours.

Equation: _____b = _____(b + 30)

Step 3: Solve.
Solve the equation. Show your work.

1. Use the distributive property.
2. Collect like terms on each side.
3. Perform reverse operations to isolate the variable.
4. Write the answer as an equation.

Step 4: Check your answer and present your answer.
Check: Substitute your answer for b in the equation. Show your work.

Explain how you know your answer is reasonable.

Present: Give your answer in a complete sentence with the correct units.
Answer:
2.1.1 Study: Solving Multistep Linear Equations

ANSWER KEY

Key Terms
In your own words, write a definition for each key term listed below.

**distributive property:**
The rule that if \( a, b, \) and \( c \) are numbers or expressions, then \( a \cdot (b + c) = a \cdot b + a \cdot c \).

**infinite:**
Without end or limit; going on forever; impossible to count.

**like terms:**
Terms in an algebraic expression that have the same variables raised to the same powers.

1) Practice: Organizing Information (Page 1)
Fill in the blanks to complete the steps.

**How to Solve Equations in the Form** \( ax + b = c \)

<table>
<thead>
<tr>
<th>Step</th>
<th>Example: ( 3x + 4 = 10 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. _____ ( b ) from both sides.</td>
<td>( 3x + 4 - 4 = 10 - 4 )</td>
</tr>
<tr>
<td>Subtract</td>
<td>( 3x = 6 )</td>
</tr>
<tr>
<td>2. _____ both sides by ( a ).</td>
<td>( \frac{3x}{3} = \frac{6}{3} )</td>
</tr>
<tr>
<td>Divide</td>
<td>( x = \frac{6}{3} = 2 )</td>
</tr>
</tbody>
</table>

**How to Solve Equations in the Form** \( ax - b = c \)

<table>
<thead>
<tr>
<th>Step</th>
<th>Example: ( 2x - 7 = 3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. _____ ( b ) to both sides.</td>
<td>( 2x - 7 + 7 = 3 + 7 )</td>
</tr>
<tr>
<td>Add</td>
<td>( 2x = 10 )</td>
</tr>
<tr>
<td>2. _____ both sides by ( a ).</td>
<td>( \frac{2x}{2} = \frac{10}{2} )</td>
</tr>
<tr>
<td>Divide</td>
<td>( x = \frac{10}{2} = 5 )</td>
</tr>
</tbody>
</table>
2) Practice: Organizing Information (Page 4)

Fill in the blank to complete the steps and examples.

How to Collect Like Terms

<table>
<thead>
<tr>
<th>Step</th>
<th>Example: $7 + 3x + x + 4 + 2x = 9$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Group all terms with the same variable parts.</td>
<td>$7 + 4 + (3x + x + 2x) = 9$</td>
</tr>
<tr>
<td>2. Group all constants.</td>
<td>$(7 + 4) + (3x + x + 2x) = 9$</td>
</tr>
<tr>
<td>3. Simplify.</td>
<td>$11 + 6x = 9$</td>
</tr>
</tbody>
</table>

3) Practice: Summarizing (Page 7)

1. What is the distributive property?

Possible response: A rule that states that $a \cdot (b + c) = a \cdot b + a \cdot c$

2. When should you use the distributive property?

Possible response: When a variable expression is inside parentheses and is multiplied by a factor

3. When should you use the distributive property when solving an equation?

Possible response: To get rid of parentheses

4) Practice: Organizing Information (Pages 7 – 9)

Write 1, 2, or 3 in the blanks to show the correct order of steps in the process.

How to Solve Multistep Linear Equations

1. Collect like terms on each side of the equation.
2. Use inverse operations to isolate the variable.
3. Use the distributive property to get rid of parentheses.
5) Practice: Monitoring and Applying Fix-Up Strategies (Pages 7 – 9)
Solve each equation for $x$. Show your work. Then check your answer by substituting it back into the equation.

<table>
<thead>
<tr>
<th>Solve</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $5(x - 1) + 3 = 13$</td>
<td>$5(x - 1) + 3 = 13$</td>
</tr>
<tr>
<td>$5x - 5 + 3 = 13$</td>
<td>$5(3 - 1) + 3 = 13$</td>
</tr>
<tr>
<td>$5x - 2 = 13$</td>
<td>$5(2) + 3 = 13$</td>
</tr>
<tr>
<td>$5x = 15$</td>
<td>$10 + 3 = 13$</td>
</tr>
<tr>
<td>$x = 3$</td>
<td>$13 = 13$</td>
</tr>
<tr>
<td>2. $-2x + (12 - 9) = 2 + 9 + 2x$</td>
<td>$-2x + (12 - 9) = 2 + 9 + 2x$</td>
</tr>
<tr>
<td>$-2x + 3 = 11 + 2x$</td>
<td>$-2(-2) + 3 = 11 - 2(-2)$</td>
</tr>
<tr>
<td>$-2x - 2x + 3 = 11$</td>
<td>$4 + 3 = 11 - 4$</td>
</tr>
<tr>
<td>$-4x + 3 = 11$</td>
<td>$7 = 7$</td>
</tr>
<tr>
<td>$-4x = 8$</td>
<td></td>
</tr>
<tr>
<td>$x = -2$</td>
<td></td>
</tr>
</tbody>
</table>

6) Practice: Number of solutions (Pages 12 – 15)
Write no solution or infinite solutions in each blank.
1. An equation that has ________________ is never true, no matter what the value of $x$ is. no solution
2. An equation that has ________________ is always true, no matter what the value of $x$ is. infinite solutions
3. $x = x + 7$ has ________________.
   no solution
4. $3(x + 2) = 3x + 6$ has ________________.
infinite solutions

7) Practice: Using Text Features and Visual Cues
Complete the steps for the roof problem.
Step 1: Understand the problem. (Pages 17 – 19)
1. What do you want to know?
   
   Bill's rate for putting shingles on a roof
   2. What do you know?
      o To do the same number of shingles, Bill needs _____ hours and Chip needs _____ hours. 7; 4
      o Chip's rate:
      30 more shingles per hour than Bill
         o __________ is faster than __________.

   Chip; Bill
3. What variable will you use? Explain your choice. ________________
   b for Bill's rate
4. What are the units for your variable? ________________
   shingles per hour

**Step 2: Gather your resources.** (Page 18)
Write equations for the problem.

**Sentence:** Chip's rate is _____ more than Bill's rate.
30
**Equation:** Chip's rate = b + _____
30

**Sentence:** Bill's rate multiplied by _____ hours equals Chip's rate multiplied by _____ hours.
7; 4
**Equation:** _____b = _____(b + 30)
7; 4

**Step 3: Solve.** (Page 19)
Solve the equation. Show your work.

<table>
<thead>
<tr>
<th>Step</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>7b = 4(b + 30)</td>
</tr>
<tr>
<td>2.</td>
<td>7b = 4b + 120</td>
</tr>
<tr>
<td>3.</td>
<td>7b - 4b = 4b - 4b + 120</td>
</tr>
<tr>
<td>4.</td>
<td>3b = 120</td>
</tr>
<tr>
<td></td>
<td>b = 40</td>
</tr>
</tbody>
</table>

**Step 4: Check your answer and present your answer.** (Page 19)

**Check:** Substitute your answer for b in the equation. Show your work.

7b = 4(b + 30)
7(40) = 4(40 + 30)
280 = 4(70)
280 = 280

Explain how you know your answer is reasonable.

Possible response: When I substitute my answer for the variable, the equation is true.

**Present:** Give your answer in a complete sentence with the correct units.

**Answer:** ________________

Bill's rate is 40 shingles per hour.
## Quiz: Solving Multistep Linear Equations

### Question 1a of 10
What is the solution to this equation?

$$2x + 4 = 16$$

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>$x = 40$</td>
</tr>
<tr>
<td>B.</td>
<td>$x = 24$</td>
</tr>
<tr>
<td>C.</td>
<td>$x = 6$</td>
</tr>
<tr>
<td>D.</td>
<td>$x = 10$</td>
</tr>
</tbody>
</table>

### Question 2a of 10
What is the solution to this equation?

$$4x + 16 - x = 22 + 6$$

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>$x = 3$</td>
</tr>
<tr>
<td>B.</td>
<td>$x = 11$</td>
</tr>
<tr>
<td>C.</td>
<td>$x = 4$</td>
</tr>
<tr>
<td>D.</td>
<td>$x = 2$</td>
</tr>
</tbody>
</table>
Question 3a of 10
What is the solution to this equation?

\[-8x + 4 = 36\]

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>(x = -4)</td>
</tr>
<tr>
<td>B.</td>
<td>(x = -5)</td>
</tr>
<tr>
<td>C.</td>
<td>(x = 5)</td>
</tr>
<tr>
<td>D.</td>
<td>(x = 4)</td>
</tr>
</tbody>
</table>

Question 4a of 10
What is the solution to this equation?

\[x + 4(x + 5) = 40\]

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>(x = 12)</td>
</tr>
<tr>
<td>B.</td>
<td>(x = 7)</td>
</tr>
<tr>
<td>C.</td>
<td>(x = 4)</td>
</tr>
<tr>
<td>D.</td>
<td>(x = 9)</td>
</tr>
</tbody>
</table>
**Question 5a of 10**
What is the solution to this equation?

\[ x + 20 + 10x = 20 + 9x \]

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>( x = 2 )</td>
</tr>
<tr>
<td>B.</td>
<td>( x = 0 )</td>
</tr>
<tr>
<td>C.</td>
<td>( x = 10 )</td>
</tr>
<tr>
<td>D.</td>
<td>( x = 20 )</td>
</tr>
</tbody>
</table>

---

**Question 6a of 10**
What is the solution to this equation?

\[ 3(4x + 6) = 9x + 12 \]

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>( x = -2 )</td>
</tr>
<tr>
<td>B.</td>
<td>( x = 10 )</td>
</tr>
<tr>
<td>C.</td>
<td>( x = -10 )</td>
</tr>
<tr>
<td>D.</td>
<td>( x = 2 )</td>
</tr>
</tbody>
</table>
Question 7a of 10
Which would not be a step in solving $5x + 15 + 2x = 24 + 4x$?

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Isolate the variable.</td>
</tr>
<tr>
<td>B</td>
<td>Collect like terms.</td>
</tr>
<tr>
<td>C</td>
<td>Collect variable terms on one side.</td>
</tr>
<tr>
<td>D</td>
<td>Use the distributive property.</td>
</tr>
</tbody>
</table>

Question 8a of 10
How many solutions are there to the equation below?

$8x + 47 = 8(x + 5)$

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>Infinitely many</td>
</tr>
</tbody>
</table>
**Algebra 1: Weeks 3-4, April 20 – May 1**

**Question 9a of 10**
How many solutions are there to the equation below?

\[6x + 30 + 4x = 10(x + 3)\]

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>Infinitely many</td>
</tr>
</tbody>
</table>

**Question 10a of 10**
Write and solve an equation to answer the question:
Alan bought 3 pencils and a notebook. The notebook cost $6, and he spent a total of $12. How much did each pencil cost? Use \( p \) to represent the cost of each pencil.

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>[3p + 6 = 12 \Rightarrow p = 2;] each pencil cost $2.</td>
</tr>
<tr>
<td>B</td>
<td>[6p + 3 = 12 \Rightarrow p = 2;] each pencil cost $2.50.</td>
</tr>
<tr>
<td>C</td>
<td>[6p + 3 = 12 \Rightarrow p = 1.5;] each pencil cost $1.50.</td>
</tr>
<tr>
<td>D</td>
<td>[3p + 6 = 12 \Rightarrow p = 2;] each pencil cost $2.</td>
</tr>
</tbody>
</table>