ALGEBRA 1: Week of April 27

- Go through the slides (notes) and work through the examples on a separate piece of paper.
- Do the given practice problems (again, on a separate piece of paper).
- Check your answers with the key given (last slide).
- Take a photo or scan in your work and submit it in Google Classroom. If you have questions or would like feedback on your work, add that as a comment with your submitted work.
- The other option for turn in is to send it in on Monday when the new packet is available.
- Check your school email/google calendar for online help sessions via Zoom.

Day 1: Lesson 3.7

Completing the Square

Target: Convert quadratic functions from general form to vertex form. Solve quadratic functions in general form by completing the square.

Vocabulary

Perfect Square Trinomial

A trinomial that is the square of a binomial.

Examples:

$(x + 2)^2 = x^2 + 4x + 4$

$(2x + 1)^2 = 4x^2 + 4x + 1$

Completing the Square

The creation of a perfect square trinomial by adding a constant to an expression in the form $x^2 + bx$.

Explore! Making it Perfect!

Step 1 Multiply each expression to create a perfect square trinomial.

a. $(x + 3)^2$ **b.** $(x + 6)^2$ **c.** $(x - 4)^2$ **d.** $(x - 7)^2$

Step 2 Examine the b term (in $x^2 + bx + c$) in each expanded expression above. How does it relate to the number in the parentheses?

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Step 3 Examine the constant in each expanded expression above. How does it relate to the number in the parentheses?

Step 4 Complete the blanks in each expression using the patterns you found in the previous steps.

$(x + m)^2 = x^2 + \_\_\_\_x + \_\_\_\_$ $(x + n)^2 = x^2 + \_\_\_\_x + \_\_\_\_$

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Step 5 In order to create a perfect square trinomial from a general form equation, you need to move the constant away from the other terms. Once you have done this you can find just the right constant to make a perfect square trinomial.

For each equation below, move the constant away from the other terms by using inverse operations.

a. $y = x^2 + 6x + 4$ **b.** $y = x^2 - 14x - 9$ **c.** $y = x^2 + 3x + 1$

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Step 6 Next find half of the b term and square it for each equation in **Step 5**. Add this amount to both sides of the equation. *Remember, the number must be added to both sides to retain equality.*

Step 7 You have now formed trinomials which factor into a perfect square on the right sides of each of your equations. Write this side in the form $(x + m)^2$ or $(x + n)^2$. Combine like terms on the left side of each of the equations.

Explore! **Making it Perfect!**

Step 8 To complete the process of converting the equation to vertex form, move the constant back to the right side of the equation using inverse operations. What are the coordinates of the vertex of each of the three quadratic functions?

Step 9 Convert $y = x^2 + 10x - 3$ to vertex form. What are the coordinates of the vertex of this parabola?

Day 1 Practice Problems

Find the value of *c* that makes each trinomial a perfect square.

1. $x^2 + 10x + c$ 2. $x^2 - 8x + c$ 3. $x^2 - x + c$

Write each trinomial as a perfect square.

4. $x^2 + 4x + 4$ 5. $x^2 - 16x + 64$ 6. $x^2 + 11x + 30.25$

End Day 1

Day 2: General Form to Vertex Form – Completing the Square

1. Move the constant to the opposite side of the equation using inverse operations.
2. Add a constant to both sides of the equation that is equal to $\left(\frac{b}{2}\right)^2$.
3. Write $x^2 + bx + c$ as a perfect square.
4. Move the constant using inverse operations so the quadratic function is in vertex form.

Example 1

Convert $y = x^2 + 12x + 7$ to vertex form. Give the coordinates of the vertex.

Move the constant to the left side of the equation.

$$\begin{array}{r|r} y = x^2 + 12x + 7 & \\ -7 & -7 \\ \hline y - 7 = x^2 + 12x & \end{array}$$

Find the new constant by calculating $\left(\frac{b}{2}\right)^2$.

$$\left(\frac{b}{2}\right)^2 = \left(\frac{12}{2}\right)^2 = 36$$

Add 36 to both sides of the equation.

$$\begin{array}{r|r} y - 7 = x^2 + 12x & \\ +36 & +36 \\ \hline y + 29 = x^2 + 12x + 36 & \end{array}$$

Example 1 Continued…

Convert $y = x^2 + 12x + 7$ to vertex form. Give the coordinates of the vertex.

Rewrite the right side of the equation as a perfect square.

$$y + 29 = (x + 6)^2 \qquad \left(x + \frac{b}{2}\right)^2$$

Move the constant back to the right side of the equation using inverse operations so that the equation is in vertex form.

$$\begin{array}{r|r} y + 29 = (x + 6)^2 & \\ -29 & -29 \\ \hline y = (x + 6)^2 - 29 & \end{array}$$

The vertex of the parabola is at (−6, −29).

Day 2 Practice Problems

Convert each quadratic function to vertex form. Give the coordinates of the vertex.

7. $y = x^2 + 8x$ 8. $y = x^2 - 4x + 2$

9. $y = x^2 + 10x - 3$ 10. $y = x^2 + 7x + 5.25$

11. $y = x^2 + 14x - 24$ 12. $y = x^2 - x + 1$

End Day 2

Day 3

Example 2

Solve the equation $0 = x^2 - 8x - 6$. Write each answer to the nearest tenth.

Move the constant to the left side of the equation.

$$\begin{array}{r} 0 = x^2 - 8x - 6 \\ +6 \qquad\qquad +6 \\ \hline 6 = x^2 - 8x \end{array}$$

Find the new constant by calculating $\left(\frac{b}{2}\right)^2$.

$$\left(\frac{b}{2}\right)^2 = \left(\frac{-8}{2}\right)^2 = 16$$

Add 16 to both sides of the equation.

$$\begin{array}{r} 6 = x^2 - 8x \\ +16 \qquad\qquad +16 \\ \hline 22 = x^2 - 8x + 16 \end{array}$$

Example 2 Continued…

Solve the equation $0 = x^2 - 8x - 6$. Write each answer to the nearest tenth.

$$22 = x^2 - 8x + 16$$

Rewrite the right side of the equation as a perfect square.

$$22 = (x-4)^2$$

Square root both sides of the equation.

$$\pm\sqrt{22} = \sqrt{(x-4)^2}$$

Add 4 to both sides of the equation.

$$\begin{array}{r} \pm 4.7 \approx x - 4 \\ +4 \qquad\quad +4 \\ \hline \end{array}$$

Find the value of each solution.

$4.7 + 4 = 8.7$

$-4.7 + 4 = -0.7$

Remember: When you square root, the solution could be + or −.

The solutions to the equation are $x \approx 8.7$ and $x \approx -0.7$.

Day 3 Practice Problems

Solve each quadratic equation by completing the square. Round answers to the nearest tenth when necessary.

13. $-12 = x^2 + 8x$

14. $0 = x^2 - 10x + 8$

15. $0 = x^2 + 12x - 108$

16. $23 = x^2 + 20x - 12$

17. $x^2 - 2x = 2$

18. $x^2 - 14x = -48$

End Day 3

Practice Set Day 4

Each quadratic function below is given in one form (vertex form, general form or factored form). Write each function in the two forms it is not written in.

1. $y = x^2 - 2x - 3$

2. $f(x) = (x+4)^2 - 9$

3. $g(x) = (x+5)(x+3)$

4. $y = x^2 + 6x$

5. $g(x) = (x-2)(x-8)$

6. $f(x) = (x+1)^2 - 1$

ANSWER PAGE

Day 1:

1. $c = 25$
2. $c = 16$
3. $c = 0.25$
4. $(x+2)^2$
5. $(x-8)^2$
6. $(x+5.5)^2$

Day 2:

7. $y = (x+4)^2 - 16$;
   Vertex: $(-4, -16)$
8. $y = (x-2)^2 - 2$;
   Vertex: $(2, -2)$
9. $y = (x+5)^2 - 28$;
   Vertex: $(-5, -28)$
10. $y = (x+3.5)^2 - 7$;
    Vertex: $(-3.5, -7)$
11. $y = (x+7)^2 - 73$;
    Vertex: $(-7, -73)$
12. $y = (x-0.5)^2 + 0.75$;
    Vertex: $(0.5, 0.75)$

Explore!

Step 1: a) $x^2 + 6x + 9$
b) $x^2 + 12x + 36$
c) $x^2 - 8x + 16$
d) $x^2 - 14x + 49$

Step 2: It is twice as large.

Step 3: It is the square.

Step 4: $x^2 + 2nx + n^2$
$x^2 + 2\overline{n}x + \overline{n}^2$

Step 5: a) $y - 4 = x^2 + 6x$
b) $y + 9 = x^2 - 14x$
c) $y - 1 = x^2 + 3x$

Explore!

Step 6:
a) $y - 4 + 9 = x^2 + 6x + 9$
b) $y + 9 + 49 = x^2 - 14x + 49$
c) $x^2 + 3x + 2.25 =$

Step 7:
a) $y + 5 = (x+3)^2$
b) $y + 58 = (x-7)^2$
c) $y + 1.25 = (x+1.5)^2$

Step 8:
a) $y = (x+3)^2 - 5$; $(-3, -5)$
b) $y = (x-7)^2 - 58$; $(7, -58)$
c) $y = (x+1.5)^2 - 1.25$;
$(-1.5, -1.25)$

Step 9: $y = (x+5)^2 - 28$;
$(-5, -28)$

ANSWER PAGE

	vertex form	general form	factored form
1.	$y = (x-1)^2 - 4$	$y = x^2 - 2x - 3$	$y = (x-3)(x+1)$
2.	$f(x) = (x+4)^2 - 9$	$y = x^2 + 8x + 7$	$y = (x+7)(x+1)$
3.	$g(x) = (x+4)^2 - 1$	$g(x) = x^2 + 8x + 15$	$g(x) = (x+5)(x+3)$
4.	$y = (x+3)^2 - 9$	$y = x^2 + 6x$	$y = x(x+6)$
5.	$g(x) = (x-5)^2 - 9$	$g(x) = x^2 - 10x + 16$	$g(x) = (x-2)(x-8)$
6.	$y = (x+1)^2 - 1$	$y = x^2 + 2x$	$y = x(x+2)$

Day 4:

13. $x = -2$ and $x = -6$
14. $x \approx 9.1$ and $x \approx 0.9$
15. $x = 6$ and $x = -18$
16. $x \approx 1.6$ and $x \approx -2.6$
17. $x \approx 2.7$ and $x \approx -0.7$
18. $x = 8$ and $x = 6$

Day 3:

ALGEBRA: LAST SLIDE for this week!