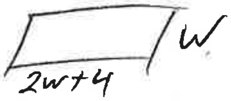
Unit 5 Part 1 Study Guide Name Key Per. _____

Activity 29

1. Kathleen is building a rectangular pen for her dog with a length that is 4 feet longer than 2 times the width. If the width is represented by w, write an equation to represent the area A.

$l = 2w + 4$

$w = w$



$A = w(2w+4)$

$A = 2w^2 + 4w$

2. Write each quadratic function in standard form.
   a. $g(x) = x(x-2) + 4$

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

   b. $f(x) = (x-4)^2 + 16$ $(x-4)(x-4) \rightarrow x^2 - 8x + 16$

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

   $f(x) = x^2 - 8x + 32$

   c. $h(x) = -8 + (7-x)^2$ $(7-x)(7-x) \rightarrow x^2 - 14x + 49$

   $-8 + x^2 - 14x + 49$

   $h(x) = x^2 - 14x + 41$

3. Which statement about quadratic functions is NOT true?

   a. The domain of a quadratic function describes the possible values of x and the range describes the possible values of y.

   b. The graph of a quadratic function is a parabola.

   c. The minimum or maximum value of a quadratic function is the y-coordinate of the graph's vertex.

   ~~d.~~ The y-intercepts of a parabola occur when ~~f(x)=0~~.

   $x = 0$

Activity 30

4. Write an equation of a function which has been transformed from the parent function $f(x) = x^2$....
   a. Whose graph has been translated 2 units up.

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

   b. Whose graph has been translated 3 units to the left.

   $(-3, 0)$ $h(x) = (x+3)^2$

   c. Whose graph has been translated 2 units down, 4 units to the left, and has been shrunk vertically by a factor of 3/4.

   $k(x) = \frac{3}{4}(x+4)^2 - 2$

   d. Whose graph has been translated 9 units right, stretched vertically by a factor of 3, and is reflected over the x axis.

   $m(x) = -3(x-9)^2$

5. For item 5, use the functions $f(x) = x^2$, $g(x) = \frac{1}{3}(x-3)^2$, and $h(x) = -2(x+1)^2 - 3$

   a. Describe the transformation from the graph f(x) to the graph g(x).

   $x^2 \rightarrow \frac{1}{3}(x-3)^2$

   Shrunk by vertical factor of 1/3

   Translated right 3 units

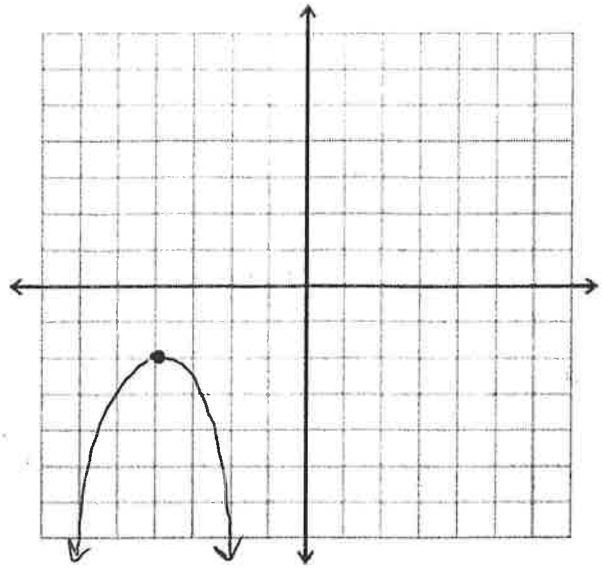
   b. Describe the transformation from the graph f(x) to the graph h(x).

   $x^2 \rightarrow -2(x+1)^2 - 3$

   → Reflected
   - Flipped over x-axis
   - Stretched by vertical factor of 2
   - Translated left 1 and down 3 units

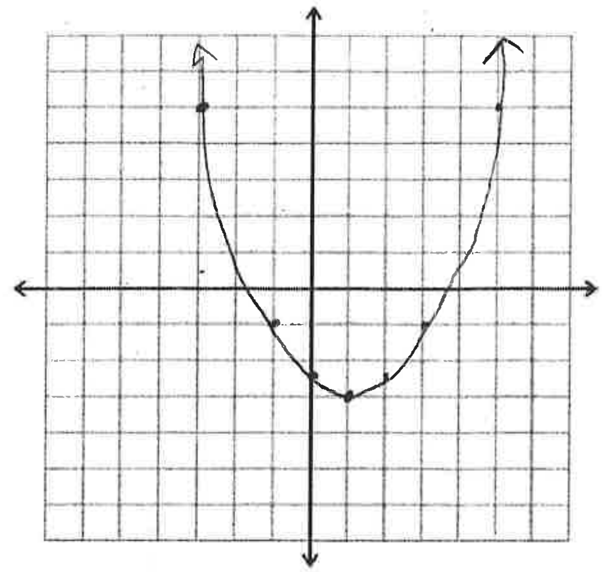
6. Graph the transformation of the function $f(x) = x^2$

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



7. Graph the transformation of the function $f(x) = x^2$

$$h(x) = \frac{1}{2}(x-1)^2 - 3$$



Activity 31

8. Solve each quadratic equation by factoring

a. $16x^2 - 24x + 9$ $ac: 144$ $b: -24$

$16x^2 - 12x - 12x + 9$

$4x(4x-3) - 3(4x-3)$ $(4x-3)(4x-3) = 0$ $x = 3/4$

$4x - 3 = 0$

$+3\ \ +3$

$\frac{4x}{4} = \frac{3}{4}$

b. $-2 = 3x^2 + 7x$ $ac: 6$ $b: 7$

$3x^2 + 7x + 2 = 0$

$3x^2 + 6x + 1x + 2$

$3x(x+2) + 1(x+2)$ $(3x+1)(x+2) = 0$

$3x + 1 = 0$ $x + 2 = 0$

$-1\ \ -1$ $-2\ \ -2$

$\frac{3x}{3} = \frac{-1}{3}$ $x = -2$

$x = -1/3$

c. $x^2 + 10x = 24$

$x^2 + 10x - 24 = 0$

$(x+12)(x-2) = 0$ $x + 12 = 0$ $x - 2 = 0$

$-12\ \ -12$ $+2\ \ +2$

$x = -12$ $x = 2$

d. $x^2 + 3x - 28 = 12$

$x^2 + 3x - 40 = 0$

$(x+8)(x-3) = 0$ $x + 8 = 0$ $x - 3 = 0$

$-8\ \ -8$ $+3\ \ +3$

$x = -8$ $x = 3$

9. Identify the vertex for each quadratic function. Is it a maximum or a minimum?

a. $y = -x^2 - 4x + 5$ $x = \frac{-b}{2a}$

$\frac{-(-4)}{2(-1)}$ $\frac{4}{-2} = -2$ $x = -2$ Use Calc

$y = 9$

Vertex: $(-2, 9)$ Maximum

b. $f(x) = 4x^2 - 8x + 3$

$\frac{-(-8)}{2(4)}$ $\frac{8}{8} = 1$ $x = 1$

$y = -1$

Vertex $(1, -1)$ Minimum

10. The height in feet of the water in a large fountain is given by the function $f(x) = -\frac{1}{2}x^2 + 10x$. What is the maximum height that the water reaches?

Vertex

$x = \frac{-b}{2a}$ $\frac{-10}{2(-\frac{1}{2})} = \frac{-10}{-1} = 10$ $x = 10$

$y = 50$

vertex $(10, 50)$ Height of 50 ft

11. Identify the x-intercepts, the equation for the axis of symmetry, and the vertex.

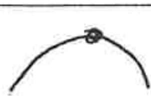
$$f(x) = x^2 + 8x + 15$$

$x = \frac{-b}{2a} = \frac{-8}{2(1)} = \frac{-8}{2} = -4$ $(x+3)(x+5) = 0$

$y = -1$ $x = -3$ $x = -5$

AoS: $x = -4$ Vertex: $(-4, -1)$

X-int: $(-3, 0)$ $(-5, 0)$



Activity 32

12. Solve by the square root method.

a. $4x^2 = 25$

$\frac{4x^2}{4} = \frac{25}{4}$ $\sqrt{x^2} = \sqrt{\frac{25}{4}}$ $x = \pm\frac{5}{2}$

b. $5x^2 - 30 = 0$

$+30 \quad +30$

$\frac{5x^2}{5} = \frac{30}{5}$ $\sqrt{x^2} = \sqrt{6}$ $x = \pm\sqrt{6}$

c. $(x+4)^2 - 5 = 2$

$+5 \quad +5$

$\sqrt{(x+4)^2} = \sqrt{7}$ $x+4 = \pm\sqrt{7}$

$-4 \quad -4$

$x = -4 \pm \sqrt{7}$

13. Solve by completing the square.

a. $x^2 - 4x - 6 = 0$

$+6 \quad +6$

$\left(\frac{-4}{2}\right)^2$ $x^2 - 4x = 6 + 4$

$(2)^2 = 4$ $x^2 - 4x + 4 = 10$

$\sqrt{(x-2)^2} = \sqrt{10}$

$x - 2 = \pm\sqrt{10}$

$+2 \quad +2$

$x = 2 \pm \sqrt{10}$

b. $x^2 - 14x = -13$

$\left(\frac{-14}{2}\right)^2$ $x^2 - 14x + 49 = -13 + 49$

49 $\sqrt{(x-7)^2} = \sqrt{36}$

$x - 7 = \pm 6$

$+7 \quad +7$

$x = 7 \pm 6$

$x = 13$

$x = 1$

c. $x^2 = 7 - 6x$

$+6x \quad +6x$

$\left(\frac{6}{2}\right)^2$ $x^2 + 6x = 7$

$+9 \quad +9$

$x + 6x + 9 = 16$

9

$\sqrt{(x+3)^2} = \sqrt{16}$

$x + 3 = \pm 4$

$-3 \quad -3$

$x = -3 \pm 4$

$x = 1$

$x = -7$

d. $2x^2 + 7x + 23 = x^2 - 5x - 9$

$x^2 + 12x + 32 = 0$

$x^2 + 12x = -32$

$\sqrt{(x+6)^2} = \sqrt{-32}$

$x + 6 = \pm\sqrt{-1}\,\sqrt{16}\,\sqrt{2}$

$x + 6 = \pm 4i\sqrt{2}$

$-6 \quad -6$

$x = -6 \pm 4i\sqrt{2}$

14a) $y = x^2 - 5x + 4$

$-4 \quad -4$

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

$\left(\frac{-5}{2}\right)^2 =$

$y - 4 = x^2 - 5x$

$+25/4 \quad +25/4$

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

$\left(\frac{-5}{2}\right)^2 = \frac{25}{4}$

$y + 9/4 = (x - 5/2)^2$

$-9/4 \quad -9/4$

14b) $y = (x - 5/2)^2 - 9/4$

Translated right 5/2 down 9/4

15. Solve by using the quadratic formula.

a. $2x^2 - 7x - 60 = 0$

$x = -4 \quad x = 7.5$

$\frac{-(-7) \pm \sqrt{(-7)^2 - 4(2)(-60)}}{2(2)}$ $\frac{7 \pm \sqrt{49 + 480}}{4}$

$\frac{7 \pm \sqrt{529}}{4}$ $\frac{7 \pm 23}{4}$

$\frac{30}{4} = 7.5$ $\frac{-16}{4} = -4$

b. $12 = 6x + x^2$

$0 = x^2 + 6x - 12$

$\frac{-6 \pm \sqrt{6^2 - 4(1)(-12)}}{2(1)}$ $\sqrt{4}\sqrt{21}$

$\frac{-6 \pm \sqrt{36 + 48}}{2}$ $\frac{-6 \pm \sqrt{84}}{2}$ $\frac{-6 \pm 2\sqrt{21}}{2}$

$x = -3 \pm \sqrt{21}$

c. $x^2 - 10x + 23 = 0$

$\frac{-(-10) \pm \sqrt{(-10)^2 - 4(1)(23)}}{2(1)}$

$\frac{10 \pm \sqrt{100 - 92}}{2}$ $\frac{10 \pm \sqrt{8}}{2}$ $\frac{10 \pm 2\sqrt{2}}{2}$ $x = 5 \pm \sqrt{2}$

16. Which of the following shows how to use the quadratic formula to solve $2x^2 - 3x - 8 = 0$?

A. $\frac{-3 \pm \sqrt{(-3)^2 - 4(2)(-8)}}{2(2)}$

B. $\frac{3 \pm \sqrt{(-3)^2 - 4(2)(-8)}}{2(2)}$

C. $\frac{-3 \pm \sqrt{-3^2 - 4(2)(-8)}}{2(2)}$

D. $\frac{3 \pm \sqrt{-3^2 - 4(2)(-8)}}{2(2)}$

17. You have learned several ways to solve a quadratic equation: factoring, using square roots, completing the square, and using the quadratic formula. For each quadratic equation below, solve using the method of your choice.

$ac = -10$, $b = 3$

$5 \cdot -2$, $5 + -2$

a. $2x^2 + 3x - 5$

$2x^2 - 2x + 5x - 5$

$2x(x-1) + 5(x-1) = 0$

$(2x+5)(x-1) = 0$

$2x + 5 = 0$ $\quad$ $x - 1 = 0$

$2x = -5$ $\quad$ $x = 1$

$x = -5/2$

b. $\sqrt{x^2} = \sqrt{100}$

$x = \pm 10$

c. $2x^2 + 4x = 0$

$2x(x+2) = 0$

$2x = 0$ $\quad$ $x + 2 = 0$

$x = 0$ $\quad$ $x = -2$

d. $x^2 - 4x + 1 = 0$

$\left(\frac{-4}{2}\right)^2$, 4

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

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

$\sqrt{(x-2)^2} = \sqrt{3}$

$x - 2 = \pm\sqrt{3}$

$x = 2 \pm \sqrt{3}$

e. $x^2 + 6x - 7 = 0$

$\left(\frac{6}{2}\right)^2$, 9

$x^2 + 6x + 9 = 7 + 9$

$\sqrt{(x+3)^2} = \sqrt{16}$

$x + 3 = \pm 4$

$x = -3 \pm 4$

$x = 1$ $\quad$ $x = -7$

f. $x^2 + 3x = 5$

$x^2 + 3x - 5 = 0$

$\frac{-3 \pm \sqrt{3^2 - 4(1)(-5)}}{2(1)}$

$\frac{-3 \pm \sqrt{9-20}}{2}$

$\frac{-3 \pm \sqrt{-11}}{2}$

$x = \frac{-3 \pm i\sqrt{11}}{2}$

18. Use the discriminant to determine the number of real solutions

a. $4x^2 + 12x + 9 = 0$

$\sqrt{12^2 - 4(4)(9)}$

$144 - 144 = 0$

1 Solution

b. $0 = 5x^2 - 7x - 6$

$\sqrt{(-7)^2 - 4(5)(-6)}$

$49 + 120 = 169$

2 Solutions

c. $x^2 - x + 5 = 0$

$\sqrt{(-1)^2 - 4(1)(5)}$

$1 - 20 = -19$

2 Imaginary Solutions

19. Solve each equation.

a. $x^2 + 121 = 0$

$\sqrt{x^2} = \sqrt{-121}$

$x = \pm 11i$

b. $x^2 + 4x + 5 = 0$

$\left(\frac{4}{2}\right)^2$, 4

$x^2 + 4x + 4 = -5 + 4$

$\sqrt{(x+2)^2} = \sqrt{-1}$

$x + 2 = \pm\sqrt{-1}$

$x = -2 \pm \sqrt{-1}$

$x = -2 \pm i$

c. $(x-1)^2 + 3 = 0$

$\sqrt{(x-1)^2} = \sqrt{-3}$

$x - 1 = \pm\sqrt{-3}$

$x = 1 \pm \sqrt{-3}$

$x = 1 \pm i\sqrt{3}$