Unit 2B Review Problems

1. Max was doing some rock climbing at a local park. When he reached the top of the cliff he was climbing he threw a rock out into the water below the cliff. The height of the rock can be modeled by the function h(t) = -16t^2 + 48t + 215, where t is the time in seconds and h is the height in feet.

a. How long did it take for the rock to reach his maximum height?

$$x = -\frac{48}{2(-16)} = 1.5 \text{ seconds}$$

b. What was the highest point that the rock reached?

$$h(1.5) = -16(1.5)^2 + 48(1.5) + 215$$

$$h(1.5) = 251 \, feet$$

c. At what height was Max when he threw the rock?

$$h(0) = -16(0)^2 + 48(0) + 215$$

$$h(0) = 215 \, feet$$

d. At what time does the rock hit the water?

$$-16x^2 + 48x + 215 = 0$$

$$x = \frac{-48 \pm \sqrt{48^2 - 4(-16)(215)}}{2(-16)}$$

$$x = \frac{-48 \pm \sqrt{16064}}{-32}$$

$$x = 5.46 \quad or \quad x = -2.46$$

Since x can't be negative it would take 5.46 seconds

2. A picture has a height that is 4/3 its width. It is to be enlarged to have an area of 192 square inches. What will be the dimensions of the enlargement?

$$l = \frac{4}{3}w \qquad A = l \bullet w$$

$$192 = \left(\frac{4}{3}w\right) \bullet w$$

$$192 = \frac{4}{3}w^2$$

Width = 12 inches and Length = 16 inches

$$144 = w^2$$

$$w = \pm 12$$

3. A garden measuring 12 meters by 16 meters is to have a pedestrian pathway installed all around it, increasing the total area to 285 square meters. What will be the width of the pathway?

$$(2x + 12)(2x + 16) = 285$$

$$4x^2 + 56x + 192 = 285$$

$$4x^2 + 56x - 93 = 0$$

The path will be 1.5 meters

$$(2x + 31)(2x - 3) = 0$$

$$x = -15.5 \quad or \quad x = 1.5$$

Solving by Factoring

Factor each equation completely and solve for x.

1. $y = -x^2 + 6x$

$-x^2 + 6x = 0$

$-x(x-6) = 0$

$x = 0$ *or* $x = 6$

2. $y = 4x^2 - 9$

$4x^2 - 9 = 0$

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

$x = -\frac{3}{2}$ *or* $x = \frac{3}{2}$

3. $y = 2x^2 + 18x + 28$

$2x^2 + 18x + 28 = 0$

$2\left(x^2 + 9x + 14\right) = 0$

$2(x+2)(x+7) = 0$

$x = -2$ *or* $x = -7$

4. $y = x^2 - x - 72$

$x^2 - x - 72 = 0$

$(x-9)(x+8) = 0$

$x = 9$ *or* $x = -8$

5. $y = x^2 + 14x + 24$

$x^2 + 14x + 24 = 0$

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

$x = -12$ *or* $x = -2$

6. $y = 3x^2 + 5x + 2$

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

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

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

Transformations

For each of the following: List the transformations, find the vertex, sketch the graph, and describe the type of roots(0, 1, or 2).

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

Trans: Reflect over x-axis
Vertical Stretch
Up 1 places

Vetex: (0, 1)
Roots: 1(double root)

2. $y = (x+2)^2 + 3$

Left 2 places
Up 3 places

Vertex: (-2, 3)
Roots: 0

Solving Equations

Solve each of the following equations by taking the square root of both sides.

1. $y = 4(x+1)^2 - 100$

$4(x+1)^2 - 100 = 0$

$4(x+1)^2 = 100$

$(x+1)^2 = 25$

$x + 1 = \pm 5$

$x = -6$ *or* $x = 4$

2. $y = 3x^2 - 108$

$3x^2 - 108 = 0$

$3x^2 = 108$

$x^2 = 36$

$x = -6$ *or* $x = 6$

3. $y = 5(x-7)^2 - 135$

$5(x-7)^2 - 135 = 0$

$5(x-7)^2 = 135$

$(x-7)^2 = 27$

$x - 7 = \pm 3\sqrt{3}$

$x = 7 - 3\sqrt{3}$ *or* $x = 7 + 3\sqrt{3}$

4. $y = 2(x-3)^2 + 49$

$2(x-3)^2 + 49 = 0$

$2(x-3)^2 = -49$

$(x-3)^2 = -\frac{49}{2}$

$x - 3 = \pm\frac{7\sqrt{2}}{2}i$

$x = 3 - \frac{7\sqrt{2}}{2}i$ *or* $x = 3 + \frac{7\sqrt{2}}{2}i$

Solving using Quadratic Formula

Solve each of the following equations by using quadratic formula.

1. $y = x^2 - 12x + 40$

$x = \frac{12 \pm \sqrt{(-12)^2 - 4(1)(40)}}{2(1)}$

$x = \frac{12 \pm \sqrt{-16}}{2}$

$x = \frac{12 \pm 4i}{2}$

$x = 6 - 2i$ *or* $x = 6 + 2i$

2. $y = -3x^2 + 4x + 8$

$x = \frac{-4 \pm \sqrt{4^2 - 4(-3)(8)}}{2(-3)}$

$x = \frac{-4 \pm \sqrt{112}}{-6}$

$x = \frac{-4 \pm 4\sqrt{7}}{-6}$

$x = \frac{-2 - 2\sqrt{7}}{-2}$ *or* $x = \frac{-2 + 2\sqrt{7}}{-2}$

3. $y = 9x^2 + 24x + 16$

$x = \frac{-24 \pm \sqrt{24^2 - 4(9)(16)}}{2(9)}$

$x = \frac{-24 \pm \sqrt{0}}{18}$

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

Solving using Completing the Square

Solve each of the following equations by completing the square.

1. $y = x^2 - 12x - 6$

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

$x^2 - 12x + \left(\frac{-12}{2}\right)^2 = 6 + \left(\frac{-12}{2}\right)^2$

$(x-6)^2 = 42$

$x - 6 = \pm\sqrt{42}$

$x = 6 - \sqrt{42}$ *or* $x = 6 + \sqrt{42}$

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

$2x^2 - 8x + 4 = 0$

$x^2 - 4x + 2 = 0$

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

$(x-2)^2 = 2$

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

$x = 2 - \sqrt{2}$ *or* $x = 2 + \sqrt{2}$

3. $y = x^2 - 5x + 8$

$x^2 - 5x + 8 = 0$

$x^2 - 5x + \left(\frac{-5}{2}\right)^2 = -8 + \left(\frac{-5}{2}\right)^2$

$\left(x - \frac{5}{2}\right)^2 = -\frac{7}{4}$

$x - \frac{5}{2} = \pm\frac{\sqrt{7}}{2}i$

$x = \frac{5}{2} - \frac{\sqrt{7}}{2}i$ *or* $x = \frac{5}{2} + \frac{\sqrt{7}}{2}i$

Solving Radical equations

Solve each of the following radical equations for x.

1. $3\sqrt[3]{x} = 5$

$\sqrt[3]{x} = \frac{5}{3}$

$x = \left(\frac{5}{3}\right)^3$

$x = \frac{125}{27}$

2. $4\sqrt[4]{x} - 7 = 5$

$4\sqrt[4]{x} = 12$

$\sqrt[4]{x} = 3$

$x = 81$

3. $\sqrt{2x+8} = x + 4$

$\sqrt{2x+8} = x + 4$

$2x + 8 = (x+4)^2$

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

$0 = x^2 + 6x + 8$

$0 = (x+2)(x+4)$

$x = -2$ *or* $x = -4$

4. $x^{\frac{3}{4}} - 1 = 6$

$x^{\frac{3}{4}} - 1 = 6$

$x^{\frac{3}{4}} = 7$

$x = 7^{\frac{4}{3}}$

5. $x^{\frac{2}{3}} = -4$

No solution

6. $x^{\frac{2}{5}} = 4$

$x^{\frac{2}{5}} = 4$

$x = 32$

7. $\sqrt[4]{3x+2} - \sqrt[4]{6x-7} = 0$

$\sqrt[4]{3x+2} = \sqrt[4]{6x-7}$

$3x + 2 = 6x - 7$

$9 = 3x$

$x = 3$

8. $\sqrt{x+5} = -10$

No Solution

Given the following roots, write the equation for the quadratic in **standard** form.

1. x = -3, x = 4

$y = (x+3)(x-4)$

$y = x^2 - x - 12$

2. $x = \pm 7$

$y = (x+7)(x-7)$

$y = x^2 - 49$

3. $x = \frac{3}{2}; x = -\frac{2}{5}$

$y = \left(x - \frac{3}{2}\right)\left(x + \frac{2}{5}\right)$

$y = (2x-3)(5x+2)$

$y = 10x^2 - 11x - 6$

Find the vertex, y-intercept, x-intercepts, rewrite in vertex form, list the transformation, and graph the quadratic $y = -4x^2 - 6x + 4$

Vertex: $(-0.75, 6.25)$

y-int: $(0, 4)$

x-int: $(-2, 0); (0.5, 0)$

Vertex Form: $y = -4(x + 0.75)^2 + 6.25$

Transformations:

- Reflect over x-axis
- Vertical Stretch
- Left 0.75 places
- Up 6.25 places