

$$x = \frac{-b}{2a}$$

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Unit 8 Test Study Guide

Quadratic Equations

Topic #1: Axis of Symmetry & Vertex

<p>1. $y = -x^2 + 10x - 28$</p> <p>$x = \frac{-10}{2(-1)} \quad x = 5$</p> <p>$y = -5^2 + 10 \cdot 5 - 28$</p> <p>Axis of Symmetry $x = 5$</p> <p>Vertex $(5, -3)$</p>	<p>2. $y = 2x^2 + 4x$</p> <p>$x = \frac{-4}{2(2)} \quad x = -1$</p> <p>$y = 2(-1)^2 + 4(-1)$</p> <p>Axis of Symmetry $x = -1$</p> <p>Vertex $(-1, -2)$</p>	<p>3. $y = x^2 - 9$</p> <p>$x = \frac{0}{2(1)} \quad x = 0$</p> <p>$y = 0^2 - 9$</p> <p>Axis of Symmetry $x = 0$</p> <p>Vertex $(0, -9)$</p>
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Topic #2: Graphing Quadratic Equations

<p>4. $y = x^2 - 8x + 15$</p> <p>$x = \frac{8}{2(1)}$</p> <p>$x = 4$</p> <p>$y = 4^2 - 8 \cdot 4 + 15$</p> <p>$y = -1$</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr><th>x</th><th>y</th></tr> </thead> <tbody> <tr><td>1</td><td>8</td></tr> <tr><td>2</td><td>3</td></tr> <tr><td>3</td><td>0</td></tr> <tr><td>4</td><td>-1</td></tr> <tr><td>5</td><td>0</td></tr> <tr><td>6</td><td>3</td></tr> <tr><td>7</td><td>8</td></tr> </tbody> </table>	x	y	1	8	2	3	3	0	4	-1	5	0	6	3	7	8		<p>Axis of Symmetry: $x = 4$</p> <p>Vertex: $(4, -1)$</p> <p>Domain: all real #s</p> <p>Range: $y \geq -1$</p> <p>Zeros: $x = \{3, 5\}$</p>
x	y																		
1	8																		
2	3																		
3	0																		
4	-1																		
5	0																		
6	3																		
7	8																		
<p>5. $y = -x^2 + 4x - 4$</p> <p>$x = \frac{-4}{2(-1)}$</p> <p>$x = 2$</p> <p>$y = -2^2 + 4 \cdot 2 - 4$</p> <p>$y = 0$</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr><th>x</th><th>y</th></tr> </thead> <tbody> <tr><td>-1</td><td>-9</td></tr> <tr><td>0</td><td>-4</td></tr> <tr><td>1</td><td>-1</td></tr> <tr><td>2</td><td>0</td></tr> <tr><td>3</td><td>-1</td></tr> <tr><td>4</td><td>-4</td></tr> <tr><td>5</td><td>-9</td></tr> </tbody> </table>	x	y	-1	-9	0	-4	1	-1	2	0	3	-1	4	-4	5	-9		<p>Axis of Symmetry: $x = 2$</p> <p>Vertex: $(2, 0)$</p> <p>Domain: all real #s</p> <p>Range: $y \leq 0$</p> <p>Zeros: $x = \{2\}$</p>
x	y																		
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<p>6. $y = -2x^2 - 3$</p> <p>$x = \frac{0}{2(-2)}$</p> <p>$x = 0$</p> <p>$y = -2 \cdot 0^2 - 3$</p> <p>$y = -3$</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr><th>x</th><th>y</th></tr> </thead> <tbody> <tr><td>-3</td><td>-21</td></tr> <tr><td>-2</td><td>-11</td></tr> <tr><td>-1</td><td>-5</td></tr> <tr><td>0</td><td>-3</td></tr> <tr><td>1</td><td>-5</td></tr> <tr><td>2</td><td>-11</td></tr> <tr><td>3</td><td>-21</td></tr> </tbody> </table>	x	y	-3	-21	-2	-11	-1	-5	0	-3	1	-5	2	-11	3	-21		<p>Axis of Symmetry: $x = 0$</p> <p>Vertex: $(0, -3)$</p> <p>Domain: all real #s</p> <p>Range: $y \leq -3$</p> <p>Zeros: $x = \emptyset$</p>
x	y																		
-3	-21																		
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2	-11																		
3	-21																		

Topic #3: Solving Quadratic Equations (By Factoring!)

<p>7. $x^2 - 7x = 44$</p> <p>$x^2 - 7x - 44 = 0$</p> <p>$(x - 11)(x + 4) = 0$</p> <p>$x - 11 = 0 \quad x + 4 = 0$</p> <p style="text-align: center;">$x = \{11, -4\}$</p>	<p>8. $2x^2 + 3x - 72 = x^2 + 2x$</p> <p>$x^2 + x - 72 = 0$</p> <p>$(x + 9)(x - 8) = 0$</p> <p>$x + 9 = 0 \quad x - 8 = 0$</p> <p style="text-align: center;">$x = \{-9, 8\}$</p>
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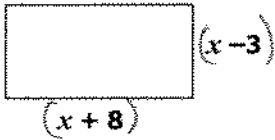
<p>9. $3x^2 + 75 = 30x$ $3x^2 - 30x + 75 = 0$ $3(x^2 - 10x + 25) = 0$ $3(x - 5)(x - 5) = 0$ $x = \{5\}$</p>	<p>10. $11x^2 - x = x^2 + 2$ $10x^2 - x - 2 = 0$ $x^2 - x - 20 = 0$ $(x - 5)(x + 4) = 0$ $(2x - 1)(5x + 2) = 0$ $x = \{\frac{1}{2}, -\frac{2}{5}\}$</p>
<p>11. $9x^2 - 36x = 0$ $9x(x - 4) = 0$ $9x = 0$ $x - 4 = 0$ $x = \{0, 4\}$</p>	<p>12. $16x^2 = 10x$ $16x^2 - 10x = 0$ $2x(8x - 5) = 0$ $2x = 0$ $8x - 5 = 0$ $x = \{0, \frac{5}{8}\}$</p>
<p>13. $x^2 - 100 = 0$ $(x + 10)(x - 10) = 0$ $x + 10 = 0$ $x - 10 = 0$ $x = \{-10, 10\}$</p>	<p>14. $25x^2 + 1 = 5$ $25x^2 - 4 = 0$ $(5x - 2)(5x + 2) = 0$ $x = \{\frac{2}{5}, -\frac{2}{5}\}$</p>
<p>15. $(x - 1)(x - 8) = 0$ $x - 1 = 0$ $x - 8 = 0$ $x = \{1, 8\}$</p>	<p>16. $(x - 7)(x + 3) = 24$ $x^2 + 3x - 7x - 21 = 24$ $x^2 - 4x - 45 = 0$ $(x - 9)(x + 5) = 0$ $x = \{9, -5\}$</p>

Topic #4: Solving Quadratic Equations (By the Quadratic Formula!)

<p>17. $x^2 - x = 18 \rightarrow x^2 - x - 18 = 0$ $x = \frac{1 \pm \sqrt{(-1)^2 - 4(1)(-18)}}{2(1)}$ $x = \frac{1 \pm \sqrt{73}}{2}$ $x = \{4.77, -3.77\}$</p>	<p>18. $-x^2 + 4x = x - 20 \rightarrow -x^2 + 3x + 20 = 0$ $x = \frac{-3 \pm \sqrt{3^2 - 4(-1)(20)}}{2(-1)}$ $x = \frac{-3 \pm \sqrt{89}}{-2}$ $x = \{-3.22, 6.22\}$</p>
<p>19. $8x^2 = 20x$ $8x^2 - 20x = 0$ $x = \frac{20 \pm \sqrt{(-20)^2 - 4(8)(0)}}{2(8)}$ $x = \frac{20 \pm \sqrt{400}}{16}$ $x = \{0, 2.5\}$</p>	<p>20. $4x^2 = 81 \rightarrow 4x^2 - 81 = 0$ $x = \frac{0 \pm \sqrt{0^2 - 4(4)(-81)}}{2(4)}$ $x = \frac{0 \pm \sqrt{1296}}{8}$ $x = \{4.5, -4.5\}$</p>

Topic #5: Area Problems

21. If the area of the rectangle below is 42 inches squared, find the value of x.



$$x = 6$$

$$(x+8)(x-3) = 42$$

$$x^2 - 3x + 8x - 24 = 42$$

$$x^2 + 5x - 66 = 0$$

$$(x+11)(x-6) = 0$$

$$x = \{ \cancel{11}, 6 \}$$

22. The length of a rectangle is five feet less than its width. If the area of the rectangle is 84 square feet, find its dimensions.

Let $x = \text{width}$
Let $x-5 = \text{length}$

$$12 \times 7$$

$$x(x-5) = 84$$

$$x^2 - 5x - 84 = 0$$

$$(x-12)(x+7) = 0$$

$$x = \{ 12, \cancel{57} \}$$

Topic #6: Projectile Motion

23. Natalie found a tennis ball outside a tennis court. She picked up the ball and threw it over the fence into the court. The path of the ball can be represented by $h = -16t^2 + 18t + 5$

a. Find the maximum height of the tennis ball.

$$t = \frac{-18}{2(-16)} \quad t = 0.56$$

$$h = -16(0.56)^2 + 18(0.56) + 5$$

$$h = 10.06 \text{ ft}$$

b. How long will it take to reach the ground?

$$t = \frac{-18 \pm \sqrt{18^2 - 4(-16)(5)}}{2(-16)}$$

$$t = \frac{-18 \pm \sqrt{644}}{-32} \quad t = \{ \cancel{-2.8}, 1.36 \}$$

$$1.36 \text{ sec.}$$

24. A circus acrobat is shot out of a cannon with an initial upward speed of 50 ft/s. The equation for the acrobat's pathway can be modeled by $h = -16t^2 + 50t + 4$.

a. Find the maximum height of the acrobat.

$$t = \frac{-50}{2(-16)} \quad t = 1.56$$

$$h = -16(1.56)^2 + 50(1.56) + 4$$

$$h = 43.06 \text{ ft}$$

b. How long will it take to reach the ground?

$$t = \frac{-50 \pm \sqrt{50^2 - 4(-16)(4)}}{2(-16)}$$

$$t = \frac{-50 \pm \sqrt{2756}}{-32} \quad t = \{ \cancel{-0.8}, 3.20 \}$$

$$3.20 \text{ sec.}$$

Topic #7: Linear & Quadratic Modeling

25. Debbie recorded the time it took seven children of different ages to run a lap around the track. Using an equation to model the data, find the approximate time it would take for a 6 year old to run a lap. **★ Linear!**

AGE (years)	TIME (sec)
4	225
8	185
10	138
11	130
14	112
14	106
18	52

$$y = -12.13x + 272.27$$

$$y = -12.13(6) + 272.27$$

$$y = 199.49 \text{ sec.}$$

26. A pistol is accidentally discharged vertically in the air. The height, h, of the bullet at time t seconds is recorded in the table below. Using an equation to model the data, find the height of the pistol after 10 seconds. **★ Quadratic!**

t (sec)	h (ft)
0	3
1	187
2	339
3	459
4	547

$$y = -16x^2 + 200x + 3$$

$$y = -16(10)^2 + 200(10) + 3$$

$$y = 403 \text{ ft.}$$

UNIT 8 TEST REVIEW

Find Someone Who!

Directions: Trade papers with 12 different people to solve the following problems.

- 1 Find the axis of symmetry and vertex for the following quadratic equation:

$$y = -x^2 + 8x - 23$$

$$x = \frac{-8}{2(-1)} \quad y = -4^2 + 8(4) - 23$$

$$y = -7$$

Axis of Symmetry

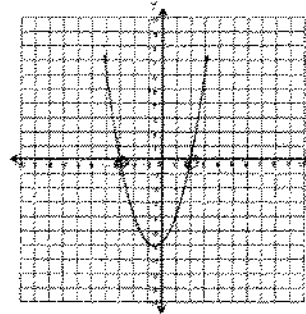
$$x = 4$$

Vertex

$$(4, -7)$$

Name: _____

- 2 Identify the factors of the quadratic equation below. Write your answers in the boxes.



$$x = \{-3, 2\}$$

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

Name: _____

- 3 Write the quadratic equation below in standard form.

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

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

$$y = x^2 - 3x - 3x + 9 + 5$$

$$y = x^2 - 6x + 14$$

Name: _____

- 4 Solve by factoring:

$$x^2 - 30 = 7x$$

$$x^2 - 7x - 30 = 0$$

$$(x - 10)(x + 3) = 0$$

$$x - 10 = 0 \quad x + 3 = 0$$

$$x = \{10, -3\}$$

Name: _____

- 5 Solve by factoring:

$$3x^2 + 3x = 60$$

$$3x^2 + 3x - 60 = 0$$

$$3(x^2 + x - 20) = 0$$

$$3(x + 5)(x - 4) = 0$$

$$x + 5 = 0 \quad x - 4 = 0$$

$$x = \{-5, 4\}$$

Name: _____

- 6 Solve by factoring:

$$10x^2 + 13x = 2x + 6$$

$$10x^2 + 11x - 6 = 0$$

$$x^2 + 11x - 60 = 0$$

$$(x + 15)(x - 4) = 0$$

$$\frac{10}{2} \quad \frac{2}{5}$$

$$(2x + 3)(5x - 2) = 0$$

$$x = \left\{ -\frac{3}{2}, \frac{2}{5} \right\}$$

Name: _____

7

Solve by factoring:

$$12x^2 - 20x = 0$$

$$4x(3x - 5) = 0$$

$$\frac{4x}{4} = 0 \quad \frac{3x - 5}{+5 +5} = 0$$

$$x = 0 \quad \frac{3x}{3} = \frac{5}{3}$$

$$x = \left\{ 0, \frac{5}{3} \right\}$$

Name: _____

8

Solve by factoring:

$$2x^2 = x^2 + 36$$

$$x^2 - 36 = 0$$

$$(x + 6)(x - 6) = 0$$

$$x = \left\{ -6, 6 \right\}$$

Name: _____

9

Solve by factoring:

$$(x + 9)(x - 2) = 42 \quad \leftarrow \text{must be 0!}$$

$$x^2 - 2x + 9x - 18 = 42$$

$$x^2 + 7x - 18 = 42$$

$$x^2 + 7x - 60 = 0$$

$$(x + 12)(x - 5) = 0$$

$$x = \left\{ -12, 5 \right\}$$

Name: _____

10

Which quadratic equation has roots of -5 and 2?

$$\text{A. } y = x^2 + 3x - 10 \quad y = (x + 5)(x - 2) \quad \leftarrow x = \{-5, 2\}$$

$$\text{B. } y = x^2 - 3x - 10 \quad y = (x - 5)(x + 2)$$

$$\text{C. } y = x^2 + 7x + 10 \quad y = (x + 5)(x + 2)$$

$$\text{D. } y = x^2 - 7x + 10 \quad y = (x - 5)(x - 2)$$

Name: _____

The height of an arrow shot into the air can be represented by the equation $h = -16t^2 + 110t + 6$, where t is time in seconds and h is height in feet.

11

What is the maximum height of the arrow?

$$t = \frac{-110}{2(-16)}$$

$$t = 3.44$$

$$h = -16(3.44)^2 + 110(3.44) + 6$$

$$h = \boxed{195.06 \text{ ft}}$$

Name: _____

12

How long will it take the arrow to reach the ground?

$$t = \frac{-110 \pm \sqrt{110^2 - 4(-16)(6)}}{2(-16)}$$

$$t = \frac{-110 \pm \sqrt{12484}}{-32}$$

$$t = \left\{ -0.5, 6.93 \right\}$$

$$\boxed{6.93 \text{ seconds}}$$

Name: _____