

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

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>
---	---	---

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"> <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> <p>y-int: $(0, 15)$</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"> <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> <p>y-int: $(0, -4)$</p>
x	y																		
-1	-9																		
0	-4																		
1	-1																		
2	0																		
3	-1																		
4	-4																		
5	-9																		
<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"> <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: none</p> <p>y-int: $(0, -3)$</p>
x	y																		
-3	-21																		
-2	-11																		
-1	-5																		
0	-3																		
1	-5																		
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>$x = 11, -4$</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>$x = -9, 8$</p>
--	--

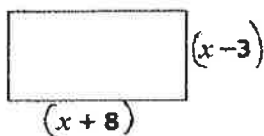
<p>9. $3x^2 + 75 = 30x$ $3x^2 - 30x + 75 = 0$ $3(x^2 - 10x + 25) = 0$ $3(x - 5)(x - 5) = 0$ $x = 5$</p>	<p>10. $11x^2 - x = x^2 + 2$ $(10x^2 - x - 2) = 0$ $x^2 - x - 20 = 0$ $(x - 5)(x + 4) = 0$ $(2x - 1)(5x + 2) = 0$ $x = \frac{1}{2}, -\frac{2}{5}$</p>
<p>11. $9x^2 - 36x = 0$ $9x(x - 4) = 0$ $9x = 0$ $x - 4 = 0$ $x = 0, 4$</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. $x^2 - x = 18 \rightarrow x^2 - x - 18 = 0$ $x = \frac{1 \pm \sqrt{(-1)^2 - 4(1)(-18)}}{2(1)}$ $x = \frac{1 \pm \sqrt{73}}{2}$ $x = .477, -3.77$</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.



$$x = 6$$

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

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

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

$$(x+11)(x-6) = 0 \quad x = \{ \cancel{11}, 6 \}$$

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 $x-5 = \text{length}$

$$12 \times 7$$

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

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

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

$$x = \{ 12, \cancel{7} \}$$

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?

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

$$t = \frac{-18 \pm \sqrt{644}}{-32} \quad t = \{ \cancel{0.8}, 1.36 \}$$

$$1.36 \text{ sec.}$$

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

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

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

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