

Name Key

Algebra 2 Quadratic Functions Study Guide

Graphing Quadratic Functions and Inequalities

$$f(x) = ax^2 + bx + c$$

- Formula for finding the axis of symmetry $x = -b/2a$
- How do you find the vertex? plug in AoS to find y
- How do you know if a function has a maximum or minimum? $a > 0 \rightarrow \text{min}$; $a < 0 \rightarrow \text{max}$
- How do you find the y-intercept? always c
- How do you find the mirror point? count across from y-int
- How do you find the x-intercept(s)? solve (factor/quad form/complete square)
- For inequalities, what symbols cause you to draw a solid line? \geq or \leq
draw a dashed line? $>$ or $<$
- For inequalities, how do you know how to shade? $<$, \leq under; $>$, \geq above

1. Graph $f(x) = x^2 + 2x - 3$

AoS $-2/2(1) = -2/2 = -1$ $(-1, -4)$

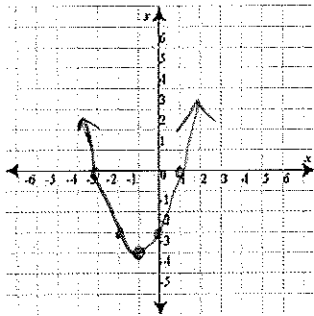
Vertex $(-1)^2 + 2(-1) - 3 = -4$

Min/Max?

Y-int $(0, -3)$

Mirror Point $(-2, -3)$

X-int $(1, 0)$ $(-3, 0)$



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

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

$$x = 1 \quad x = -3$$

2. Graph $y > x^2 + 6x + 7$

AoS $x = -6/2 = -3$

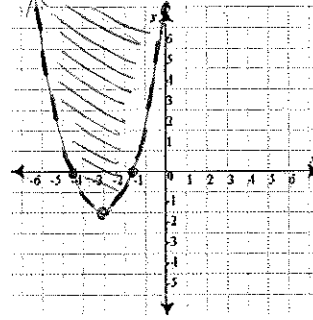
Vertex $(-3)^2 + 6(-3) + 7 = -2$ $(-3, -2)$

Min/Max?

Y-int $(0, 7)$

Mirror Point _____

X-int $(-1, 0)$ $(-4, 0)$



$$x^2 + 6x + 7 = 0$$

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

$$\frac{6}{2} = (3)^2 = 9$$

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

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

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

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

Solving Quadratic Functions

By factoring

$$3. \quad 48x^2 - 12x = 0$$

$$12x(4x - 1) = 0$$

$$12x = 0 \quad 4x - 1 = 0$$

$$\boxed{\begin{matrix} X = 0 \\ X = \frac{1}{4} \end{matrix}}$$

$$4. \quad 10x^2 - 65x - 35 = 0$$

$$5(2x^2 - 13x - 7) = 0$$

$$5(x^2 - 13x - 14) \rightarrow 5\left(x - \frac{14}{2}\right)\left(x + \frac{1}{2}\right) \rightarrow 5(x - 7)(2x + 1) = 0$$

$$\boxed{\begin{matrix} X = 7 \\ X = -\frac{1}{2} \end{matrix}}$$

$$5. \quad x^2 - 8x + 15 = 0$$

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

$$\boxed{X = 3 \quad X = 5}$$

By the square root property

$$6. \quad \sqrt{x^2} = \sqrt{81}$$

$$\boxed{X = \pm 9}$$

$$7. \quad 12x^2 = 2352$$

$$x^2 = 196$$

$$\boxed{X = \pm 14}$$

$$8. \quad 3(x - 13)^2 = 432$$

$$\boxed{X = 1 \quad X = 25}$$

By completing the square

$$9. \quad x^2 - 4x - 5 = 0$$

$$\frac{b}{2} = \frac{-4}{2} = -2 \Rightarrow (-2)^2 = 4$$

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

$$x^2 - 4x + 4 = 9$$

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

$$x - 2 = \pm 3$$

$$\boxed{\begin{matrix} X = -1 \\ X = 5 \end{matrix}}$$

$$10. \quad x^2 - 3x + 1 = 0$$

$$\frac{b}{2} = \frac{-3}{2} \Rightarrow \left(\frac{-3}{2}\right)^2 = \frac{9}{4}$$

$$x^2 - 3x + \frac{9}{4} = \frac{5}{4}$$

$$\left(x - \frac{3}{2}\right)^2 = \frac{5}{4}$$

$$x - \frac{3}{2} = \pm \frac{\sqrt{5}}{2}$$

$$\boxed{X = \frac{3}{2} \pm \frac{\sqrt{5}}{2}}$$

By the quadratic formula

11. What is the quadratic formula?

$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

12. Solve. $x^2 - 6x + 21 = 0$

$$X = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(21)}}{2(1)} = \frac{6 \pm \sqrt{-48}}{2} = \frac{6 \pm 4i\sqrt{3}}{2} = \boxed{3 \pm 2i\sqrt{3}}$$

Quadratic Formula + The Discriminant

13. What is the discriminant? under the $\sqrt{\quad}$ - tells us how many solutions δ
14. $b^2 - 4ac > 0$ and a perfect square 2 real integer roots $\sqrt{25} = \pm 5$
15. $b^2 - 4ac > 0$ and NOT a perfect square 2 real irrational roots $\sqrt{18} = \pm 3\sqrt{2}$
16. $b^2 - 4ac = 0$ one root
17. $b^2 - 4ac < 0$ no real roots (imaginary roots)
18. Find the discriminant, state the number and type of roots, state the actual roots.

$$6x^2 - 2x - 1 = 0$$

$$b^2 - 4ac$$

$$(-2)^2 - 4(6)(-1) = 28$$

2 real irrational roots
cannot factor

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(6)(-1)}}{2(6)}$$

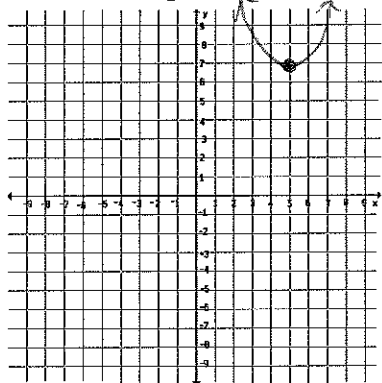
$$x = \frac{2 \pm \sqrt{28}}{12} \rightarrow \frac{2 \pm 2\sqrt{7}}{12} = \frac{1 \pm \sqrt{7}}{6}$$

Transformations with Quadratic Functions

19. State both the standard form and vertex form of a quadratic function.

$$y = ax^2 + bx + c \rightarrow y = a(x+h)^2 + k$$

20. Write the equation in vertex form and graph. $y = x^2 - 10x + 32$



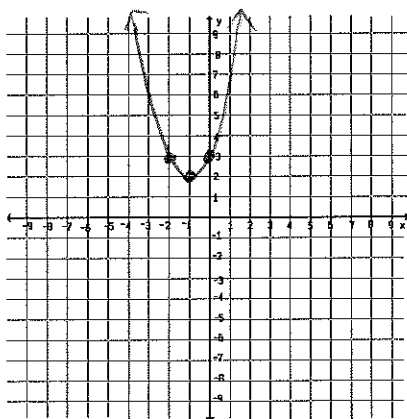
$$x = \frac{-(-10)}{2(1)} = \frac{10}{2} = 5$$

$$y = (5)^2 - 10(5) + 32 = 7$$

$$\begin{matrix} (5, 7) \\ h \quad k \end{matrix}$$

$$y = (x-5)^2 + 7$$

21. Graph $y = (x+1)^2 + 2$



vertex: $(-1, 2)$

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

$$(x+1)(x+1) + 2$$

$$x^2 + 2x + 1 + 2$$

$$x^2 + 2x + 3$$

y-int: $(0, 3)$

Simplifying Radicals and Complex / Imaginary Numbers

22. $3\sqrt{98}$ $21\sqrt{2}$

23. $\sqrt{-45x^5y^{12}}$ $3ix^2y^6\sqrt{5x}$

24. $(-4 + 2i) + (6 - 3i)$ $2 - i$

25. $(5 - 2i)(4 - i)$ $18 - 13i$

26. $\frac{7-13i}{2i} \cdot \frac{i}{i} = \frac{7i-13i^2}{2i^2} = \frac{7i+13}{-2}$ or $\frac{-13-7i}{2}$

27. $\frac{5+i}{3+i} \cdot \frac{3-i}{3-i} = \frac{16-2i}{10} = \frac{8-i}{5}$

28. i^{159} i

Word Problems

29. David threw a baseball into the air. The function of the height of the baseball in feet is $h = 80t - 16t^2$, where t represents the time in seconds after the ball was thrown. Determine how long it took for the ball to fall back to the ground.

$80t - 16t^2 = 0$ $t = 0$ $t = 5$ 5 seconds *solve*

$-16t = 0$ $t - 5 = 0$ $t = 5$

30. Using the function above, how high did David throw it?

vertex

$x = \frac{-b}{2a} = \frac{-80}{2(-16)} = 2.5$

$h = 80(2.5) - 16(2.5)^2 = \boxed{100 \text{ ft}}$