

Key

Know it!
Note

9-1 Identify Quadratic Functions

Tell whether each function is quadratic. Explain.

1. $y + 2 = 4x + 3x + 12$

No, not x^2

2. $\{(-2, 11), (-1, 1), (0, -5), (1, -7), (2, -5)\}$

+1 +1 +1
-10 -6 -2 +2
+4 +4 +4

Yes, since the common difference is the same for the x-values & the second common difference is the same for the y-values.

Tell whether the graph of each quadratic function opens upward or downward and whether the parabola has a maximum or a minimum.

3. $y = -x^2 + 4x - 1$

Open down, maximum

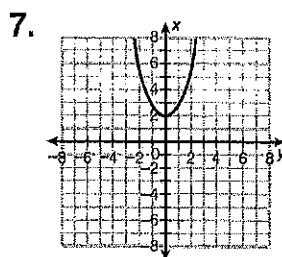
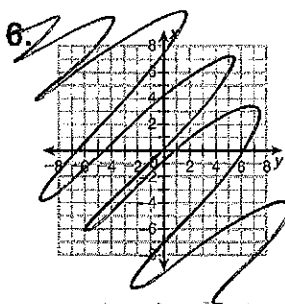
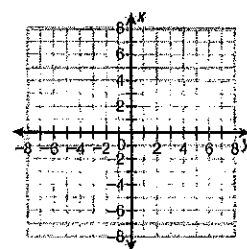
4. $y = 2x^2 + 3x + 5$

open up, minimum

~~5. Graph the function $y = -\frac{3}{4}x^2 + x + 4$ and give the domain and range.~~
~~x-values~~ ~~y-values~~

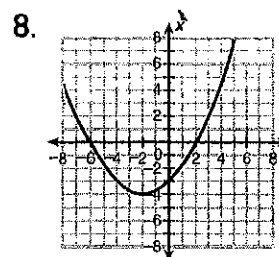
9-2 Characteristics of Quadratic Functions

Find the zeros of each function from its graph. Then find its axis of symmetry.



No Zeros

axis of sym
 $x = 0$



$(-6, 0) (2, 0)$

A.O.S. $x = -2$

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

Find the vertex of each parabola.

9. $y = x^2 + 6x - 7$

$\frac{-6}{2(1)} = \frac{-6}{2} = -3$

$x = -3$

~~10. $y = x^2 - 10x + 21$~~

11. $y = 3x^2 + 9x - 12$

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

9-3 Graphing Quadratic Functions

Graph each quadratic function.

$x = \frac{-b}{2a} = \frac{-6}{2(2)} = \frac{-6}{4} = -\frac{3}{2}$

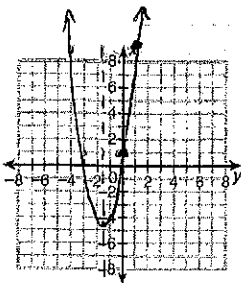
 $y = 2(-\frac{3}{2})^2 + 6(-\frac{3}{2}) + 1$

 $y = -1\frac{1}{2} = -1.5$

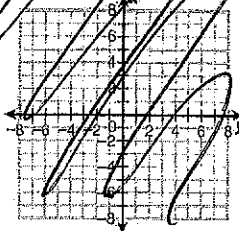
plug in Note

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

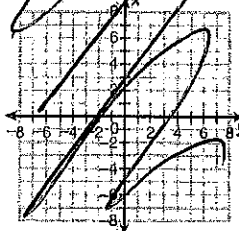
x	y
-1.5	-5.5
0	1
1	9



13. $y + 3x^2 = \frac{1}{3}x - 1$



14. $y = \frac{1}{2}x^2 - 2x + 4$



9-4 Transforming Quadratic Functions

Compare the graph of each function with the graph of $f(x) = x^2$.

15. $g(x) = x^2 - 5$

Down 5

16. $g(x) = -\frac{4}{5}x^2$

Reflect across the x-axis
Horizontal stretch

9-5 Solving Quadratic Equations by Graphing

Solve each equation by graphing the related function.

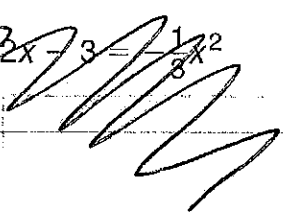
17. $x^2 - 4x = 0$

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

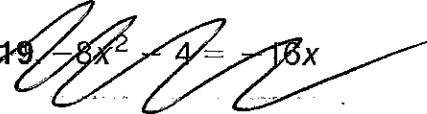
x	y
2	-4
3	-3
4	0
0	0

$x = 0$
 $x = 4$

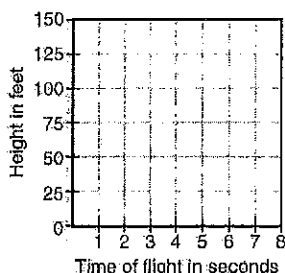
18. $2x - 3 = \frac{1}{8}x^2$



19. $-8x^2 - 4 = -16x$



20. A baseball is thrown upward with an initial velocity of 96 feet per second. The equation $h = -16t^2 + 96t$ represents the height, h , of a baseball after t seconds. Graph the equation. How long will it take the baseball to return to the ground?



t	h
0	0
1	80
2	128
3	144
4	128
5	80
6	0

$t = 6 \text{ sec}$

9-6 Solving Quadratic Equations by Factoring

Use the Zero Product Property to solve each equation.

21. $(x - 5)(x + 2) = 0$

$x = 5 \quad x = -2$

~~22. $(2x - 5)(4x - 5) = 0$~~

23. $x(x - 5) = 0$

$x = 0 \quad x = 5$

Solve each quadratic equation by factoring.

24. $x^2 + 5x + 6 = 0$

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

$x = -2 \quad x = -3$

25. $2x^2 + 5x - 12 = 0$

$(2x - 3)(x + 4) = 0$

$x = \frac{3}{2} \quad x = -4$

~~26. $4x^2 = 4x - 1$~~

9-7 Solving Quadratic Equations by Using Square Roots

Solve using square roots.

27. $\frac{2x^2}{2} = \frac{72}{2}$

~~30. $4x^2 + 13 = 49$~~

$x^2 = 36$
 $x = \pm 6$

28. $0 = 5x^2 - 245$

$+245 \quad +245$

~~31. $8x^2 + 10 = 42$~~

$\frac{245}{5} = \frac{5x^2}{5}$

$\sqrt{49} = \sqrt{x^2}$

$\pm 7 = x$

$x = \pm 7$

29. $25x^2 - 16 = 0$

$+16 \quad +16$

~~32. $36x^2 - 59 = 10$~~

$\frac{25x^2}{25} = \frac{16}{25}$

$\sqrt{x^2} = \sqrt{\frac{16}{25}}$

$x = \frac{\pm \sqrt{16}}{\sqrt{25}} = \pm \frac{4}{5}$

$x = \pm \frac{4}{5}$

Solve. Round to the nearest hundredth.

$$33. 84 - 7x^2 = -22$$

$$\begin{aligned} -84 & -84 \\ -7x^2 & = -106 \\ -7 & -7 \\ x^2 & = 15.14 \end{aligned}$$

$$x = \pm 3.89$$

~~$34. 16x^2 - 144 = 28$~~

~~$35. 18x^2 - 186 = 94$~~

9-8 Completing the Square

Complete the square for each expression. $\left(\frac{b}{2}\right)^2$

$$36. x^2 - 14x + \square$$

$$\left(\frac{-14}{2}\right)^2 = (-7)^2 = 49$$

$$37. x^2 + 6x + \square$$

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

$$38. x^2 - 11x + \square$$

$$\left(\frac{-11}{2}\right)^2 = (-5.5)^2 = 30.25$$

Solve by completing the square.

$$39. x^2 + 10x - 11 = 0$$

$$\begin{aligned} x^2 + 10x + 25 & = 11 + 25 \\ \sqrt{(x+5)^2} & = \sqrt{36} \\ x+5 & = \pm 6 \\ x+5=6 & \quad x+5=-6 \\ -5 & \quad -5 \quad -5 \quad -5 \\ x=1 & \quad x=-11 \end{aligned}$$

$$40. x^2 - 24x + 63 = 0$$

$$\begin{aligned} x^2 - 24x + 144 & = -63 + 144 \\ \sqrt{(x-12)^2} & = \sqrt{81} \\ x-12 & = \pm 9 \\ x-12=9 & \quad x-12=-9 \\ +12 & \quad +12 \quad +12 \quad +12 \\ x=21 & \quad x=3 \end{aligned}$$

~~$41. 2x^2 - 8x = 20$~~

$$44. x^2 - 2x = 2$$

$$\begin{aligned} x^2 - 2x + 1 & = 2 + 1 \\ \sqrt{(x-1)^2} & = \sqrt{3} \\ x-1 & = \pm \sqrt{3} \\ x-1=\sqrt{3} & \quad x-1=-\sqrt{3} \\ +1 & \quad +1 \quad +1 \quad +1 \\ x=2.73 & \quad x=-0.73 \end{aligned}$$

45. The area of a rectangle is given by $A = x^2 + 4x - 5$. Find the expressions for possible lengths and widths of the rectangle.

9-9 The Quadratic Formula and the Discriminant

Solve using the Quadratic Formula. Round your answer to the nearest hundredth.

$$a=2 \quad b=4 \quad c=-3$$

$$46. 2x^2 - 4x - 3 = 0$$

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

$$\begin{aligned} \frac{4 \pm \sqrt{16+24}}{4} & = \frac{4 \pm \sqrt{40}}{4} \\ & = \frac{4 \pm 6.32}{4} \end{aligned}$$

$$\begin{aligned} & \rightarrow 2.58 \\ & \rightarrow -0.58 \end{aligned}$$

$$49. x^2 + 2x = 1$$

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

$$a=1 \quad b=2 \quad c=-1$$

$$\frac{-2 \pm \sqrt{2^2 - 4(1)(-1)}}{2(1)} = \frac{-2 \pm \sqrt{4+4}}{2} = \frac{-2 \pm \sqrt{8}}{2}$$

$$\begin{aligned} & \rightarrow 0.41 \\ & \rightarrow -2.41 \end{aligned}$$

$$a=8 \quad b=10 \quad c=-33$$

$$48. 8x^2 + 10x - 33 = 0$$

$$\frac{-10 \pm \sqrt{10^2 - 4(8)(-33)}}{2(8)}$$

$$\begin{aligned} & = \frac{-10 \pm \sqrt{100+1056}}{16} \\ & = \frac{-10 \pm \sqrt{1156}}{16} \end{aligned}$$

$$\begin{aligned} & = \frac{-10 \pm 34}{16} \end{aligned}$$

$$\begin{aligned} & \rightarrow 1.5 \\ & \rightarrow -2.75 \end{aligned}$$