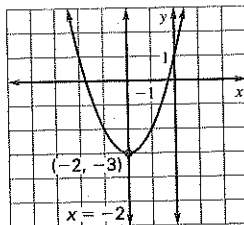


Chapter 10, continued

8. $y = x^2 + 4x + 1$

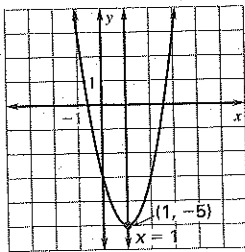


Because $a > 0$, the parabola opens up.

Axis of symmetry: $x = \frac{-b}{2a} = \frac{-4}{2(1)} = -2$.

The x -component of the vertex is -2 . The y -component of the vertex is $y = (-2)^2 + 4(-2) + 1 = -3$.

9. $y = 2x^2 - 4x - 3$

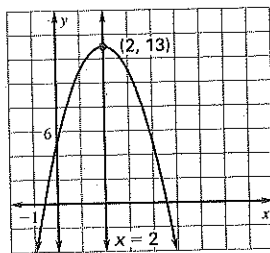


Because $a > 0$, the parabola opens up.

Axis of symmetry: $x = \frac{-b}{2a} = \frac{-(-4)}{2(2)} = 1$.

The x -coordinate of the vertex is $\frac{-b}{2a}$ or 1. The y -coordinate of the vertex is $y = 2(1)^2 + 4(1) - 3 = -5$.

10. $y = 2x^2 + 8x + 5$



Because $a < 0$, the parabola opens down.

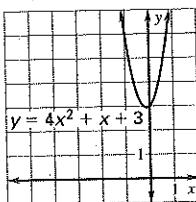
Axis of symmetry: $x = \frac{-b}{2a} = \frac{-8}{2(-2)} = 2$.

The x -coordinate of the vertex is $\frac{-b}{2a}$ or 2. The y -coordinate of the vertex is $y = -2(2)^2 + 8(2) + 5 = 13$.

11. $4x^2 + x + 3 = 0$

The graph has no x -intercepts.

This means there are no solutions.

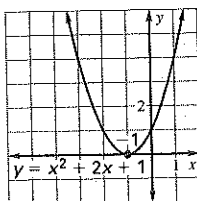


12. $x^2 + 2x = -1$

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

The x -intercept of the graph is -1 .

The solution is -1 .

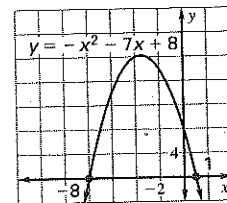


13. $-x^2 + 8 = 7x$

$-x^2 - 7x + 8 = 0$

The x -intercepts of the graph are -8 and 1 .

The solutions are -8 and 1 .



14. $6x^2 - 54 = 0$

$6x^2 = 54$

$x^2 = 9$

$x = \pm 3$

The solutions are -3 and 3 .

15. $3x^2 + 7 = 4$

$3x^2 = -3$

$x^2 = -1$

Negative real numbers do not have real square roots. So, there is no solution.

16. $g^2 + 11 = 24$

$g^2 = 13$

$g = \pm \sqrt{13}$

The solutions are $\sqrt{13} \approx 3.61$ and $-\sqrt{13} \approx -3.61$.

17. $7n^2 + 5 = 9$

$7n^2 = 4$

$n^2 = \frac{4}{7}$

$n = \pm \sqrt{\frac{4}{7}}$

The solutions are $\sqrt{\frac{4}{7}} \approx 0.76$ and $-\sqrt{\frac{4}{7}} \approx -0.76$.

18. $2(a + 7)^2 = 34$

$(a + 7)^2 = 17$

$a + 7 = \pm \sqrt{17}$

$a = -7 \pm \sqrt{17}$

The solutions are $-7 + \sqrt{17} \approx -2.88$ and

$-7 - \sqrt{17} \approx -11.12$.

19. $3(w - 4)^2 = 5$

$(w - 4)^2 = \frac{5}{3}$

$w - 4 = \pm \sqrt{\frac{5}{3}}$

$w = 4 \pm \sqrt{\frac{5}{3}}$

The solutions are $4 + \sqrt{\frac{5}{3}} \approx 5.29$ and $4 - \sqrt{\frac{5}{3}} \approx 2.71$.

20. $x^2 - 14x = 51$

$x^2 - 14x + 7^2 = 51 + 7^2$

$(x - 7)^2 = 100$

$x - 7 = \pm \sqrt{100}$

$x = 7 \pm 10$

The solutions are $7 + 10 = 17$ and $7 - 10 = -3$.

Chapter 10, continued

21. $2a^2 + 12a - 4 = 0$

$$a^2 + 6a - 2 = 0$$

$$a^2 + 6a = 2$$

$$a^2 + 6a + 3^2 = 2 + 3^2$$

$$(a + 3)^2 = 11$$

$$a + 3 = \pm\sqrt{11}$$

$$a = -3 \pm \sqrt{11}$$

The solutions are $-3 + \sqrt{11} \approx 0.32$ and $-3 - \sqrt{11} \approx -6.32$.

22. $2n^2 + 4n + 1 = 10n + 9$

$$2n^2 - 6n = 8$$

$$n^2 - 3n = 4$$

$$n^2 - 3n + \left(-\frac{3}{2}\right)^2 = 4 + \left(-\frac{3}{2}\right)^2$$

$$\left(n - \frac{3}{2}\right)^2 = \frac{25}{4}$$

$$n - \frac{3}{2} = \pm\sqrt{\frac{25}{4}}$$

$$n = \frac{3}{2} \pm \frac{5}{2}$$

The solutions are $\frac{3}{2} + \frac{5}{2} = 4$ and $\frac{3}{2} - \frac{5}{2} = -1$.

23. $5g^2 - 3g + 6 = 2g^2 + 9$

$$3g^2 - 3g = 3$$

$$g^2 - g = 1$$

$$g^2 - g + \left(-\frac{1}{2}\right)^2 = 1 + \left(-\frac{1}{2}\right)^2$$

$$\left(g - \frac{1}{2}\right)^2 = \frac{5}{4}$$

$$g - \frac{1}{2} = \pm\sqrt{\frac{5}{4}}$$

$$g = \frac{1}{2} \pm \sqrt{\frac{5}{4}}$$

The solutions are $\frac{1}{2} + \sqrt{\frac{5}{4}} \approx 1.62$ and $\frac{1}{2} - \sqrt{\frac{5}{4}} \approx -0.62$.

24. $x^2 - 2x - 15 = 0$

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-15)}}{2(1)} = \frac{2 \pm \sqrt{64}}{2}$$

$$= \frac{2 \pm 8}{2}$$

The solutions are $\frac{2+8}{2} = 5$ and $\frac{2-8}{2} = -3$.

25. $2m^2 + 7m - 3 = 0$

$$m = \frac{-7 \pm \sqrt{7^2 - 4(2)(-3)}}{2(2)} = \frac{-7 \pm \sqrt{73}}{4}$$

The solutions are $\frac{-7 + \sqrt{73}}{4} \approx 0.39$ and $\frac{-7 - \sqrt{73}}{4} \approx -3.89$.

26. $-w^2 + 5w = 3$

$$-w^2 + 5w - 3 = 0$$

$$w = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(-1)(-3)}}{2(-1)} = \frac{-5 \pm \sqrt{13}}{-2}$$

The solutions are $\frac{-5 \pm \sqrt{13}}{-2} \approx 0.70$ and $\frac{-5 - \sqrt{13}}{-2} \approx 4.30$.

27. $5n^2 - 7n = -1$

$$5n^2 - 7n + 1 = 0$$

$$n = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(5)(1)}}{2(5)} = \frac{7 \pm \sqrt{29}}{10}$$

The solutions are $\frac{7 + \sqrt{29}}{10} \approx 1.24$ and $\frac{7 - \sqrt{29}}{10} \approx 0.16$.

28. $t^2 - 4t = 6t + 8$

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

$$t = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(-12)}}{2(1)} = \frac{6 \pm \sqrt{84}}{2}$$

The solutions are $\frac{6 + \sqrt{84}}{2} \approx 7.58$ and $\frac{6 - \sqrt{84}}{2} \approx -1.58$.

29. $2h^2 - 1 = 10 - 9h^2$

$$9h^2 + 2h - 11 = 0$$

$$h = \frac{-2 \pm \sqrt{2^2 - 4(9)(-11)}}{2(9)} = \frac{-2 \pm \sqrt{400}}{18}$$

$$= \frac{-2 \pm 20}{18}$$

The solutions are $\frac{-2 + 20}{18} = 1$ and $\frac{-2 - 20}{18} \approx -1.22$.

30. Let l = length of the rectangle and w = width of the rectangle

$$\text{Area} = l \cdot w$$

When Area = 500, $l = 4x - 3$, and $w = 2x + 6$:

$$500 = (4x - 3)(2x + 6)$$

$$500 = 8x^2 + 18x - 18$$

$$0 = 8x^2 + 18x - 518$$

$$0 = 4x^2 + 9x - 259$$

$$x = \frac{-9 \pm \sqrt{9^2 - 4(4)(-259)}}{2(4)} = \frac{-9 \pm \sqrt{4225}}{8} = \frac{-9 \pm 65}{8}$$

The solutions are $\frac{-9 + 65}{8} = 7$ and $\frac{-9 - 65}{8} = -9.25$.

Distances must be positive, so the value of x is 7.

The dimensions are $4(7) - 3$, or 25 meters by $2(7) + 6$, or 20 meters.

31. $x^2 - 2x + 2 = 0$

$$b^2 - 4ac = (-2)^2 - 4(1)(2) = -4$$

The discriminant is negative, so the equation has no solution.

32. $4g^2 + 12g + 9 = 0$

$$b^2 - 4ac = (12)^2 - 4(4)(9) = 0$$

The discriminant is zero, so the equation has one solution.

Chapter 10, continued

33. $5w^2 - 4w - 1 = 0$

$$b^2 - 4ac = (-4)^2 - 4(5)(-1) = 36$$

The discriminant is positive, so the equation has two solutions.

34. $\frac{1}{8}y^2 - 6 = 0$

$$b^2 - 4ac = (0)^2 - 4\left(\frac{1}{8}\right)(-6) = 3$$

The discriminant is positive, so the equation has two solutions.

35. $n^2 - 3n = 4 - 2n^2$

$$3n^2 - 3n - 4 = 0$$

$$b^2 - 4ac = (-3)^2 - 4(3)(-4) = 57$$

The discriminant is positive, so the equation has two solutions.

36. $2q^2 + 1 = 3q - 5$

$$2q^2 - 3q + 6 = 0$$

$$b^2 - 4ac = (-3)^2 - 4(2)(6) = -39$$

The discriminant is negative, so the equation has no solutions

37.

x	1	2	3	4	5	6
y	1	2	4	8	16	32

Ratios: $\frac{2}{1} = 2$ $\frac{4}{2} = 2$ $\frac{8}{4} = 2$ $\frac{16}{8} = 2$ $\frac{32}{16} = 2$

The table of values represents an exponential function because the ratios are equal.

38.

x	-2	-1	0	1	2	3
y	0	3	6	9	12	15

Differences: 3 3 3 3 3

The table of values represents a linear function because the differences are equal.

Chapter 10 Test (p. 701)

- C; The graph of $y = x^2 - 2$ is a vertical translation (of 2 units down) of the graph of $y = x^2$.
- A; The graph of $y = x^2 + 2$ is a vertical translation (of 2 units up) of the graph of $y = x^2$.
- B; The graph of $y = -2x^2$ is a vertical stretch (by a factor of 2) and a reflection in the x -axis of the graph of $y = x^2$.

4. $y = 2x^2 + 6x - 5$

Because $a > 0$, the graph opens up.

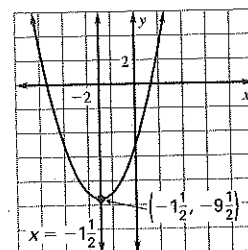
Axis of symmetry:

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

When $x = -\frac{3}{2}$:

$$y = 2\left(-\frac{3}{2}\right)^2 + 6\left(-\frac{3}{2}\right) - 5 = -\frac{19}{2}$$

Vertex: $\left(-\frac{3}{2}, -\frac{19}{2}\right)$.



5. $y = -4x^2 - 8x + 25$

Because $a < 0$, the graph opens down.

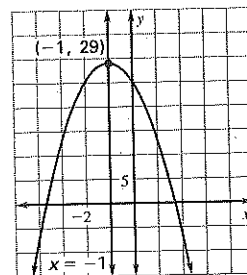
Axis of symmetry:

$$x = -\frac{b}{2a} = -\frac{8}{2(-4)} = -1$$

When $x = -1$:

$$y = -4(-1)^2 - 8(-1) + 25 = 29$$

Vertex: $(-1, 29)$.



6. $y = -\frac{1}{4}x^2 - x - 7$

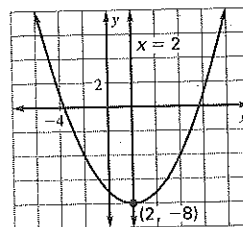
Because $a < 0$, the graph opens down.

Axis of symmetry:

$$x = -\frac{b}{2a} = -\frac{-1}{2\left(-\frac{1}{4}\right)} = 2$$

When $x = 2$: $y = -\frac{1}{4}(2)^2 - (2) - 7 = -8$

Vertex: $(2, -8)$.



7. $f(x) = x^2 + 5x + 1$

$$0 = x^2 + 5x + 1$$

$$x = \frac{-5 \pm \sqrt{5^2 - 4(1)(1)}}{2(1)} = \frac{-5 \pm \sqrt{21}}{2}$$

The zeros are $\frac{-5 + \sqrt{21}}{2} \approx -0.2$ and $\frac{-5 - \sqrt{21}}{2} \approx -4.8$.

8. $f(x) = x^2 - 8x + 3$

$$0 = x^2 - 8x + 3$$

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(3)}}{2(1)} = \frac{8 \pm \sqrt{52}}{2}$$

The zeros are $\frac{8 + \sqrt{52}}{2} \approx 7.6$ and $\frac{8 - \sqrt{52}}{2} \approx 0.4$.