Review Exercises (Ch. 7)

1) The slope of a linear equation is constant (it never changes). A quadratic equation has a slope that always changes.

3) $x \approx -0.83$ or $x = 1.2$

5) $7x^2 - 1 = 2$

$7x^2 = 3$

$x^2 = \frac{3}{7}$ çExtract the square

$x = \pm\sqrt{\frac{3}{7}}$

$x = \sqrt{\frac{3}{7}} \approx 0.65$ or $x = -\sqrt{\frac{3}{7}} \approx -0.65$

7) $2x^2 - 7x = 15$

$2x^2 - 7x - 15 = 0$

$2x^2 - 10x + 3x - 15 = 0$ çSplit the middle term

$(2x^2 - 10x) + (3x - 15) = 0$ çGroup the terms

$2x(x - 5) + 3(x - 5) = 0$ çFactor out GCF of both groups

$(2x + 3)(x - 5) = 0$ çFactor out common binomial

$2x + 3 = 0$ or $x - 5 = 0$ çZero product property

$2x = -3$ or $x = 5$

$x = -\frac{3}{2}$ or $x = 5$

9)

a) Graph $Y_1 = (\pi/3)X^2$ and graph $Y_2 = 180$. Use the intersect function [2nd] [CALC] [5] to conclude that 180 g of cheese can cover a pizza with a diameter of approximately 13.1 inches.

b) $c = \frac{\pi}{3}d^2$

$180 = \frac{\pi}{3}d^2$

$\frac{3}{\pi}\ 180 = \frac{3}{\pi}\ \frac{\pi}{3}d^2$

$\frac{540}{\pi} = d^2$

$d = \sqrt{\frac{540}{\pi}}$ in çNote we ignore the negative root (Why?)

11)

a) Let *l* denote the length of the rectangle and let *w* denote its width. From the problem we have

$l = w + 3$ çLength is 3 m more than the width

$lw = 10$ çArea is 10 square meters

$(w + 3)w = 10$ çSubstitute w + 3 for l in 2nd equation

$w^2 + 3w = 10$

Graph Y_1 = X^2 +3X and graph Y_2 = 10. Use the intersect function 2nd CALC 5 to conclude X = 2. So w = 2 m and l = (2) + 3 = 5 m. You could also graph Y_1 = X^2 + 3X –10 and use the zero function 2nd CALC 2 to find the positive x-intercept (root) of the equation.

b) $l = w + 3$

$lw = 10$

$(w + 3)w = 10$

$w^2 + 3w = 10$

$w^2 + 3w - 10 = 0$

$w^2 - 2w + 5w - 10 = 0$ çSplit the middle term

$(w^2 - 2w) + (5w - 10) = 0$ çGroup the terms

$w(w - 2) + 5(w - 2) = 0$ çFactor out GCF of each group

$(w - 2)(w + 5) = 0$ çFactor out common binomial

$w - 2 = 0$ or $w + 5 = 0$ çZero product property

$w = 2$ or $w = -5$

$w = 2$ çNegative root must be ignored (Why?)

The width of the rectangle is 2 meters and its length is 5 meters.

13) Vertex: Minimum at ($^{-}1$,$^{-}7$)

Roots: $^{-}3.65$, 1.65

Y-intercept: (0,$^{-}6$)

15) Vertex: Minimum at ($^{-}2.5$, 2.5)

Roots: None

Y-intercept: (0,15)

17) $x^2 + 2nx - k = 0$ çSee description after Fact 7.1

$x^2 + 5x - 2 = 0$ çQuadratic with 2n = 5 and k = 2.

$x^2 + 5x = 2$

$x^2 + 5x + \frac{25}{4} = 2 + \frac{25}{4}$ ç$n = \frac{5}{2}$, $n^2 = \frac{25}{4}$

$x^2 + 5x + \frac{25}{4} = \frac{33}{4}$ çLeft side is now a perfect square trinomial

$(x + \frac{5}{2})^2 = \frac{33}{4}$

$x + \tfrac{5}{2} = \pm\sqrt{\tfrac{33}{4}}$

$x = -\tfrac{5}{2} \pm \sqrt{\tfrac{33}{4}}$

$x = -\tfrac{5}{2} + \sqrt{\tfrac{33}{4}} \approx 0.37$ or $x = -\tfrac{5}{2} - \sqrt{\tfrac{33}{4}} \approx -5.37$

19)

a) A graphing method can only give an approximation of the solutions to this quadratic because they contain square roots of numbers that aren't perfect squares. The calculator can only approximate at this point.

b) $x^2 + 2nx - k = 0$ çSee description after Fact 7.1

$x^2 + 2x - 6 = 0$ çQuadratic with $2n = 2$ and $k = 6$

$x^2 + 2x = 6$

$x^2 + 2x + 1 = 6 + 1$ ç$2n = 2$, $n = 1$, $n^2 = 1$

$x^2 + 2x + 1 = 7$ çLeft side is now a perfect square trinomial

$(x + 1)^2 = 7$

$x + 1 = \pm\sqrt{7}$

$x = -1 \pm \sqrt{7}$

c) Answers may vary. Exact results can be immediately substituted back into the equation to check for correctness. Also, you can continue working with an exact solution with no loss of accuracy. You can approximate the root at any time for as much accuracy as needed.

21) $2x^2 + \tfrac{2}{3}x - \tfrac{1}{6} = 0$

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

$$x = \frac{-(\tfrac{2}{3})}{2\quad(2)} \pm \frac{\sqrt{(\tfrac{2}{3})^2 - 4\quad(2)\quad(-\tfrac{1}{6})}}{2\quad(2)}$$

$$x = \frac{-\tfrac{2}{3}}{4} \pm \frac{\sqrt{\tfrac{4}{9} - (-\tfrac{8}{6})}}{4}$$

$$x = -\frac{2}{12} \pm \frac{\sqrt{\tfrac{8}{18} + \tfrac{24}{18}}}{4}$$

$$x = -\frac{2}{12} \pm \frac{\sqrt{\tfrac{32}{18}}}{4}$$

$$x = -\frac{2}{12} \pm \frac{\sqrt{\tfrac{16}{9}}}{4}$$

$$x = -\frac{2}{12} \pm \frac{\frac{4}{3}}{4}$$

$$x = -\frac{2}{12} \pm \frac{4}{12}$$

$$x = -\frac{1}{6} \pm \frac{2}{6}$$

$$x = -\frac{1}{6} + \frac{2}{6} = \frac{1}{6} \text{ or } x = -\frac{1}{6} - \frac{2}{6} = -\frac{3}{6} = -\frac{1}{2}$$

$$x = \frac{1}{6} \text{ or } x = -\frac{1}{2}$$

23) $y = -x^2 + 6x + 5$ çQuadratic with $a = {}^{-}1$, $b = 6$, $c = 5$

a) x-coordinate of vertex is $x = \frac{-b}{2a}$.

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

y-coordinate of vertex $= -(3)^2 + 6(3) + 5 = -9 + 18 + 5 = 14$
Vertex: (3, 14)

b) Discriminant $= b^2 - 4ac$

$= (6)^2 - 4(-1)(5)$

$= 36 - (-20)$

$= 56$

Since the discriminant = 56 > 0, the quadratic has two real roots.

c) $-x^2 + 6x + 5 = 0$

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

$$x = \frac{-(6)}{2\ \ (-1)} \pm \frac{\sqrt{56}}{2\ \ (-1)}$$ çSee part (b): $b^2 - 4ac = 56$

$$x = \frac{-6}{-2} \pm \frac{\sqrt{56}}{-2}$$

$$x = 3 \pm \frac{\sqrt{56}}{-2}$$

$$x = 3 \mp \frac{\sqrt{56}}{2}$$

$$x = 3 \pm \frac{\sqrt{56}}{2}$$

25)

a) (6.1, 34.5)

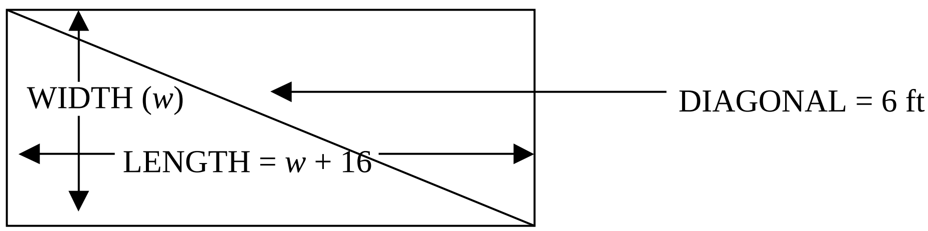
b) The vertex (6.1, 34.5) indicates that the ball reached a maximum height of approximately 34.5 meters approximately 6.1 seconds after it was thrown.

c) (12.6, 0)—approximately

d) The *x*-intercept (12.6, 0) indicates that the ball hit the ground approximately 12.6 sec after it was thrown.

27)

a)



b) Let *w* denote the width of the rectangular tabletop *in inches*.
Since there are 12 inches in 1 ft, the diagonal length = 6 (12 in) = 72 in. Now by the Pythagorean Theorem (Section 2.2), we have $w^2 + (w+16)^2 = (72\text{ in})^2$

c)

$$w^2 + (w+16)^2 = (72)^2$$
$$w^2 + (w+16)^2 = 5{,}184$$
$$w^2 + (w+16)(w+16) = 5{,}184$$
$$w^2 + w(w+16) + 16(w+16) = 5{,}184$$
$$w^2 + w^2 + 16w + 16w + 256 = 5{,}184$$
$$2w^2 + 32w + 256 = 5{,}184$$
$$2w^2 + 32w - 4928 = 0$$
$$2\ (w^2 + 16w - 2464) = 0$$ çFactor out common monomial
$$w^2 + 16w - 2464 = 0$$

The quadratic expression on the left side of the equation isn't nicely factorable. By graphing, we discover $w \approx 42.3\text{ in}$.

d) The table's width is approximately 42.3 in.
The table's length is approximately (42.3) + 16 = 58.3 in.

29) $0.045x^2 + 0.22x = 175$

Graph Y_1 = 0.045X^2 + 0.22X and graph Y2 = 175 and find the positive *x*-coordinate of their point of intersection. You could also graph Y_1 = 0.045X^2 + 0.22X – 175 and find this graph's positive *x*-intercept.

The vehicle was traveling at a speed of approximately 60 miles per hour.