

$$\begin{aligned}
 103. \text{ (c) } h &= -16t^2 + v_0t + h_0 & v_0 &= 32 \text{ feet/sec} \\
 50 &= -16t^2 + 32t + 100 & h &= 50 \text{ feet} \\
 0 &= -16t^2 + 32t + 50 \\
 0 &= 8t^2 - 16t - 25 & & \text{(Divide by } -2) \\
 t &= \frac{-(-16) \pm \sqrt{(-16)^2 - 4(8)(-25)}}{2(8)} \\
 t &= \frac{16 \pm \sqrt{256 + 800}}{16} \\
 t &= \frac{16 \pm \sqrt{1056}}{16} = \frac{16 \pm 4\sqrt{66}}{16} = \frac{4 \pm \sqrt{66}}{4} \approx 3.0 \text{ seconds}
 \end{aligned}$$

Quadratic formula method was used because the numbers were large and equation would not factor.

$$\begin{aligned}
 \text{(d) } 0 &= -16t^2 + 32t + 100 & 0 &= -16t^2 + 32t + 84 \\
 0 &= 4t^2 - 8t - 25 & 0 &= 4t^2 - 8t - 21 \\
 t &= \frac{-(-8) \pm \sqrt{(-8)^2 - 4(4)(-25)}}{2(4)} & t &= \frac{-(-8) \pm \sqrt{(-8)^2 - 4(4)(-21)}}{2(4)} \\
 t &= \frac{8 \pm \sqrt{64 + 400}}{8} & t &= \frac{8 \pm \sqrt{64 + 336}}{8} \\
 t &= \frac{8 \pm \sqrt{464}}{8} & t &= \frac{8 \pm \sqrt{400}}{8} \\
 t &\approx 3.7 \text{ seconds} & t &\approx 3.5 \text{ seconds}
 \end{aligned}$$

105. $b^2 - 4ac$. If the discriminant is positive, the quadratic equation has two real solutions; if it is zero, the equation has one (repeated) real solution; and if it is negative, the equation has no real solutions.

107. The four methods are factoring, extracting square roots, completing the square, and the Quadratic Formula.

Mid-Chapter Quiz for Chapter 6

1. $2x^2 - 72 = 0$

$$2(x^2 - 36) = 0$$

$$2(x - 6)(x + 6) = 0$$

$$x - 6 = 0 \quad x + 6 = 0$$

$$x = 6 \quad x = -6$$

2. $2x^2 + 3x - 20 = 0$

$$(2x - 5)(x + 4) = 0$$

$$2x - 5 = 0 \quad x + 4 = 0$$

$$x = \frac{5}{2} \quad x = -4$$

3. $t^2 = 12$

$$t = \pm\sqrt{12}$$

$$t = \pm 2\sqrt{3}$$

4. $(u - 3)^2 - 16 = 0$

$$(u - 3)^2 = 16$$

$$u - 3 = \pm 4$$

$$u = 3 \pm 4 = 7, -1$$

5. $s^2 + 10s + 1 = 0$

$$s^2 + 10s = -1$$

$$s^2 + 10s + 25 = -1 + 25$$

$$(s + 5)^2 = 24$$

$$s + 5 = \pm\sqrt{24}$$

$$s = -5 \pm 2\sqrt{6}$$

6. $2y^2 + 6y - 5 = 0$

$$y^2 + 3y = \frac{5}{2}$$

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

$$\left(y + \frac{3}{2}\right)^2 = \frac{10}{4} + \frac{9}{4}$$

$$\left(y + \frac{3}{2}\right)^2 = \frac{19}{4}$$

$$y + \frac{3}{2} = \pm\frac{\sqrt{19}}{2}$$

$$y = -\frac{3}{2} \pm \frac{\sqrt{19}}{2}$$

$$7. x = \frac{-4 \pm \sqrt{4^2 - 4(1)(-6)}}{2(1)}$$

$$x = \frac{-4 \pm \sqrt{16 + 24}}{2}$$

$$x = \frac{-4 \pm \sqrt{40}}{2}$$

$$x = \frac{-4 \pm 2\sqrt{10}}{2} = -2 \pm \sqrt{10}$$

$$8. v = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(6)(-4)}}{2(6)}$$

$$v = \frac{3 \pm \sqrt{9 + 96}}{12}$$

$$v = \frac{3 \pm \sqrt{105}}{12}$$

$$9. x = \frac{-5 \pm \sqrt{5^2 - 4(1)(7)}}{2(1)}$$

$$x = \frac{-5 \pm \sqrt{25 - 28}}{2}$$

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

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

$$10. \quad 36 = (t - 4)^2$$

$$\pm 6 = t - 4$$

$$4 \pm 6 = t$$

$$10, -2 = t$$

$$11. (x - 10)(x + 3) = 0$$

$$(x - 10) = 0 \quad x + 3 = 0$$

$$x = 10 \quad x = -3$$

$$12. x^2 - 3x - 10 = 0$$

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

$$x - 5 = 0 \quad x + 2 = 0$$

$$x = 5 \quad x = -2$$

$$13. (2b - 3)(2b - 3) = 0$$

$$2b - 3 = 0 \quad 2b - 3 = 0$$

$$b = \frac{3}{2} \quad b = \frac{3}{2}$$

$$14. m = \frac{-10 \pm \sqrt{10^2 - 4(3)(5)}}{2(3)}$$

$$m = \frac{-10 \pm \sqrt{100 - 60}}{6}$$

$$m = \frac{-10 \pm \sqrt{40}}{6}$$

$$m = \frac{-10 \pm 2\sqrt{10}}{6}$$

$$m = \frac{-5 \pm \sqrt{10}}{3}$$

$$15. \quad x - 2\sqrt{x} - 24 = 0$$

$$\text{let } u = \sqrt{x}$$

$$(\sqrt{x})^2 - 2\sqrt{x} - 24 = 0$$

$$u^2 - 2u - 24 = 0$$

$$(u - 6)(u + 4) = 0$$

$$u = 6 \quad u = -4$$

$$\sqrt{x} = 6 \quad \sqrt{x} = -4$$

$$x = 6^2 \quad x = (-4)^2$$

$$x = 36 \quad x = 16$$

$$16. \quad x^4 + 7x^2 + 12 = 0$$

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

$$x^2 = -4 \quad x^2 = -3$$

$$x = \pm\sqrt{-4} \quad x = \pm\sqrt{-3}$$

$$x = \pm 2i \quad x = \pm\sqrt{3}i$$

Check:

$$36 - 2\sqrt{36} - 24 \stackrel{?}{=} 0$$

$$36 - 12 - 24 \stackrel{?}{=} 0$$

$$0 = 0$$

Not a solution

$$16 - 2\sqrt{16} - 24 \stackrel{?}{=} 0$$

$$16 - 8 - 24 \stackrel{?}{=} 0$$

$$-16 \neq 0$$

17. Keystrokes:

$$[Y=] .5 [X,T,\theta] [x^2] [-] 3 [X,T,\theta] [-] 1 [GRAPH]$$

$$0 = .5x^2 - 3x - 1$$

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

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

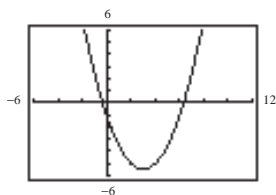
$$x = \frac{6 \pm \sqrt{36 + 8}}{2}$$

$$x = \frac{6 \pm \sqrt{44}}{2}$$

$$x = \frac{6 \pm 2\sqrt{11}}{2}$$

$$x = 3 \pm \sqrt{11}$$

$$x \approx 6.32 \text{ and } -0.32$$



18. Keystrokes:

$$[Y=] [X,T,\theta] [x^2] [+] .045 [X,T,\theta] [-] 4 [GRAPH]$$

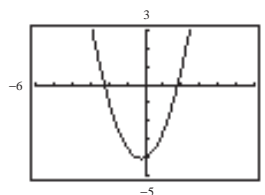
$$0 = x^2 + 0.45x - 4$$

$$x = \frac{-0.45 \pm \sqrt{(0.45)^2 - 4(1)(-4)}}{2(1)}$$

$$x = \frac{-0.45 \pm \sqrt{0.2025 + 16}}{2}$$

$$x = \frac{-0.45 \pm \sqrt{16.2025}}{2}$$

$$x \approx 1.79 \text{ and } -2.24$$



$$\begin{aligned} 19. \quad 500 &= x(20 - 0.2x) \\ &= 20x - 0.2x^2 \end{aligned}$$

$$0.2x^2 - 20x + 500 = 0$$

$$x^2 - 100x + 2500 = 0$$

$$x = \frac{-(-100) \pm \sqrt{(-100)^2 - 4(1)(2500)}}{2(1)}$$

$$x = \frac{100 \pm \sqrt{10,000 - 10,000}}{2}$$

$$x = \frac{100 \pm \sqrt{0}}{2} = 50 \text{ units}$$

$$20. \text{ Verbal model: } \boxed{\text{Area}} = \boxed{\text{Length}} \cdot \boxed{\text{Width}}$$

$$\text{Equation: } 2275 = x \cdot (100 - x)$$

$$2275 = 100x - x^2$$

$$0 = x^2 - 100x + 2275$$

$$0 = (x - 35)(x - 65)$$

$$x - 35 = 0$$

$$x = 35 \text{ meters}$$

$$x - 65 = 0$$

$$x = 65 \text{ meters}$$

$$35 \text{ meters} \times 65 \text{ meters}$$