6. $31.8 + \sqrt{81.3} = 40.8$

7. $\log(43.7 \times 192) = 3.92$

8. $-\frac{1}{(0.357)^2} = -7.85$

9. $A = bh = (23.1)(14.8) = 342$

10. $C = D\pi \Rightarrow D = \frac{C}{\pi} = \frac{3970}{\pi} = 1260$

16. $C = \frac{\$28.08}{24} = \$1.17$

17. $6.34 \text{ mi} \times \frac{1.6093 \text{ km}}{1 \text{ mi}} = 10.2 \text{ km}$

18. $\left(\frac{84}{84 + 69}\right) 100\% = 54.9$

19. $x = 0.804 \sin(56.6°) = 0.671$

20. Ignoring the "$\times 10^7$" and decimals for a moment, use the Pyth Thm to get $x = \sqrt{(345)^2 + (376)^2} = 510 \Rightarrow 5.10 \times 10^7$

26. Points in the form (time, length): $(1, 8.78)$ and $(2.5, 6.56)$. Find the constant rate of burning (slope): $m = \frac{8.78 - 6.56}{1 - 2.5} = -1.48$ in/hr. From the length at 1 hour, go back one "slope" to get $8.78 - (-1.48) = 10.3$ in.

27. The least cost involves using the largest number of boxes of 9 nuggets as possible, since they are cheaper on a per nugget basis. This is equivalent to finding the least number of boxes of 5. Since she must have exactly 124 nuggets, we must find integers solutions to the equation $9x + 5y = 124$, where x is the number of boxes of 9 and y is the number of boxes of 5. Solving for x, we have $x = \frac{124 - 5y}{9}$. We need to find the value of x that is a positive integer when y is a nonnegative integer. Starting with $y = 0$, $y = 1$, etc., the first integer result comes from $y = 5$: $x = \frac{124 - 5(5)}{9} = \frac{99}{9} = 11$. Thus, the least cost comes from 11 boxes of 9 nuggets and 5 boxes of 5 nuggets: $\$5.76(11) + \$4.32(5) = \$84.96$

28. $x = 2020 - 1960 = 60$
$P(60) = 0.00314(60)^2 + 0.158(60) + 9.53 = 30.34$
$PE = 100\%\left(\frac{\text{Est}}{\text{Act}} - 1\right) = 100\%\left(\frac{30.34}{29.1} - 1\right) = 4.26\%$

29. $TSA = 6s^2 = 6(5.51)^2 = 182$

30. $V = \pi r^2 h \Rightarrow 30.8 = \pi r^2 (3.09)$
$\Rightarrow r = \sqrt{\frac{30.8}{\pi(3.09)}} = 1.78$

36. $F = 147 \times 2^{8/12} = 233$

37. $1 \text{ ft}^3 = 7.4805 \text{ gal}$
$103.97 \text{ gal} \times \frac{1 \text{ ft}^3}{7.4805 \text{ gal}} = 13.8988 \text{ ft}^3$ (5SD)
$13.8988 \text{ ft}^3 \times \left(\frac{12 \text{ in}}{1 \text{ ft}}\right)^3 = 24017.13 \text{ in}^3$ (5SD)
$V = A\ell =$ (cross sectional area)(length) $\Rightarrow 24017.13 \text{ in}^3 = A(81.25 \text{ in}) \Rightarrow A = 295.5955$ (4SD) Water forms a segment of the semicircle:

$$A_{\text{seg}} = \frac{1}{2} r^2 (\theta - \sin\theta)$$

[θ must be in radians to use this formula]
$295.5955 \text{ in}^2 = \frac{1}{2}\left(\frac{28.56 \text{ in}}{2}\right)^2 (\theta - \sin\theta) \Rightarrow \theta - \sin(\theta) = 2.89915$ (4SD)
Use solver or graph to find $\theta = 3.02022$ rad. (4SD)
Let z be the distance from the center of the circle to the top of the water. Use right triangle trig, $\cos\left(\frac{\theta}{2}\right) = \frac{z}{r} \Rightarrow z = 0.866051$ in (4SD)
$\Rightarrow$ Water height $= r - z = 13.41$ in (4SD)

38. $\omega = \dfrac{8 \text{ rev}}{\text{min}} \times \dfrac{2\pi \text{ rad}}{1 \text{ rev}} \times \dfrac{1 \text{ min}}{60 \text{ s}} = 0.83776 \text{ rad/s}$

$\theta = \omega t = (0.83776 \text{ rad/s})(11.7 \text{ s}) = 9.8018 \text{ rad}$

Coordinatize with merry-go-round center at the origin. Johnny gets on at $\theta = 0$ rad, which we set to $(5, 0)$ and bench to $(12, 0)$. Johnny's position on merry-go-round is $(5\cos\theta, 5\sin\theta)$ after riding the merry-go-round through an angle of θ. Using $\theta = 9.8018$ rad, Johnny's position is $(5\cos 9.8018, 5\sin 9.8018) = (-4.649, -1.8406)$

The distance between Johnny and the bench is $x = \sqrt{(12 - (-4.649))^2 + (0 - (-1.8406))^2} = 16.8$ ft

39. $s = \dfrac{a+b+c}{2} = \dfrac{19+23+27}{2} = 34.5$

$K = \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{34.5(34.5-19)(34.5-23)(34.5-27)} = 214.76$

$R = \dfrac{abc}{4K} = \dfrac{(19)(23)(27)}{4K} = 13.7$

40. Let x be the interior segment and β be the exterior angle $0.75 + 0.54$ and α be the third angle of the triangle on the right. Use the Law of Sines: $\dfrac{x}{\sin(0.75)} = \dfrac{640}{\sin(0.75+0.54)} \Rightarrow x = 454.03$ [Note the $0.75 + 0.54$ is the exterior angle, but $\sin\theta = \sin(\pi - \theta)$, so we can easily use this angle without actually computing α.]

Next, use Law of Cosines to find the desired side:

$y^2 = 500^2 + x^2 - 2(500)(x)\cos\beta \Rightarrow y = 575$

46. $\left(\dfrac{8 \text{ m}}{7.2 \text{ m}}\right)^2 = \dfrac{2.7 \text{ large bottles}}{x \text{ large bottles}}$

$\Rightarrow x = 2.187 \text{ large bottles} \times \dfrac{1 \text{ small bottle}}{0.6 \text{ large bottles}} = 3.65 \text{ small bottles}$

47. $y = -2.0333x + 105.1$

$x = 20 \Rightarrow y = -2.0333(20) + 105.1 = 64.4$

48. Use solver: $x = 1.83$

49. Three hemispheres cover the top. Diameter $= \dfrac{12.6}{3} = 4.2$

$\Rightarrow$ Radius $= 2.1$

$V = V_{\text{rect}} - 3V_{\text{hs}} = \ell wh - 3\left(\dfrac{2}{3}\pi r^3\right)$

$= (12.6)(4.2)(5) - 2\pi(2.1)^3 = 206$

50. ℓ = slant height and $LSA = 4(\frac{1}{2}b\ell) = 2b\ell$

$\Rightarrow 46.2 = 2(2.90)\ell \Rightarrow \ell = 7.9655$

h = altitude $\Rightarrow \ell^2 = h^2 + \left(\dfrac{b}{2}\right)^2$

$\Rightarrow (7.9655)^2 = h^2 + \left(\dfrac{2.90}{2}\right)^2 \Rightarrow h = 7.8324$

Diagonal $D = b\sqrt{2} = 4.101$

$\theta = \tan^{-1}\left(\dfrac{h}{D/2}\right) = 75.3°$

56. $f'(x) = \dfrac{2(x) - 1(x-3)}{x^2} = \dfrac{x+3}{x^2}$

$f'(1) = \dfrac{1+3}{1^2} = 4.00$

57. $R(t) = \int R'(t)\,dt = \int \dfrac{5}{\sqrt{t}}\,dt = \int 5t^{-1/2}\,dt = \dfrac{5t^{1/2}}{1/2} + C = 10\sqrt{t} + C$

$R(0) = 7.2 \Rightarrow 10\sqrt{0} + C = 7.2 \Rightarrow C = 7.2$

$R(t) = 10\sqrt{t} + 7.2$

$R(2) = 10\sqrt{2} + 7.2 = 21.3$ million dollars

[Note $t = 2$ since $t = 0$ is first month, $t = 1$ is second month, and $t = 2$ is third month.]

58. $\det(PQ) = \det P \times \det Q = [(4.7)(5.6) - (-0.3)(-1.2)] \times [(8)(-5) - (4)(3)] = (25.96)(-52) = -1350$

59. $y = 2 + x - x^2 = 0 \Rightarrow (2-x)(1+x) = 0 \Rightarrow x = -1, 2$

[Discard $x = -1$]

Use Discs: $V = \pi\int_0^2 [f(x)]^2\,dx = \pi\int_0^2 (2 + x - x^2)^2\,dx = \pi\int_0^2 4 + 4x - 3x^2 - 2x^3 + x^4\,dx = \pi\left[4x + 2x^2 - x^3 - \dfrac{1}{2}x^4 + \dfrac{1}{5}x^5\right]_0^2 = 20.1$

60. Notice that since the "top" of the trapezoid on the right is the same as the "leg" of the trapezoid on the left, each trapezoid has 3 congruent short sides and a long side. Name the short side x and the desired side y.

From the isosceles triangle on top, solve for x using the Law of Cosines (isos. triangle version): $c^2 = 2a^2(1-\cos\theta)$

$8.80^2 = 2x^2(1-\cos 130°) \quad \Rightarrow \quad x = 4.8549$

Compute the obtuse angles of the trapezoids: $\dfrac{360° - 130°}{2} = 115°$

Drop the altitude from the 130° vertex to the base to form a right triangle. Using x as the hypotenuse, the base angle of the trapezoid is $180° - 115° = 65°$. The small side of the right triangle is $z = x\cos(65°) = 2.0518$. The long side $y = 2x + 2z = 13.8$

61. $v_0 = 12 \text{ mph} \times \dfrac{22 \text{ ft/s}}{15 \text{ mph}} = 17.6 \text{ ft/s}$

$v_f = 28 \text{ mph} \times \dfrac{22 \text{ ft/s}}{15 \text{ mph}} = 41.067 \text{ ft/s}$

$t = 16$ s

$\Delta x = \left(\dfrac{17.6 \text{ ft/s} + 41.067 \text{ ft/s}}{2}\right)(16 \text{ s}) = 469 \text{ ft}$

62. $p = \dfrac{1}{88}$

$x = p^{250} = \left(\dfrac{1}{88}\right)^{250} = 88^{-250}$

$\log x = \log 88^{-250} = -250\log 88 = -250(1.94448) = -486.120668 = -487 + 0.8793319625 \Rightarrow x = 10^{-487+0.8793319625} = 10^{0.8793319625} \times 10^{-487} = 7.57 \times 10^{-487}$

63. $\theta = 52.5°$ and $v = 220$ ft/s

Horz Range $R = \dfrac{v^2 \sin(2\theta)}{g} = \dfrac{(220 \text{ ft/s})^2 \sin(2 \times 52.5°)}{32.17 \text{ ft/s}^2} = 1453.24$ ft

Short by $1720 - 1453.24 = 267$ ft

64. Label circle center O and lower left vertex of rectangle D. Drop radius down to intersect line AB, label this point C. $AC = 18.6$ since tangents from a point to a circle are congruent.

The vertical angles at B are congruent. The right triangles ABD and CBO are similar. Since $CO = R$ (radius) and $AD = \dfrac{R}{2}$, the ratio of the sides between the similar triangles is $1 : 2$. Thus, $BC : AB = 2 : 1$ and $AB = \frac{1}{3}(AC) = 6.2$

65. Let s be the side of the square and let z be the portion of the altitude of the equilateral triangle that sticks out of the square. Thus, $z = 822 - s$.

Total Area = Square Area + Little Equilateral Triangle Area $= s^2 + \dfrac{z^2}{\sqrt{3}} = s^2 + \dfrac{(822-s)^2}{\sqrt{3}} = 360000 \Rightarrow s = 568.15$

Altitude of Large Equilateral Triangle $= \dfrac{\sqrt{3}}{2}s = 492 \Rightarrow a = 822 - 492 = 330$