Even answers, Chapter 1

1.2. 3.28×10^{3} ft

1.4 $1.13\times10^{4}\ \dfrac{\text{kg}}{\text{m}^3}$

1.6 4.86 hectares

1.8 67 mi/h

1.10 (a) 88 ft/s
(b) 9.8 m/s^2
(c) $10^3\ \text{kg/m}^2$

1.12 1 year $= 3.15567...\times10^{7}$ s ; $\pi\times10^{7}$ s $= 3.14159...\times10^{7}$ s

$$\text{Error} := \frac{3.15567 - 3.14159}{3.15167}$$

$\text{Error} = 4.467\times 10^{-3}$ $\text{Error} = 0.447\%$

1.14 (a) 72 mm^2 (two significant figures)
(b) 0.50 (also two significant figures)
(c) 36 mm (to the nearest millimeter)
(d) 6 mm
(e) 2.0 (two significant figures)

1.16 The fractional uncertainty in the area is $\dfrac{0.07\ \text{cm}^2}{9.69\ \text{cm}^2} = 0.72\%,$ and the fractional uncertainties in the length and width are $\dfrac{0.01\ \text{cm}}{5.10\ \text{cm}} = 0.20\%$ and $\dfrac{0.01\ \text{cm}}{1.9\ \text{cm}} = 0.53\%.$ The sum of these fractional uncertainties is $0.20\% + 0.53\% = 0.73\%$, in agreement with the fractional uncertainty in the area.

1.18 3×10^{8} gal/day

1.20 11,000 kernels

1.22 (a) $1\times10^{4}\ \text{m}^3/\text{yr}$.
(b) 27 m

1.24 3×10^{9} beats/lifespan
4×10^{7} gal/lifespan

1.26 2×10^5 drops

1.28 3.8×10^{12} bills $\approx 4\times10^{12}$ bills

1.32 (a) $C = 9.0$ m at an angle of $\theta = 34°$
(b) $D = 22$ m at an angle of $\theta = 250°$
(c) 9.0 m at an angle with the $+x$ axis of $214°$
(d) 22 m and an angle with the $+x$ axis of $70°$

1.34 **(a)** Figure 1.34 gives components 4.7 m, 8.1 m.
(b) Figure 1.34 gives components -15.6 km, 15.6 km.
(c) Figure 1.34 gives components 3.82 cm, -5.07 cm.

1.36 (a) 333º
(b) 26.6º
(c) 153º
(d) 207º

1.38 $\vec{\mathrm{R}} = 7.8$ km, 38° north of east.

1.40 (a) 148.8°
(b) 10.0 m, 194°.
(c) 8.21 km, 340.8°

1.42 (a) 5.40 cm, - 1.50 cm
(b) 5.60 cm @ 334.5º ccw
(c) 2.80 cm, 26 cm
(d) 6.62 cm @ 295º

1.44 8.6 km/h and $\phi = 36°$, north

1.46 $A = 254$ N

1.48 **(a)** $A_x = 5.0$, $A_y = -6.3$ **(b)** $A_x = 11.2$, $A_y = -9.91$ **(c)** $A_x = -15.0$, $A_y = 22.4$ **(d)** $A_x = 20$, $A_y = -30$

1.50 5.00
$\vec{\mathrm{B}} = 5.00\hat{\mathrm{i}} - 2.00\hat{\mathrm{j}}$; $B_x = +5.00$; $B_y = -2.00$
$B = 5.39$

1.54 (a) 14
(b) 58.7º

1.58 $\vec{A}\times\vec{B} = -8.00\hat{k} + 15.0\left(-\hat{k}\right) = -23.0\hat{k}.$; The magnitude of $\vec{A}\times\vec{B}$ is 23.0.

1.60. **(a)** 640 acres to a square mile.
(b) $43,560\ \text{ft}^2$
(c) (1 acre-foot) 3.26×10^5 gal, rounded to three significant figures.

1.62. **(a)** 7.04×10^{-10} s for one cycle.
(b) 5.11×10^{12} cycles/h
(c) 2.1×10^{26} cycles
(d) 4.6×10^{4} s (about 13 h).

1.64. **(a)** 0.5 kg .
(b) 6×10^{-17} kg $= 6\times10^{-14}$ g .
(c) 3×10^{-4} kg $= 0.3$ g .

1.66. **(a)** The number of grains of sand is about 10^{22} .
(b) The number of stars is 10^{22} . The two estimates result in comparable numbers for these two quantities.

1.68. Let $\vec{D}$ be the fourth force. F
Then $D_x = -22.53$ N , $D_y = -87.34$ N and $D = 90.2$ N ... $\phi = 256°$,
counterclockwise from the $+x$-axis.
$\vec{D}$ must lie in the third quadrant.

1.70. . $R = 330$ km $\theta_R = 19°$ south of east **.**

1.72. (a) $R = 3.4$ m .. $\theta = 1.2°$ below the $-x$-axis .
(b) $S = 21.0$ m .. $\theta = 28.8°$ below the $-x$-axis .

1.74. $C = 2.81$ km ; $\theta = 61.7°$ north of east.

1.76. **(a)**. $D = 189$ km .
(b) $10.5°$ west of north.

1.78. **(b)** 49 steps in a direction $76°$ south of east, which is $14°$ east of south.

1.80. **(a)** $w_x = w\sin\alpha$
(b) $w_y = w\cos\alpha$
(c) The maximum allowable weight is 959 N .

1.82. **(a)** $(200\text{ m})\,\hat{\mathrm{i}} + (85\text{ m})\,\hat{\mathrm{j}} - (30\text{ m})\,\hat{\mathrm{k}}$.
(b) 219 m.

1.84 28.2 m

1.86. **(a)** -6.62 m^2.
(b) 5.55 m^2 out of the page (the $+z$-direction).

1.88. $\left(\vec{\mathrm{A}} \times \vec{\mathrm{B}}\right)_x = 122\text{ cm}^2, \left(\vec{\mathrm{A}} \times \vec{\mathrm{B}}\right)_y = -70\text{ cm}^2, \left(\vec{\mathrm{A}} \times \vec{\mathrm{B}}\right)_z = 0.$

1.90 109°.

1.92 **(b)** $\phi = 120°$.

1.94 $\left[\dfrac{(1.00)\,\hat{\mathrm{i}} - (6.00/13.00)\,\hat{\mathrm{j}} + (11.00/13.00)\,\hat{\mathrm{k}}}{\sqrt{1.93}}\right]$

A more convenient way of writing this result is

$$\hat{C} = \frac{\vec{A} \times \vec{B}}{\sqrt{326}} = \frac{-13\hat{i} + 6\hat{j} - 11\hat{k}}{\sqrt{326}} \cong -0.72\hat{i} + 0.33j - 0.61\hat{k}$$

1.96. 36.8°.

1.98 **(a)** the uncertainty in the area is $a = lW + Lw$.
(b) The fractional uncertainty in the area is $\dfrac{l}{L} + \dfrac{w}{W}$,
the fractional uncertainty in the volume is $\dfrac{l}{L} + \dfrac{w}{W} + \dfrac{h}{H}$

1.100. **(a)** The diagram is sketched in Figure 1.100.
(b) (i) In AU, 0.9857.
(ii) In AU,1.3820.
(iii) In AU1.695.
(c) 54.6°.
(d) Mars could not have been visible at midnight, because the Sun-Mars angle is less than 90^o.