3. Using a calculator to multiply the length by the width gives a raw answer of 6 783 m^2, but this answer must be rounded to contain the same number of significant figures as the least accurate factor in the product. The least accurate factor is the length, which contains either 2 or 3 significant figures, depending on whether the trailing zero is significant or is being used only to locate the decimal point. Assuming the length contains 3 significant figures, answer (c) correctly expresses the area as $6.78 \times 10^3\ \text{m}^2$. However, if the length contains only 2 significant figures, answer (d) gives the correct result as $6.8 \times 10^3\ \text{m}^2$.

4. The calculator gives an answer of 57.573 for the sum of the 4 given numbers. However, this sum must be rounded to 58 as given in answer (d) so the number of decimal places in the result is the same (zero) as the number of decimal places in the integer 15 (the term in the sum containing the smallest number of decimal places).

6. The given area $\left(1\ 420\ \text{ft}^2\right)$ contains 3 significant figures, assuming that the trailing zero is used only to locate the decimal point. The conversion of this value to square meters is given by:

$$A = \left(1.42 \times 10^2\ \text{ft}^2\right)\left(\frac{1.00\ \text{m}}{3.281\ \text{ft}}\right)^2 = 1.32 \times 10^2\ \text{m}^2 = 132\ \text{m}^2$$

Note that the result contains 3 significant figures, the same as the number of significant figures in the least accurate factor used in the calculation. This result matches answer (c).

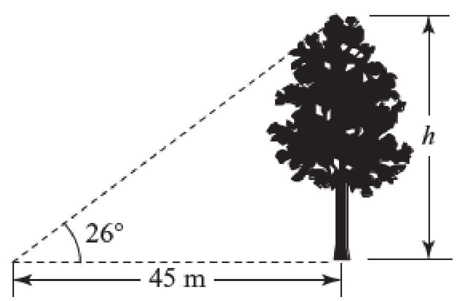
8. The given Cartesian coordinates are $x = -5.00$, and $y = 12.00$, with the least accurate containing 3 significant figures. Note that the specified point is in the second quadrant. The conversion to polar coordinates is then given by:

$$r = \sqrt{x^2 + y^2} = \sqrt{(-5.00)^2 + (12.00)^2} = 13.0$$

$$\tan\theta = \frac{y}{x} = \frac{12.00}{-5.00} = -2.40 \quad \text{and} \quad \theta = \tan^{-1}(-2.40) = -67.3° + 180° = 113°$$

Note that 180° was added in the last step to yield a second quadrant angle. The correct answer is therefore (b).

9. The situation described is shown in the drawing at the right:



From this, observe that $\tan 26° = \dfrac{h}{45\ \text{m}}$, or

$$h = (45\ \text{m})\tan 26° = 22\ \text{m}$$

Thus, the correct answer is (a).

1.9 (a) 78.9 ± 0.2 has $\boxed{\text{3 significant figures}}$ with the uncertainty in the tenths position.

(b) 3.788×10^9 has $\boxed{\text{4 significant figures}}$

(c) 2.46×10^{-6} has $\boxed{\text{3 significant figures}}$

(d) $0.003\,2 = 3.2 \times 10^{-3}$ has $\boxed{\text{2 significant figures}}$. The two zeros were originally included only to position the decimal.

1.10 $c = 2.997\ 924\ 58 \times 10^8\ \text{m/s}$

(a) Rounded to 3 significant figures: $c = \boxed{3.00 \times 10^8\ \text{m/s}}$

(b) Rounded to 5 significant figures: $c = \boxed{2.997\ 9 \times 10^8\ \text{m/s}}$

(c) Rounded to 7 significant figures: $c = \boxed{2.997\ 925 \times 10^8\ \text{m/s}}$

1.11 Observe that the length $\ell = 5.62$ cm, the width $w = 6.35$ cm, and the height $h = 2.78$ cm all contain 3 significant figures. Thus, any product of these quantities should contain 3 significant figures.

(a) $\ell w = (5.62\ \text{cm})(6.35\ \text{cm}) = \boxed{35.7\ \text{cm}^2}$

(b) $V = (\ell w)h = \left(35.7\ \text{cm}^2\right)(2.78\ \text{cm}) = \boxed{99.2\ \text{cm}^3}$

(c) $wh = (6.35\ \text{cm})(2.78\ \text{cm}) = \boxed{17.7\ \text{cm}^2}$

$V = (wh)\ell = \left(17.7\ \text{cm}^2\right)(5.62\ \text{cm}) = \boxed{99.5\ \text{cm}^3}$

(d) In the rounding process, small amounts are either added to or subtracted from an answer to satisfy the rules of significant figures. For a given rounding, different small adjustments are made, introducing a certain amount of randomness in the last significant digit of the final answer.

1.13 (a) The sum is rounded to $\boxed{797}$ because 756 in the terms to be added has no positions beyond the decimal.

(b) $0.003\,2 \times 356.3 = \left(3.2 \times 10^{-3}\right) \times 356.3 = 1.140\ 16$ must be rounded to $\boxed{1.1}$ because 3.2×10^{-3} has only two significant figures.

(c) $5.620 \times \pi$ must be rounded to $\boxed{17.66}$ because 5.620 has only four significant figures.

1.18 (a) $\ell = (348\ \text{mi})\left(\dfrac{1.609\ \text{km}}{1.000\ \text{mi}}\right) = \boxed{5.60\times10^{2}\ \text{km}} = \boxed{5.60\times10^{5}\ \text{m}} = \boxed{5.60\times10^{7}\ \text{cm}}$

(b) $h = (1\,612\ \text{ft})\left(\dfrac{1.609\ \text{km}}{5\,280\ \text{ft}}\right) = \boxed{0.491\,2\ \text{km}} = \boxed{491.2\ \text{m}} = \boxed{4.912\times10^{4}\ \text{cm}}$

(c) $h = (20\,320\ \text{ft})\left(\dfrac{1.609\ \text{km}}{5\,280\ \text{ft}}\right) = \boxed{6.192\ \text{km}} = \boxed{6.192\times10^{3}\ \text{m}} = \boxed{6.192\times10^{5}\ \text{cm}}$

(d) $d = (8\,200\ \text{ft})\left(\dfrac{1.609\ \text{km}}{5\,280\ \text{ft}}\right) = \boxed{2.499\ \text{km}} = \boxed{2.499\times10^{3}\ \text{m}} = \boxed{2.499\times10^{5}\ \text{cm}}$

In (a), the answer is limited to three significant figures because of the accuracy of the original data value, 348 miles. In (b), (c), and (d), the answers are limited to four significant figures because of the accuracy to which the kilometers-to-feet conversion factor is given.

1.23 $c = \left(3.00\times10^{8}\ \dfrac{\cancel{\text{m}}}{\cancel{\text{s}}}\right)\left(\dfrac{3\,600\ \cancel{\text{s}}}{1\ \text{h}}\right)\left(\dfrac{1\ \cancel{\text{km}}}{10^{3}\ \cancel{\text{m}}}\right)\left(\dfrac{1\ \text{mi}}{1.609\ \cancel{\text{km}}}\right) = \boxed{6.71\times10^{8}\ \text{mi/h}}$

1.35 The x coordinate is found as $x = r\cos\theta = (2.5\ \text{m})\cos 35° = \boxed{2.0\ \text{m}}$

and the y coordinate $y = r\sin\theta = (2.5\ \text{m})\sin 35° = \boxed{1.4\ \text{m}}$

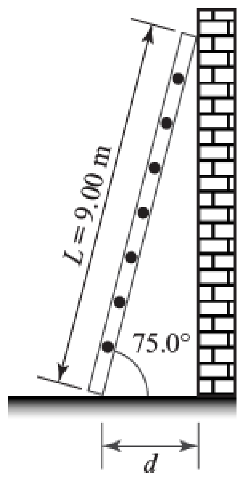
1.38 The x distance between the two points is $|\Delta x| = |x_2 - x_1| = |-3.0\ \text{cm} - 5.0\ \text{cm}| = 8.0\ \text{cm}$ and the y distance between them is $|\Delta y| = |y_2 - y_1| = |3.0\ \text{cm} - 4.0\ \text{cm}| = 1.0\ \text{cm}$. The distance between them is found from the Pythagorean theorem:

$$d = \sqrt{|\Delta x|^2 + |\Delta y|^2} = \sqrt{(8.0\ \text{cm})^2 + (1.0\ \text{cm})^2} = \sqrt{65\ \text{cm}^2} = \boxed{8.1\ \text{cm}}$$

1.42 From the diagram, $\cos(75.0°) = d/L$

Thus,

$$d = L\cos(75.0°) = (9.00\ \text{m})\cos(75.0°) = \boxed{2.33\ \text{m}}$$



1.45 (a) The side opposite $\theta = \boxed{3.00}$ (b) The side adjacent to $\phi = \boxed{3.00}$

(c) $\cos\theta = \dfrac{4.00}{5.00} = \boxed{0.800}$ (d) $\sin\phi = \dfrac{4.00}{5.00} = \boxed{0.800}$

(e) $\tan\phi = \dfrac{4.00}{3.00} = \boxed{1.33}$