PHY 2130 Homework solutions
Assignment 1

1.6 (a) Given that $a \propto F/m$, we have $F \propto ma$. Therefore, the units of force are those of *ma*, $F = \mathrm{M}\left(\mathrm{L}/\mathrm{T}^2\right) = \boxed{\mathrm{M\,L\,T^{-2}}}$.

(b) newton $= \boxed{\dfrac{\mathrm{kg \cdot m}}{\mathrm{s}^2}}$.

1.21 $c = \left(3.00 \times 10^8 \ \dfrac{\mathrm{m}}{\mathrm{s}}\right)\left(\dfrac{3600 \ \mathrm{s}}{1 \ \mathrm{h}}\right)\left(\dfrac{1 \ \mathrm{km}}{10^3 \ \mathrm{m}}\right)\left(\dfrac{1 \ \mathrm{mi}}{1.609 \ \mathrm{km}}\right) = \boxed{6.71 \times 10^8 \ \mathrm{mi/h}}$

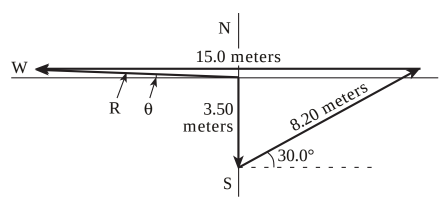
1.39 (a) From the Pythagorean theorem, the unknown side is

$$b = \sqrt{c^2 - a^2} = \sqrt{(9.00 \ \mathrm{m})^2 - (6.00 \ \mathrm{m})^2} = \boxed{6.71 \ \mathrm{m}}.$$

b) $\tan\theta = \dfrac{6.00 \ \mathrm{m}}{6.71 \ \mathrm{m}} = \boxed{0.894}$

(c) $\sin\phi = \dfrac{6.71 \ \mathrm{m}}{9.00 \ \mathrm{m}} = \boxed{0.746}$

3.1 Your sketch should be drawn to scale, and be similar to that pictured at the right. The angle from the westward direction, θ, can be measured as 4°, and the length of **R** found to be 7.9 m. The resultant displacement is then $\boxed{7.9 \ \mathrm{m\ at\ 4° \ N\ of\ W}}$.



3.11 (a) Her net *x* (east-west) displacement is $-3.00 + 0 + 6.00 = +3.00$ blocks, while her net *y* (north-south) displacement is $0 + 4.00 + 0 = +4.00$ blocks. The magnitude of the resultant displacement is

$$R = \sqrt{(x_{net})^2 + (y_{net})^2} = \sqrt{(3.00)^2 + (4.00)^2} = 5.00 \ \text{blocks},$$

and the angle the resultant makes with the *x*-axis (eastward direction) is

$$\theta = \tan^{-1}\left(\frac{4.00}{3.00}\right) = \tan^{-1}(1.33) = 53.1°$$

The resultant displacement is then $\boxed{5.00 \ \text{blocks at } 53.1° \ \text{N of E}}$.

(b) The total distance traveled is $3.00 + 4.00 + 6.00 = \boxed{13.0 \text{ blocks}}$.

3.19 The resultant displacement is $\mathbf{R} = \mathbf{A} + \mathbf{B}$, where **A** is the 150 cm displacement at 120° and **B** is the required second displacement. Solving for **B**: $\mathbf{B} = \mathbf{R} - \mathbf{A} = \mathbf{R} + (-\mathbf{A})$.

The components of **B** are

$$B_x = R_x - A_x = +190 \text{ cm} \quad \text{and} \quad B_y = R_y - A_y = -49.6 \text{ cm} .$$

Hence, $B = \sqrt{B_x^2 + B_y^2} = 196 \text{ cm}$ and $\theta = \tan^{-1}\left(\frac{B_y}{B_x}\right) = \tan^{-1}(-0.262) = -14.7°$.

$$\mathbf{B} = \boxed{196 \text{ cm at } 14.7° \text{ below the x-axis}}.$$