P7.2 (a) The work done on the raindrop by the gravitational force is given by

$$W = mgh = \left(3.35\times10^{-5}\ \text{kg}\right)\left(9.80\ \text{m/s}^2\right)(100\ \text{m}) = \boxed{3.28\times10^{-2}\ \text{J}}$$

(b) Since the raindrop is falling at constant velocity, all forces acting on the drop must be in balance, and $R = mg$, so

$$W_{\text{air resistance}} = \boxed{-3.28\times10^{-2}\,\text{J}}$$

P7.5

The definition of work by a constant force is $W = F\Delta r\cos\theta$.

(a) The applied force does work given by

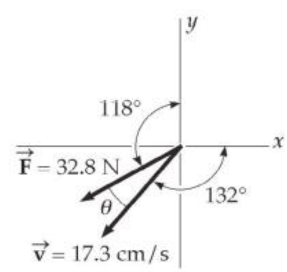
$$W = F\Delta r\cos\theta = (16.0\ \text{N})(2.20\ \text{m})\cos 25.0° = \boxed{31.9\ \text{J}}$$

(b), (c) The normal force and the weight are both at 90° to the displacement in any time interval. Both do $\boxed{0}$ work.

(d) $\sum W = 31.9\ \text{J} + 0 + 0 = \boxed{31.9\ \text{J}}$

P7.10 We must first find the angle between the two vectors. It is

$$\theta = (360° - 132°) - (118° + 90.0°)$$
$$= 20.0°$$



ANS. FIG. P7.10

Then

$$\vec{F}\cdot\vec{r} = Fr\cos\theta$$
$$= (32.8\ \text{N})(0.173\ \text{m})\cos 20.0°$$

or $\quad \vec{F}\cdot\vec{r} = 5.33\ \text{N}\cdot\text{m} = \boxed{5.33\ \text{J}}$

P7.11 (a) We use the mathematical representation of the definition of work.

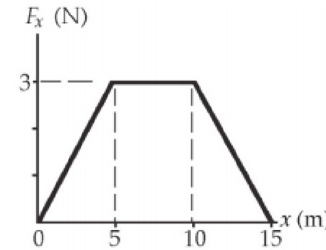
$$W = \vec{F}\cdot\Delta\vec{r} = F_x x + F_y y = (6.00)(3.00)\ \text{N}\cdot\text{m} + (-2.00)(1.00)\ \text{N}\cdot\text{m}$$
$$= \boxed{16.0\ \text{J}}$$

(b) $\theta = \cos^{-1}\left(\dfrac{\vec{F}\cdot\Delta\vec{r}}{F\Delta r}\right)$

$$= \cos^{-1}\frac{16\ \text{N}\cdot\text{m}}{\sqrt{(6.00\ \text{N})^2 + (-2.00\ \text{N})^2}\cdot\sqrt{(3.00\ \text{m})^2 + (1.00\ \text{m})^2}}$$

$$= \boxed{36.9°}$$

P7.15 We use the graphical representation of the definition of work. W equals the area under the force-displacement curve. This definition is still written $W = \int F_x\,dx$ but it is computed geometrically by identifying triangles and rectangles on the graph.



ANS. FIG. P7.15

(a) For the region $0 \le x \le 5.00$ m,

$$W = \frac{(3.00\text{ N})(5.00\text{ m})}{2} = \boxed{7.50\text{ J}}$$

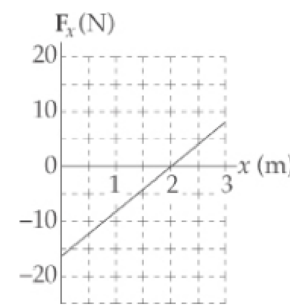
(b) For the region $5.00 \le x \le 10.0$, $W = (3.00\text{ N})(5.00\text{ m}) = \boxed{15.0\text{ J}}$

(c) For the region $10.00 \le x \le 15.0$, $W = \dfrac{(3.00\text{ N})(5.00\text{ m})}{2} = \boxed{7.50\text{ J}}$

(d) For the region $0 \le x \le 15.0$, $W = (7.50 + 7.50 + 15.0)\text{ J} = \boxed{30.0\text{ J}}$

P7.26 The force is given by $F_x = (8x - 16)$ N.

(a) See ANS. FIG. P7.26 to the right.



(b) $$W_{\text{net}} = \frac{-(2.00\text{ m})(16.0\text{ N})}{2} + \frac{(1.00\text{ m})(8.00\text{ N})}{2}$$
$$= \boxed{-12.0\text{ J}}$$