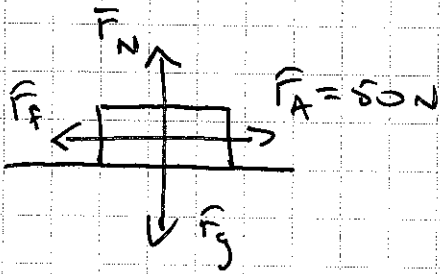


# Dynamics 2

①



$$\vec{F}_N = \vec{F}_g$$
$$\vec{F}_N = mg$$

$$a) \quad \Sigma \vec{F} = \vec{F}_A - \vec{F}_f$$

$$ma = \vec{F}_A - \mu \cdot \vec{F}_N$$

$$ma = \vec{F}_A - \mu \cdot mg$$

$$15a = 50 - (0.3)(15)(9.8)$$

$$15a = 5.9$$

$$a = \boxed{0.393 \text{ m/s}^2}$$

$$b) \quad v_f = v_i + at$$

$$= 0 + (0.393)(3)$$

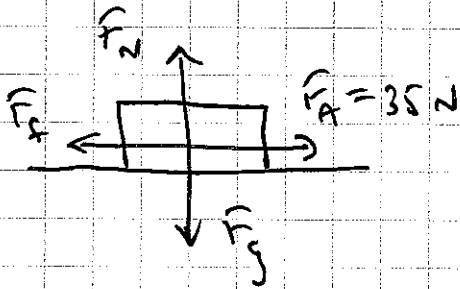
$$v_f = \boxed{1.18 \text{ m/s}}$$

$$c) \quad d = \left( \frac{v_f + v_i}{2} \right) t$$

$$= \left( \frac{1.18 + 0}{2} \right) 3$$

$$d = \boxed{1.77 \text{ m}}$$

②



$$\Sigma \vec{F} = 0 \quad (\text{constant speed})$$

$$\vec{F}_N = \vec{F}_g$$

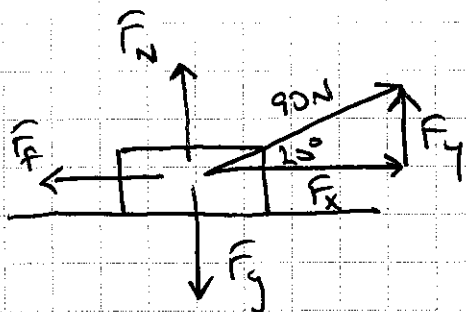
$$a) \quad \text{Weight} = \vec{F}_g = mg = (10)(9.8) = \boxed{98 \text{ N}}$$

$$b) \quad \begin{aligned} \Sigma \vec{F}_x &= \vec{F}_A + \vec{F}_f \\ 0 &= 35 + \vec{F}_f \\ \vec{F}_f &= \boxed{-35 \text{ N}} \end{aligned}$$

$$c) \quad \mu = \frac{|\vec{F}_f|}{|\vec{F}_N|} = \frac{35 \text{ N}}{98 \text{ N}} = \boxed{0.357}$$

$$d) \quad \begin{aligned} v &= \frac{d}{t} \\ 5 &= \frac{10}{t} \\ t &= \frac{10}{5} = \boxed{2 \text{ s}} \end{aligned}$$

②



$$\vec{F}_N + \vec{F}_y = \vec{F}_g$$

$$\vec{F}_N = \vec{F}_g - \vec{F}_y$$

$$a) \quad \cos 20 = \frac{\vec{F}_x}{90}$$

$$\sin 20 = \frac{\vec{F}_y}{90}$$

$$\vec{F}_x = 90 \cos 20$$

$$\vec{F}_y = 90 \sin 20$$

$$\vec{F}_x = 84.572$$

$$\vec{F}_y = 30.782$$

$$\Sigma F = \vec{F}_x - \vec{F}_f$$

$$= \vec{F}_x - \mu \cdot \vec{F}_N$$

$$= \vec{F}_x - \mu \cdot (\vec{F}_g - \vec{F}_y)$$

$$= \vec{F}_x - \mu \cdot (mg - \vec{F}_y)$$

$$= 84.572 - (0.2) [(25)(9.8) - 30.782]$$

$$\Sigma F = \boxed{41.728 \text{ N}}$$

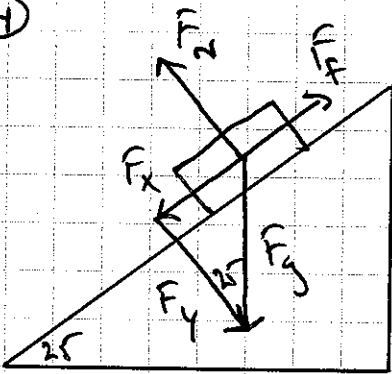
$$b) \quad a = \frac{\Sigma \vec{F}}{m} = \frac{41.728}{25} = \boxed{1.669 \text{ m/s}^2}$$

$$c) \quad d = v_i t + \frac{1}{2} a t^2$$

$$= (0)(4) + \frac{1}{2} (1.669)(4)^2$$

$$d = \boxed{13.352 \text{ m}}$$

④



$$F_N = F_y$$

$$\begin{aligned} a) \quad \overline{F}_x &= mg \sin \vartheta \\ &= (20)(9.8) \sin 25 \end{aligned}$$

$$\overline{F}_x = 82.833$$

$$\begin{aligned} \overline{F}_y &= mg \cos \vartheta \\ &= (20)(9.8) \cos 25 \end{aligned}$$

$$\overline{F}_y = 177.636$$

$$\Sigma \overline{F} = \overline{F}_x - \overline{F}_f$$

$$= \overline{F}_x - \mu \cdot \overline{F}_N$$

$$= 82.833 - (0.15)(177.636)$$

$$\Sigma \overline{F} = \boxed{56.188 \text{ N [DTS]}}$$

$$b) \quad a = \frac{\Sigma \overline{F}}{m} = \frac{56.188}{20} = \boxed{2.809 \text{ m/s}^2 \text{ [DTS]}}$$

$$\begin{aligned} c) \quad v_f^2 &= v_i^2 + 2ad \\ &= 5^2 + 2(2.809)(8) \end{aligned}$$

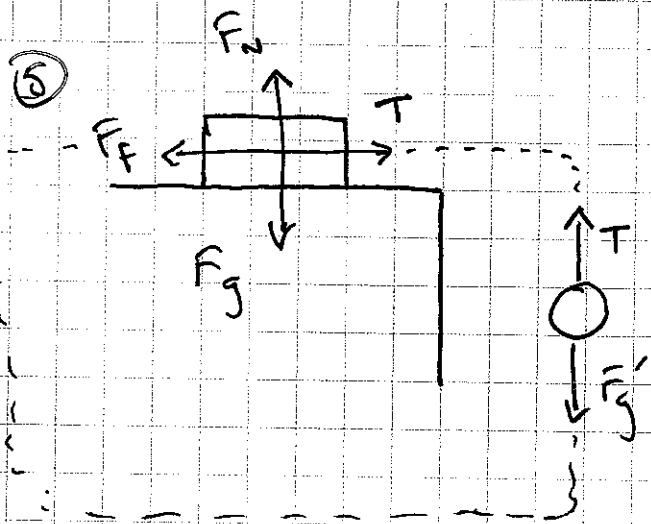
$$v_f^2 = 69.944$$

$$v_f = 8.363$$

$$d = \left( \frac{v_f + v_i}{2} \right) t$$

$$8 = \left( \frac{8.363 + 5}{2} \right) t$$

$$t = \boxed{1.197 \text{ s}}$$



ccw +

ccw -

$$F_N = F_g$$

$$\begin{aligned} a) \quad \Sigma F &= F_g' - F_f \\ &= m'g - \mu \cdot F_N \\ &= m'g - \mu mg \\ &= (3)(9.8) - (0.2)(5)(9.8) \end{aligned}$$

$$\Sigma F = \boxed{19.6 \text{ N [ccw]}}$$

$$b) \quad a = \frac{\Sigma F}{m} \quad \leftarrow \text{total mass}$$

$$= \frac{19.6}{8}$$

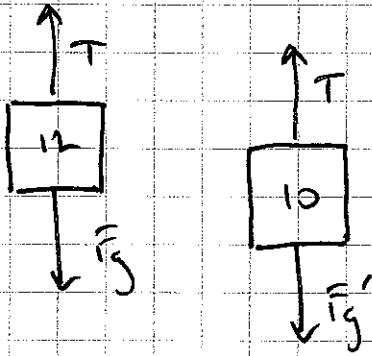
$$a = \boxed{2.45 \text{ m/s}^2 \text{ [ccw]}}$$

$$c) \quad d = v_i t + \frac{1}{2} a t^2 \quad (\text{assume } v_i = 0)$$

$$= (0)(2) + \frac{1}{2}(2.45)(2)^2$$

$$d = \boxed{4.9 \text{ m}}$$

6



ccw +

ccw -

$$\begin{aligned}\Sigma F &= F_g' - F_g \\ &= m'g - mg \\ &= (10)(9.8) - (12)(9.8)\end{aligned}$$

$$\Sigma F = -19.6 \text{ N} \quad \text{or} \quad 19.6 \text{ N} \text{ [ccw]}$$

$$a = \frac{\Sigma F}{m} \quad \leftarrow \text{total mass}$$

$$= \frac{-19.6}{22}$$

$$a = -0.891 \text{ m/s}^2 \quad \text{or} \quad \boxed{0.891 \text{ m/s}^2 \text{ [ccw]}}$$

Isolate 10 kg Mass:

$$\Sigma F = F_g' - T$$

$$m'a = m'g - T$$

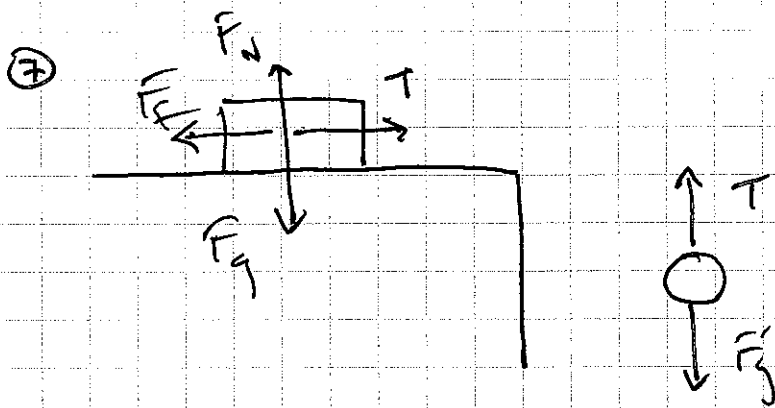
$$(10)(-0.891) = (10)(9.8) - T$$

$$T = \boxed{-106.91 \text{ N}}$$

$$d = v_i t + \frac{1}{2} a t^2$$

$$= (0)(3) + \frac{1}{2} (-0.891)(3)^2$$

$$d = \boxed{-4.010 \text{ m}}$$



$$F_N = F_g$$

$$cw +$$

$$ccw -$$

$$a) \Sigma F = F_g' - F_T$$

$$ma = m'g - F_T$$

$$9a = (3)(9.8) - 5$$

$$a = \boxed{2.711 \text{ m/s}^2 \text{ [cw]}}$$

b) Isolate 3 kg Mass:

$$\Sigma F = F_g' - T$$

$$m'a = m'g - T$$

$$(3)(2.711) = (3)(9.8) - T$$

$$T = -\boxed{21.267 \text{ N}}$$

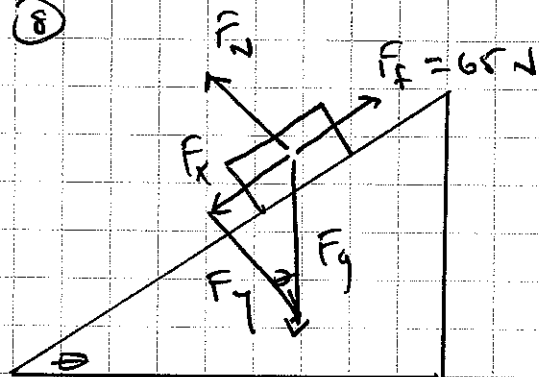
$$c) d = v_i t + \frac{1}{2} a t^2$$

$$3 = (0)t + \frac{1}{2} (2.711) t^2$$

$$3 = 1.356 t^2$$

$$t = \boxed{1.487 \text{ s}}$$

8



$$\Sigma F = 0 \quad (\text{constant speed})$$

$$F_N = F_f$$

$$\Sigma F = F_x - F_f$$

$$0 = F_x - F_f$$

$$F_x = F_f = 65 \text{ N}$$

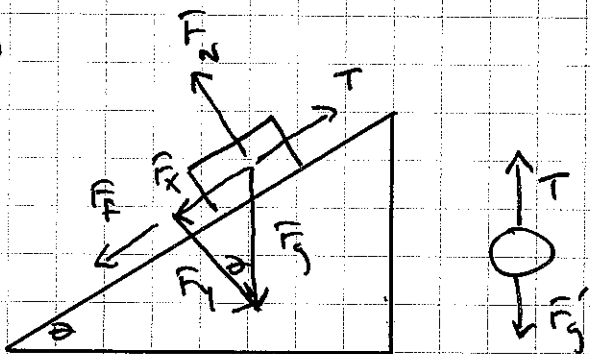
$$F_x = mg \sin \theta$$

$$65 = (30)(9.8) \sin \theta$$

$$\sin \theta = 0.221$$

$$\theta = \boxed{12.773^\circ}$$

9



$$F_N = F_f$$

cw +  
ccw -

$$\begin{aligned} a) \quad F_x &= mg \sin \theta \\ &= (25)(9.8) \sin 27 \end{aligned}$$

$$F_x = 111.228$$

$$\begin{aligned} F_y &= mg \cos \theta \\ &= (25)(9.8) \cos 27 \end{aligned}$$

$$F_y = 218.297$$

$$\begin{aligned} \Sigma F &= F_y' - F_x - F_f \\ &= (15)(9.8) - 111.228 - 12 \end{aligned}$$

$$\Sigma F = 23.772 \text{ N}$$

$$a = \frac{\Sigma F}{m} = \frac{23.772}{40}$$

$$a = \boxed{0.594 \text{ m/s}^2} \\ \text{[cw]}$$



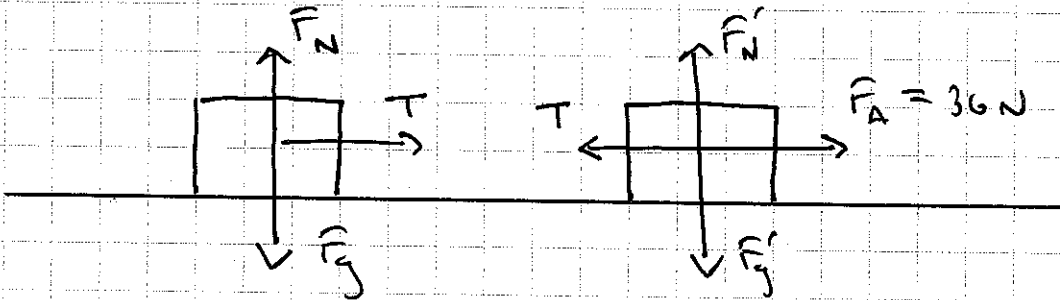
9) b) Isolate 15 Kg Mass:

$$\Sigma F = \vec{F}_g' - T$$

$$15(0.594) = (15)(9.8) - T$$

$$T = \boxed{138.09 \text{ N}}$$

10)



a)  $\Sigma \vec{F} = \vec{F}_A$

$$m a = \vec{F}_A$$

$$18 a = 36$$

$$a = \boxed{2 \text{ m/s}^2}$$

b) Isolate Y:

$$\Sigma F = T$$

$$(12)(2) = T$$

$$T = \boxed{24 \text{ N}}$$