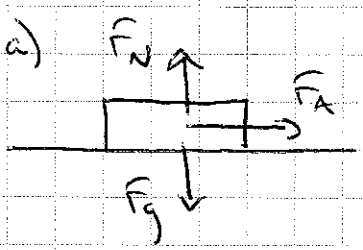
Dynamics 1

① a) 

$\Sigma F = F_A$

$\Sigma F = 30\ N$

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

$= \frac{30}{15}$

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

b) $v_i = 0$
$a = 2\ m/s^2$
$t = 10\ s$
$d = ?$

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

$= (0)(10) + \frac{1}{2}(2)(10)^2$

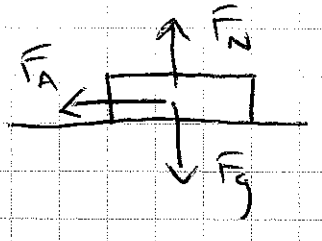
$d = \boxed{100\ m}$

c) $v_f = v_i + at$

$= 0 + (2)(10)$

$v_f = \boxed{+20\ m/s}$

②



$v_i = 30\ m/s$ $\quad a = ?$
$v_f = 0$ $\quad t = 25\ s$

$v_f = v_i + at$

$0 = 30 + a(25)$

$-30 = 25a$

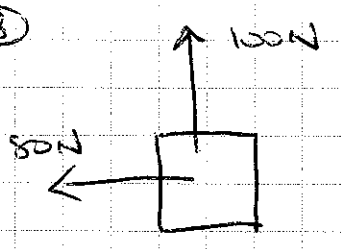
$a = -1.2\ m/s^2$

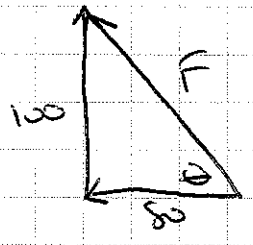
$\Sigma F = ma$

$= (1000)(-1.2)$

$\Sigma F = \boxed{-1200\ N}$

③





$F^2 = 100^2 + 80^2$

$F = 128.062\ N$

$\theta = \tan^{-1}\left(\frac{100}{80}\right)$

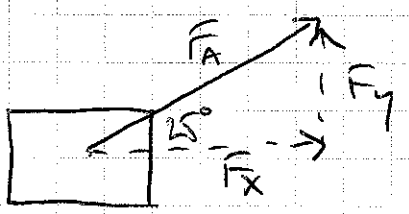
$\theta = 51.3°$

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

$= \frac{128.062}{10}$

$a = \boxed{12.8\ m/s^2\ [51°\ N\ of\ W]}$

④ a)



$\Sigma F = ma$

$= (15\,000)(0.80)$

$\Sigma F = 12\,000\ N$

$\Sigma F = F_x$

$F_x = 12\,000\ N$

$\cos 25 = \frac{F_x}{F_A}$

$F_A = \frac{F_x}{\cos 25} = \frac{12000}{\cos 25}$

$F_A = \boxed{13\,240.5\ N}$

b) F_y is balanced by the force the tracks exert on the wheels.

(5) a)

Girl 1

$\Sigma F = +360\ N$

$m = 40\ kg$

$a = \frac{\Sigma F}{m} = \frac{360}{40}$

$a = \boxed{+9\ m/s^2}$

Girl 2

$\Sigma F = -360\ N$

$m = 60\ kg$

$a = \frac{\Sigma F}{m} = \frac{-360}{60}$

$a = \boxed{-6\ m/s^2}$

b) $v_f = v_i + at$

$= 0 + (9)(0.1)$

$v_f = \boxed{+0.9\ m/s}$

$v_f = \boxed{-0.6\ m/s}$

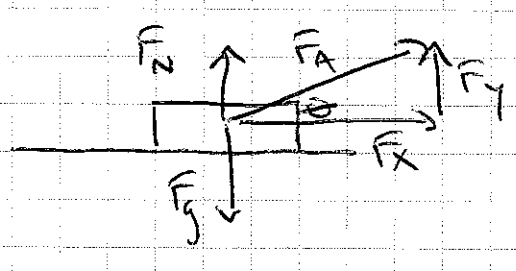
c) $d = v_i t + \frac{1}{2}at^2$

$= (0)(0.1) + \frac{1}{2}(9)(0.1)^2$

$d = \boxed{+0.045\ m}$

$d = \boxed{-0.03\ m}$

(b)



$F_A = 40\,N$

$\Sigma F = ma$

$= (10)(3.5)$

$\Sigma F = 35\,N$

$\Sigma F = F_x$

$F_x = 35\,N$

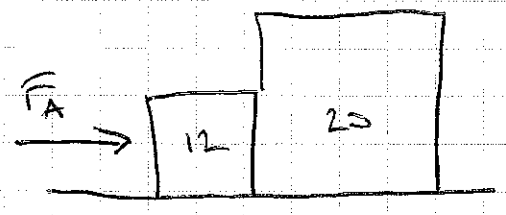
$$\cos\theta = \frac{F_x}{F_A}$$

$$\cos\theta = \frac{35}{40}$$

$$\theta = \cos^{-1}\left(\frac{35}{40}\right)$$

$$\theta = \boxed{29^\circ}$$

(7) a)



Treat them as one object to find ΣF

$\Sigma F = (m_1 + m_2)\, a$

$= (32)(9)$

$\Sigma F = 288\ N$

$F_A = \Sigma F$

$F_A = \boxed{288\ N}$

b) Isolate one mass to find action-reaction force. (F_1)

$F_A = 288\ N$

$\Sigma F = F_A - F_1$

$ma = F_A - F_1$

$(12)(9) = 288 - F_1$

$108 = 288 - F_1$

$F_1 = 288 - 108$

$F_1 = \boxed{180\ N}$