Worksheet

(8) $m = 3.0\,kg$

$F = 24N$

$v_i = 0$

$t = 5s$

$d = ?$

$F = ma$

$24 = 3a$

$a = 8.0\,m/s^2$

$v_f = v_i + at$

$v_f = 0 + 8(5)$

$v_f = 40\,m/s$

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

$$= \left(\frac{40+0}{2}\right)5 = \underline{100\,m}$$

(9) $m = 40\,kg$

$v_i = 0$

$v_f = 8\,m/s$

$t = 2s$

$v_f = v_i + at$

$8 = 0 + a(2)$

$a = 4\,m/s^2$

$F = ma = (40)(4) = \underline{160\,N}$ (The friction between her feet and the ground exerts the force)

(10) $m = 8g = 0.008\,kg$

$v_i = 400\,m/s$

$v_f = 100\,m/s$

$t = 4 \times 10^{-4}\,s$

$v_f = v_i + at$

$100 = 400 + a(4 \times 10^{-4})$

$-300 = a(4 \times 10^{-4})$

$a = 750\,000\,m/s^2$

(a) $F = ma = (0.008)(750\,000) = \underline{6000\,N}$

(b) $d = \left(\frac{v_f + v_i}{2}\right)t = \left(\frac{100+400}{2}\right)(4 \times 10^{-4}) = \underline{0.1\,m}$

(11) $m = 1.8 g = 0.0018 kg$
$v_f = 500 m/s$
$v_i = 0$
$d = 25 cm = 0.25 m$

$d = \left(\frac{v_f + v_i}{2}\right) t$
$.25 = \left(\frac{500 + 0}{2}\right) t$
$.25 = 250 t$
$t = 0.001 s$

$v_f = v_i + at$
$500 = 0 + a(.001)$
$a = 500\ 000 m/s^2$

$F = ma = (0.0018)(500\ 000) = \underline{900 N}$

(12) $v_i = 72 km/h = 20 m/s$
$v_f = 0$
$m = 1000 kg$
$F = 8000 N$

Stopping time:

$F = ma$
$8000 = 1000 a$
$a = 8 m/s^2$
(we are stopping so a must be negative)

$v_f = v_i + at$
$0 = 20 - 8t$
$t = 2.5 s$

$d = \left(\frac{v_f + v_i}{2}\right) t$
$= \left(\frac{0 + 20}{2}\right)(2.5)$
$d = 25 m$

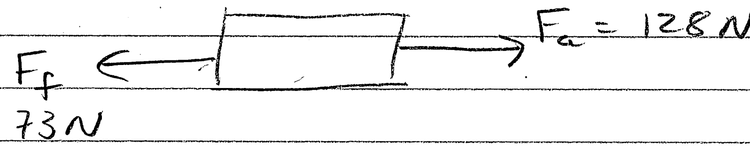
Reaction time: (during the reaction time the car is still moving forwards at its initial velocity)

$V = 20 m/s$
$t = 0.60 s$
$d = ?$

$v = \frac{d}{t}$
$20 = \frac{d}{0.6}$ $d = 12 m$

∴ The total distance is $12 + 25 = \underline{37 m}$.
You miss the child by 3 m.

(13)



$$F_{net} = 128 - 73 = 55 N \text{ forwards}$$

Empty Wagon

$F_{net} = 55 N$

$a = 5 m/s^2$

$F = ma$

$55 = m(5)$

$m = 11 kg$

Wagon and Child

$F_{net} = 55 N$

$a = 1.0 m/s^2$

$F = ma$

$55 = m(1)$

$m = 55 kg$

Mass of Child $= 55 - 11 = \underline{44 kg}$

(14)

$m = 6 kg$

$v_i = v_0$

$F = 36 N$

$v_f = 2v_0$

$d = 10 m$

$F = ma$

$36 = 6a$

$a = 6 m/s^2$

$v_f = v_i + at$

$2v_0 = v_0 + 6t$

$v_0 = 6t$

$t = \frac{v_0}{6}$

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

$10 = \left(\frac{2v_0 + v_0}{2}\right)\frac{v_0}{6}$

$10 = \left(\frac{3v_0}{2}\right)\frac{v_0}{6} = \frac{3v_0^2}{12}$

$120 = 3v_0^2$

$v_0^2 = 40$

$v_0 = \underline{6.32 m/s}$

(b) $t = \frac{v_0}{6}$

$= \frac{6.32}{6}$

$= \underline{1.05 s}$

(15)

m_1

$F = 8N$

$a = 2\ m/s^2$

$F = ma$

$8 = m_1 2$

$m_1 = 4\ kg$

m_2

$F = 8N$

$a = 4\ m/s^2$

$F = ma$

$8 = m_2 4$

$m_2 = 2\ kg$

$m_1 + m_2$

$m = 4 + 2 = 6\ kg$

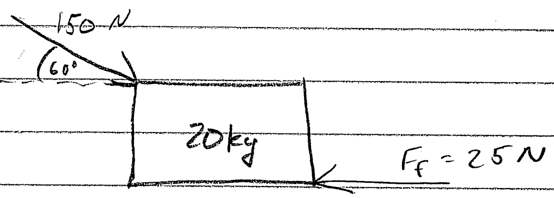
$F = 8N$

$F = ma$

$8 = 6a$

$a = 1.33\ m/s^2$

(17)



Net horizontal force

$F_a = 150 \cos 60° = 75\ N$

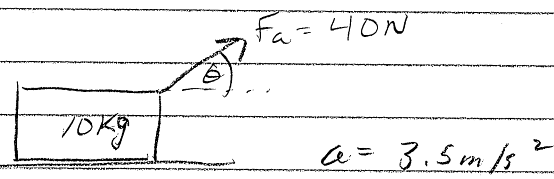
$F_{net} = 75 - 25 = 50N$

$F_{net} = ma$

$50 = 20a$

$a = 2.5\ m/s^2$

(18)



Horizontal force

$40 \cos \theta$

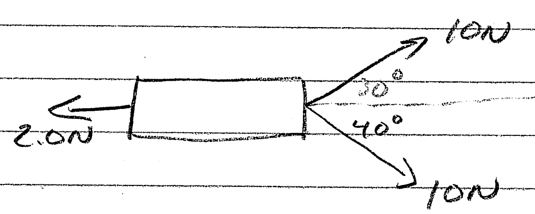
$F_{net} = ma$

$40 \cos\theta = 10(3.5)$

$\cos\theta = 0.875$

$\theta = 29°$

(19)



Net Horizontal Force:

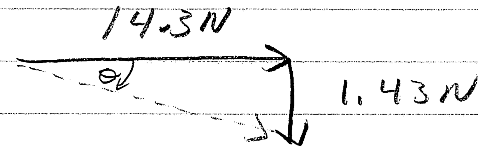
$-2.0 + 10 \cos 30 + 10 \cos 40 = 14.3\ N$

Net Vertical Force:

$10 \sin 30 - 10 \sin 40 = -1.43\ N$

19 cont'd

Total Net Force:



$c^2 = (14.3)^2 + (1.43)^2 = 206.53$

$\tan\theta = \frac{1.43}{14.3}$

$F_{net} = 14.4\ N\ \ 5.7°\ S\ of\ E$

$\theta = 5.7°$

$F_{net} = ma$

$14.4 = 10a$

$a = 1.44\ m/s^2\ \ 5.7°\ S\ of\ E$

(20) $F = ma$

$= 100(2)$

$F = 200N$

His feet must push with an equal force (Newton's Third Law)

200N

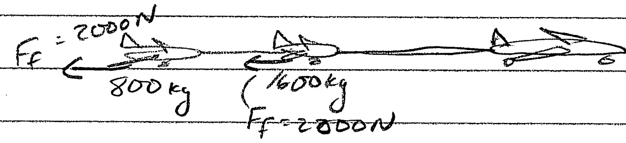
If there is no friction, then the boy's acceleration is:

$F = ma$

$200 = 30a$

$a = 6.67\ m/s^2$

(21)



(a) $V_i = 0$

$V_f = 40 m/s$

$F_{net} = 10000 - 2000 - 2000 = 6000 N$

$m = 1600 + 800 = 2400 kg$

$F = ma$

$6000 = (2400) a$

$a = 2.5 \ m/s^2$

$V_f = V_i + at$

$40 = 0 + 2.5 t$

$t = 16 s$

$d = \left(\frac{V_f + V_i}{2} \right) t$

$= \left(\frac{40 + 0}{2} \right) 16$

$\underline{d = 320 m}$

(b) $F = ma$

$F_{net} = (800)(2.5) = 2000 N$

The applied force is then $2000 + \underset{\text{friction}}{2000} = \underline{4000 N}$

(22) (a) mass is the slope of the line

$mass = \left(\frac{5 - 1}{.85 - .05} \right) = 5 \ kg$

(b) There is a frictional force acting on the cart. The magnitude of this force is where the graph crosses the y-axis.
In this case, the force of friction is approximately $\underline{0.6 \ N}$.