

$$F_{net} = ma$$

we don't know a... so that means Kinematics!!!

$$V = 60.0 \text{ km/h} \div 3.6 = 16.67 \text{ m/s}$$

$$V_0 = 0 \text{ m/s}$$

$$a = ?$$

$$d = 45 \text{ m}$$

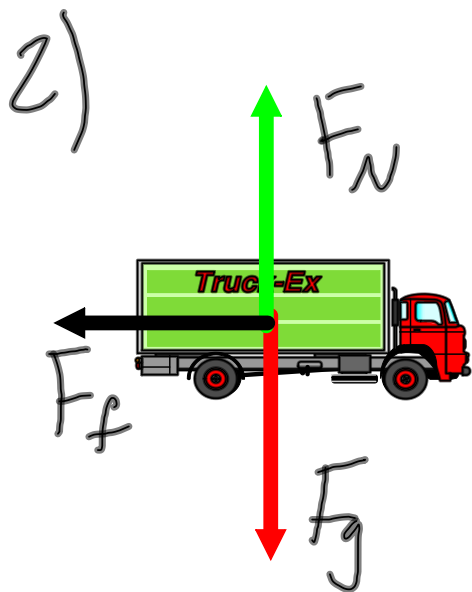
$$t =$$

$$v^2 = \cancel{v_0^2} + 2ad$$

$$a = \frac{v^2}{2d} = 3.0865 \text{ m/s}^2$$

$$F_{net} = ma = (1100 \text{ kg})(3.0865 \text{ m/s}^2)$$

$$= 3400 \text{ N}$$



Remember, while the car is rolling there is no  $F_{app}$  therefore the net force =  $F_f$

$$F_{net} = ma$$

$$F_f = ma$$

But first kinematics...

$$v = 0 \text{ m/s}$$

$$v_0 = 24 \text{ m/s}$$

$$a = ?$$

$$d = 225 \text{ m}$$

+

$$v^2 = v_0^2 + 2ad$$

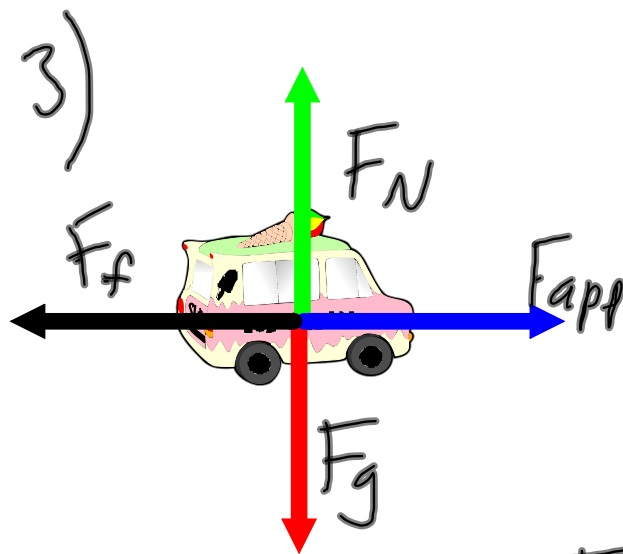
$$a = \frac{-v_0^2}{2d}$$

$$= -1.28 \text{ m/s}^2$$

Remember that we will use the "-" sign when doing kinematics but not in our force equations

$$F_f = ma = (1400 \text{ kg})(1.28 \text{ m/s}^2)$$

$$= \underline{1800 \text{ N}}$$

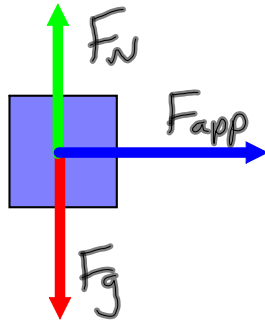


Since  $v = \text{constant}$   
 $a = 0$   
therefore  $F_{\text{net}} = 0$   
so  $F_{\text{app}} = F_f$

$$F_{\text{app}} = F_f = 350 \text{ N}$$

Note the speed of the truck (35 m/s) does not matter, just that it is constant

4) a



$$F_{net} = ma$$

Since there is only  $F_{app}$  which is winning and no opposing forces  
 $F_{net} = F_{app}$

$$F_{app} = ma$$

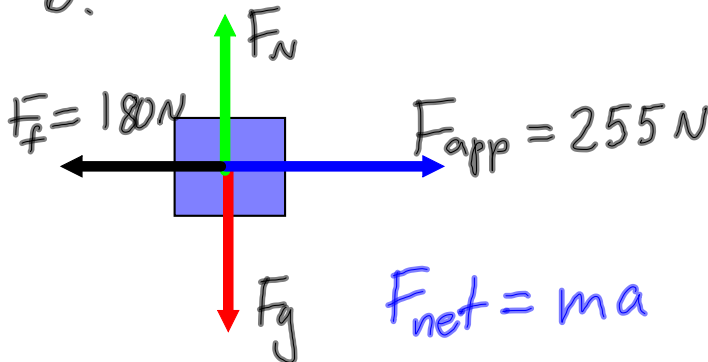
use extra sig figs later

$$= (85 \text{ kg})(3.0 \text{ m/s}^2)$$

$$\rightarrow = 255 \text{ N}$$

$$= \underline{260 \text{ N}}$$

b.



$$F_{net} = ma$$

$$F_{net} = F_{app} - F_f$$

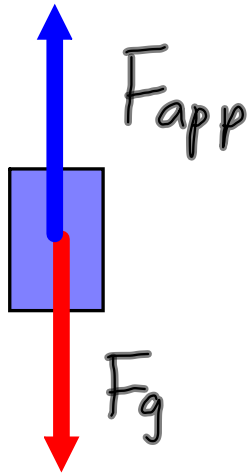
$$= 255 \text{ N} - 180 \text{ N}$$

$$= 75 \text{ N}$$

$$a = \frac{F_{net}}{m} = \frac{75 \text{ N}}{85 \text{ kg}}$$

$$= \underline{0.88 \text{ m/s}^2}$$

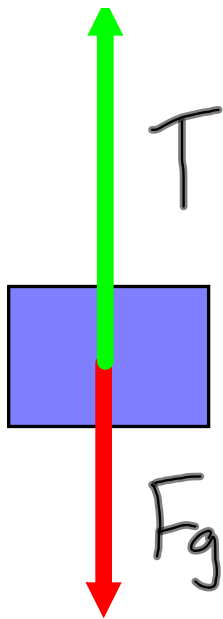
5)



since  $v = \text{constant}$   
 $a = 0$   
therefore  $F_{net} = 0$   
therefore  $F_{app} = F_g$

$$\begin{aligned} F_{app} &= F_g = m g \\ &= (15 \text{ kg})(9.80 \text{ m/s}^2) \\ &= \underline{150 \text{ N}} \end{aligned}$$

6)



$$F_{net} = ma$$

$$T - F_g = ma$$

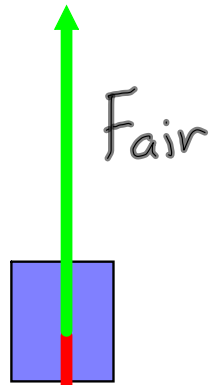
↑ winner      ← loser

$$T = ma + F_g$$

$$\begin{aligned}
 F_g &= mg \\
 &= (4.0 \text{ kg})(9.80 \text{ m/s}^2) \\
 &= 39.2 \text{ N}
 \end{aligned}$$

$$\begin{aligned}
 T &= (4.0 \text{ kg})(3.2 \text{ m/s}^2) + 39.2 \text{ N} \\
 &= \underline{52 \text{ N}}
 \end{aligned}$$

7)



$$F_g = mg = (75 \text{ kg})(9.80 \text{ m/s}^2) \\ = 735 \text{ N}$$

$$F_{\text{net}} = ma$$

$$F_{\text{air}} - F_g = ma$$

$$F_{\text{air}} = ma + F_g$$

Uh oh! No  
acceleration... you  
know what time it is!!!

$$V = 25 \text{ km/h} \div 3.6 = 6.944 \text{ m/s}$$

$$V_0 = 220 \text{ km/h} \div 3.6 = 61.11 \text{ m/s}$$

$$a = ?$$

$$d =$$

$$t = 3.8 \text{ s}$$

$$V = V_0 + at$$

$$a = \frac{V - V_0}{t}$$

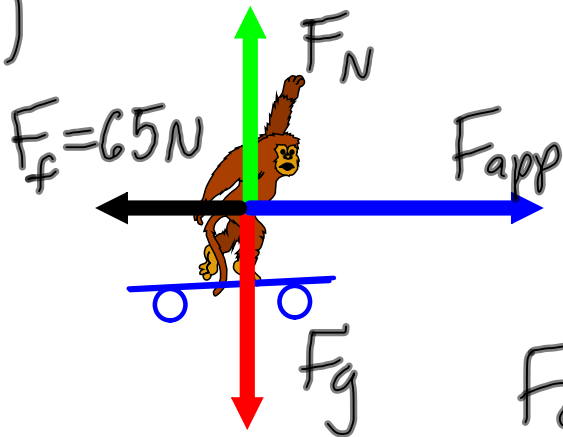
$$= -14.25 \text{ m/s}^2$$

$$F_{\text{air}} = ma + F_g$$

$$= (75 \text{ kg})(14.25 \text{ m/s}^2) + 735 \text{ N}$$

$$= 1800 \text{ N}$$

8)



$$F_{net} = ma$$

$$F_{app} - F_f = ma$$

winner loser

$$F_{app} = ma + F_f$$

find this

$$V = 13 \text{ m/s}$$

$$V_0 = 0 \text{ m/s}$$

$$a = ?$$

$$d = 8.0 \text{ m}$$

+

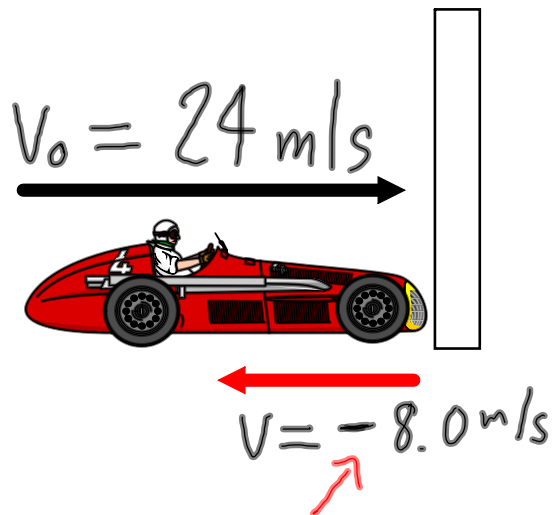
$$V^2 = V_0^2 + 2ad$$

$$a = \frac{V^2}{2d} = 10.56 \text{ m/s}^2$$

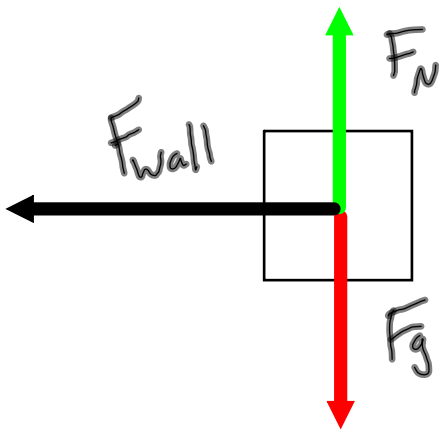
$$\begin{aligned} F_{app} &= ma + F_f \\ &= (45 \text{ kg})(10.56 \text{ m/s}^2) + 65 \text{ N} \\ &= \underline{540 \text{ N}} \end{aligned}$$



a) a.



Note that since the car bounces backwards its final velocity is negative!!!



$$F_{\text{net}} = ma$$

$$F_{\text{wall}} = ma$$

$$\begin{aligned} V &= -8.0 \text{ m/s} \\ V_0 &= 24.0 \text{ m/s} \\ a &= ? \\ d &= \\ t &= 0.90 \text{ s} \end{aligned}$$

$$\begin{aligned} V &= V_0 + at \\ a &= \frac{V - V_0}{t} \\ &= \frac{(-8.0 \text{ m/s}) - (24.0 \text{ m/s})}{0.90 \text{ s}} \\ &= 35.56 \text{ m/s}^2 \end{aligned}$$

$$\begin{aligned} F_{\text{wall}} &= ma \\ &= (1350 \text{ kg})(35.56 \text{ m/s}^2) \\ &= 4.8 \times 10^4 \text{ N} \end{aligned}$$

$$9)b. \quad F_{\text{wall}} = ma$$

$$v = -8.0 \text{ m/s}$$

$$v_0 = 24.0 \text{ m/s}$$

$$a = ?$$

$$d =$$

$$t = 0.080 \text{ s}$$

$$v = v_0 + at$$

$$a = \frac{v - v_0}{t}$$

$$= \frac{(-8.0 \text{ m/s}) - (24.0 \text{ m/s})}{0.080 \text{ s}}$$

$$= -400 \text{ m/s}^2$$

$$\begin{aligned} F_{\text{wall}} &= ma \\ &= (1350 \text{ kg})(400 \text{ m/s}^2) \\ &= \underline{5.4 \times 10^5 \text{ N}} \end{aligned}$$