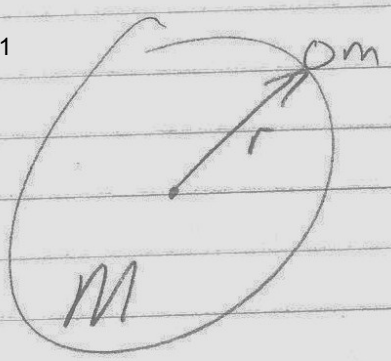
#1



$F_g = mg$

$F_g = \frac{GMm}{r^2}$

$\therefore mg = \frac{GMm}{r^2}$

$g = \frac{GM}{r^2}$

$r^2 = \frac{GM}{g}$

$r = \sqrt{\frac{GM}{g}}$

$M = 7.8 \times 10^{24}\ kg$

$r = ?$

$g = 6.8\ \frac{m}{s^2}$

$= \sqrt{\frac{(6.67\times10^{-11})(7.8\times10^{24})}{6.8}}$

$= 8.75 \times 10^{6}\ m$

#2

Since $F_g \propto m_1$, if m_1 is $\times 3$, then F is $\times 3$

Since $F_g \propto m_2$, if $m_2 \times \frac{1}{2}$, then F is $\times \frac{1}{2}$

Since $F_g \propto \frac{1}{r^2}$, if $r \times 2$, then $F \times \frac{1}{4}$

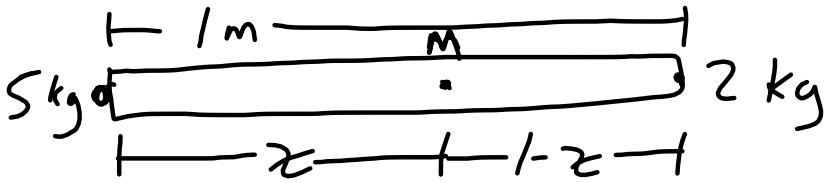
Since $F_g = \frac{Gm_1m_2}{r^2}$

$\therefore$ Since $F_{g_1} = 3.5 \times 10^{-8}\ N$ then

$F_{g_2} = 3.5 \times 10^{-8} \times 3 \times \frac{1}{2} \times \frac{1}{4}$

$= 1.31 \times 10^{-8}\ N$

#3



$$F_2 = \frac{GM(5)}{x^2} \qquad F_5 = \frac{GM(2)}{(1-x)^2}$$

$$F_5 = \frac{1}{3}F_2$$

$$\frac{GM(2)}{(1-x)^2} = \frac{1}{3}\frac{GM(5)}{x^2}$$

$$\frac{2}{(1-x)^2} = \frac{5}{3x^2}$$

$$6x^2 = 5(1-x)^2$$

$$6x^2 = 5(1-2x+x^2)$$

$$6x^2 = 5 - 10x + 5x^2$$

$$6x^2 - 5x^2 + 10x - 5 = 0$$

$$x^2 + 10x - 5 = 0$$

$$x = \frac{-10 \pm \sqrt{10^2 - 4(1)(-5)}}{2(1)}$$

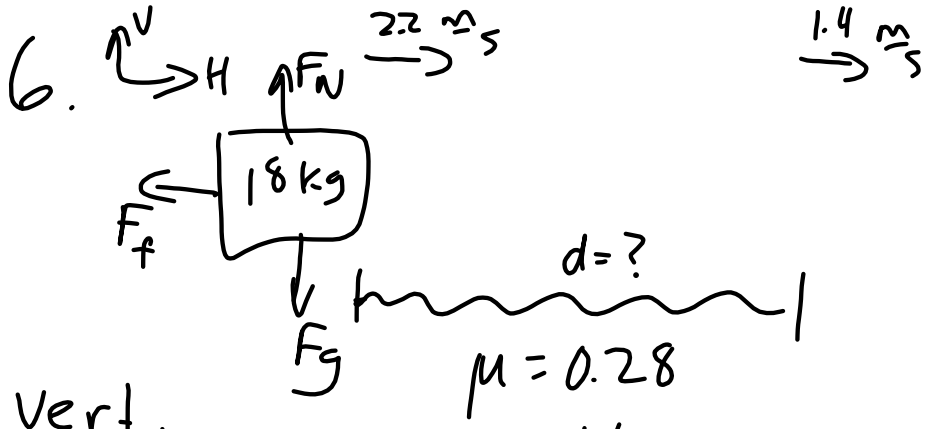
$$= \frac{-10 \pm \sqrt{100 + 20}}{2}$$

$$= \frac{-10 \pm \sqrt{120}}{2}$$

$x = 0.477$ m or $x < 0$ (off metre stick)

or 47.7 cm

6.



Vert.

$F_{NET} = 0$

$F_{NET} = F_N - F_g$

$\therefore F_N = mg$

Hor.

$F_{NET} = ma$

$F_{NET} = -F_f$

$\therefore -F_f = ma$

$V_i = 2.2 \frac{m}{s}$

$V_f = 1.4 \frac{m}{s}$

$a = -\mu g$

$= -(0.28)(9.8)$

$= -2.744 \frac{m}{s^2}$

$a = \frac{-F_f}{m}$

$= \frac{-\mu F_N}{m}$

$= \frac{-\mu mg}{m}$

$a = -\mu g$

$= -2.744$

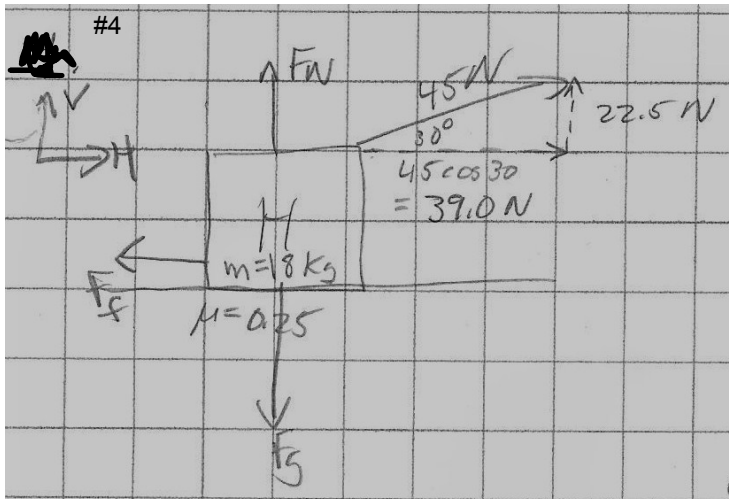
$d = \frac{V_f^2 - V_i^2}{2a}$

$= \frac{(1.4)^2 - (2.2)^2}{2(-2.744)}$

$= \frac{-2.88}{-5.488}$

$= 0.525 \text{ m}$

#4



Vertical

a) $F_{NET} = 0$

b) $F_{NET} = F_N + 22.5 - F_g$

$\therefore 0 = F_N + 22.5 - (18)(9.8)$

$F_N = 176.4 - 22.5$

$= 153.9\ N$

c) $F_f = \mu F_N$

$= (0.25)(153.9)$

$= 38.5\ N$

d) Horizontal

$F_{NET} = ma$

a) $F_{NET} = 39.0 - F_f$

$= 39.0 - 38.5$

$= 0.5\ N$

c) $\therefore ma = 0.5$

$a = \frac{0.5}{18}$

$= 0.028\ \frac{m}{s^2}$