FBD Worksheet

① a) $\Sigma F = 6000 - 3000 - 500 = 2500\ N\ [Up]$

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

$$= \frac{2500}{300}$$

$$a = 8.33\ m/s^2\ [Up]$$

b) $\Sigma F = 20000\ N - 3000\ N = 17000\ N\ [Right]$

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

$$= \frac{17000}{15000}$$

$$a = 1.13\ m/s^2\ [Right]$$

c) $\Sigma F = 1500 - 80 - 500 = 920\ N\ [Right]$

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

$$= \frac{920}{500}$$

$$a = 1.84\ m/s^2\ [Right]$$

② a) $\Sigma F = 5 + 2 - 3 = 4\ N$ [Right]

$a = \frac{\Sigma F}{m} = \frac{4}{1} = 4\ m/s^2$ [Right]

b) $\Sigma F = 5 - 2 = 3\ N$ [Right]

$m = \frac{\Sigma F}{a} = \frac{3}{2} = 1.5\ Kg$

c) $\Sigma F = 0$ (since $a = 0$)

$\Sigma F = 5 + 3 - 1 + \vec{F}_1$

$0 = 5 + 3 - 1 + \vec{F}_1$

$0 = 7 + \vec{F}_1$

$\vec{F}_1 = -7\ N$ or $7\ N$ [Left]

d) $\Sigma F = 0$ } since v = constant
$a = 0$ }

$\Sigma F = \vec{F}_1 + 5 - 30$

$0 = \vec{F}_1 - 25$

$\vec{F}_1 = 25\ N$ [Right]

② g) $\Sigma F = 5 + 18 - 20 = 3\ N\ [Right]$

$m = \frac{\Sigma F}{a} = \frac{3}{5} = 0.6\ kg$

h) If we assume that the 10 N force is gravity, then

$m = \frac{F_g}{g} = \frac{10}{9.8} = 1.02\ kg$

Otherwise, m could be any value.

$\Sigma F = 0$ } since v is constant

$a = 0$ }

$\Sigma F = \vec{F}_1 - 10$

$0 = \vec{F}_1 - 10$

$\vec{F}_1 = 10\ N\ [Up]$

i) let $F_2 = x$, then $F_1 = 2x$

$\Sigma F = F_1 - F_2$

$= 2x - x$

$1.8 \times 10^{-2} = x$

$F_1 = 2x$

$= 2(1.8 \times 10^{-2})$

$F_1 = 0.036\ N\ [Right]$

$F_2 = x$

$F_2 = 0.018\ N\ [Left]$

③ a) Vertical

$\Sigma F_y = 25 - 40 = -15\ N$ or $15\ N\ [S]$

Horizontal

$\Sigma F_x = 50 - 50 = 0$

b) Vertical

$\Sigma F_y = 30 + 50 - 40 = 40\ N\ [N]$

Horizontal

$\Sigma F_x = 50 - 10 = 40\ N\ [E]$

c) Vertical

$\Sigma F_y = 2 + 2 - 0.5 = 3.5\ N\ [N]$

Horizontal

$\Sigma F_x = 2 + 3 - 6 = 1\ N\ [W]$

d) Vertical

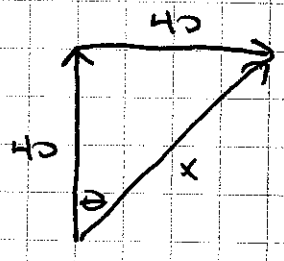
$\Sigma F_y = 10 + 25 + 5 - 3 - 2 = 30\ N\ [N]$

Horizontal

$\Sigma F_x = 21 + 4 - 25 - 15 = 10\ N\ [W]$

④ a) $\Sigma F = 15$ N [S] (since horizontal is 0)

b)



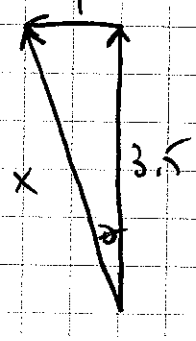
$x^2 = 45^2 + 45^2$

$x = 56.6$ N

$\theta = \tan^{-1}\left(\frac{45}{45}\right) = 45°$

$\Sigma F = 56.6$ N [NE]

c)



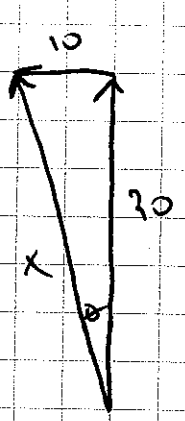
$x^2 = 1^2 + 3.5^2$

$x = 3.6$ N

$\theta = \tan^{-1}\left(\frac{1}{3.5}\right) = 16°$

$\Sigma F = 3.6$ N [16° W of N]

d)



$x^2 = 10^2 + 30^2$

$x = 31.6$ N

$\theta = \tan^{-1}\left(\frac{10}{30}\right) = 18°$

$\Sigma F = 31.6$ N [18° W of N]