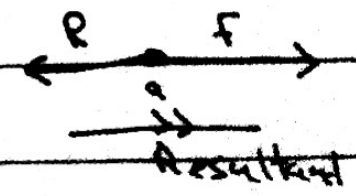
Q.1 mass = 1000 kg, $P = 20 \times 10^3$ W, $R = 600$ N, $v = 25$ ms^{-1}.

$F - R = ma$

$P = Fv$

$F = P/v$

$\frac{P}{v} - R = ma$



$\frac{20 \times 10^3 \text{ W}}{25 \text{ ms}^{-1}} - 600 \text{ N} = 1000a$

$200 = 1000a$

$a = 0.2 \text{ ms}^{-2}$.

Q.2 (i) distance traveled = area under curve.

Consider it a parallelogram:

$A = \frac{20+24}{2} \times 7 = 154$.

So original area is bigger than parallelogram.

$A = S > 154$

(ii) distance moved in forward = $20 + 20 \times 7$

$= 160$ m.

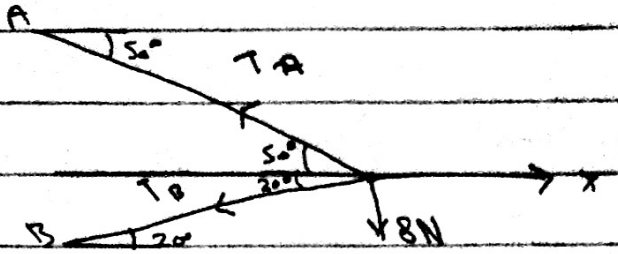
distance moved back = area of triangle

$= \frac{1}{2}bh = \frac{1}{2} \times 10 \times 8$

$= 40$.

displacement = $160 - 40 = 120$m.

Q.3 (i)



according to question question tension in complete string has to be found which means $T_A = T_B$.

$$T \sin 50^\circ = T \sin 20^\circ + 8N$$

$$T(\sin 50^\circ - \sin 20^\circ) = 8\ N$$

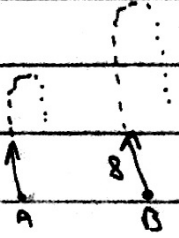
$$T = \frac{8}{0.4240} = 18.9\ N.$$

(ii) $T \cos 50 + T \cos 20 = X$

$$18(\cos 50 + \cos 20) = 28.49\ N$$

Q.4

(i) at max, $t = \frac{5-0}{10} = 0.5\ s.$



~~$S_A = 0.5(5) = 7.5$~~

~~$S_B = 0.5(0.5)$~~

$$S_A = \frac{5^2}{2 \times 10} = 1.25\ m.$$

$$S_B = 8(0.5) - 0.5(0.5)^2 \times 10 = 2.75.$$

difference $= 2.75 - 1.25 = 1.5\ m.$

ii) $(s = ut + \frac{1}{2}at^2)$

$$s_B - s_A = 0.9$$

$$(8t - \tfrac{1}{2}t^2 \times 10) - (5t - \tfrac{1}{2} \times t^2 \times 10) = 0.9$$

$$8t - 5t - \tfrac{5}{2}t^2 + \tfrac{5}{2}t^2 = 0.9$$

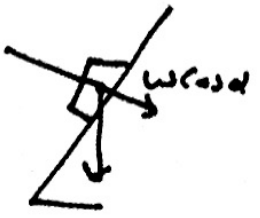
$$3t = 0.9$$

$$\underline{t = 0.3}$$

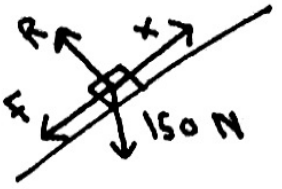
$$s_A = 5(0.3) - \tfrac{1}{2} \times 0.3^2 \times 10 = 1.05\text{ m}.$$

Q.5 (i) $150\text{ N} \times \cos 35 = R$

$R = 123\text{ N}$



(ii) $f = \mu R = 123\mu$



resolving:

$$X = 123\mu + 86.0$$

$$+\ 5x = 150\sin 35 - 123\mu$$

$$6x = 172.1$$

$$x = 28.7\text{ N}$$

$$\mu = \frac{X - 86}{123} = \frac{28.7 - 86}{123} = 0.467$$

Q.6 (a) $R = 12\cos 25^\circ = 10.88\text{ N}$

$f = \mu R = \frac{1}{4} \times 10.88 = 2.72\text{ N}$

(b) $ma = mg\sin 25^\circ - 2.72\text{ N}$

$$a = g\sin 25 - \frac{2.72}{1.2} = 1.96\text{ ms}^{-2}$$

(c) $2as = v^2 - u^2$

$v^2 = 2 \times 1.96 \times 4$

$v = \sqrt{15.68}$

$= 3.96\text{ ms}^{-1}$.

Q.7

(i) $v = 0$ (at instantaneous rest)

$t(0.12 - 0.0006t) = 0$

$t = 0$ or $t = \frac{0.12}{0.0006} = 200$ s

$a = \frac{dv}{dt} = 0.12 - 1.2 \times 10^{-3} t$

$= 0.12 - 1.2 \times 10^{-3} (200)$

$= -0.12 \text{ ms}^{-2}$

(ii) at max speed $a = 0$.

$0.12 - 1.2 \times 10^{-3} t = 0$

$t = \frac{0.12}{1.2 \times 10^{-3}} = 100$ s.

$v = 0.12(100) - 0.0006(100)^2$

$= 6 \text{ ms}^{-1}$.

(iii) $s = \int v \, dt = \int (0.12t - 0.0006t^2) \, dt$

$s = 0.06t^2 - 0.0002t^3 + C$ ($C = 0$ because at $t = 0$, $s = 0$)

$s = 0.06t^2 - 0.0002t^3$

$s = 0.06(200)^2 - 0.0002(200)^3$

$= 800$ m

(iv) $s = 0$

$0 = (0.06 - 0.0002t)(t^2)$

$t = 0$ or $t = \frac{0.06}{0.0002} = 300$ s.