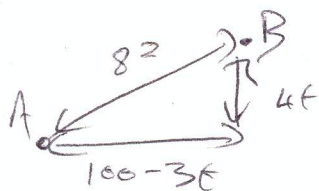


1985 HMC : Q5. (a)

(quick way)



$$82^2 = (100-3t)^2 + (4t)^2$$

$$\Rightarrow 25t^2 - 600t + 3276 = 0$$

$$\Rightarrow t = 8.4 \text{ or } 15.6$$

$$\Rightarrow \Delta t = 15.6 - 8.4 = 7.2 \text{ sec}$$

(8)(i)

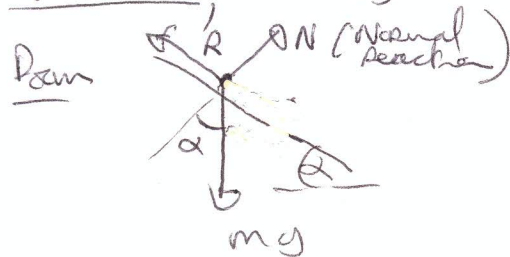
mass = 750 kg

At

max speed $a = 0$

Key told Resistance = $k v^2$

α incline $\sin \alpha = \frac{1}{25}$



Down plane
at max speed $a = 0$

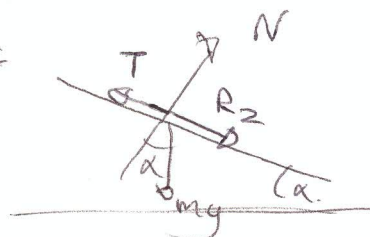
$$\Sigma F = 0$$

$$mg \sin \alpha - R = 0$$

$$\Rightarrow 750g \sin \alpha - k(30)^2 = 0$$

$$\Rightarrow k = \frac{g}{30} \quad (1)$$

up:



up plane
at max speed $a = 0$

$$\Sigma F = 0$$

$$T - R_2 - mg \sin \alpha = 0$$

$$\Rightarrow T - k(20)^2 - 750g \sin \alpha = 0$$

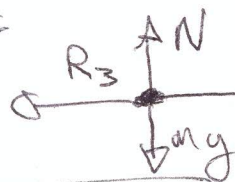
$$(1) \Rightarrow T - \frac{g}{30}(20)^2 - \frac{750}{25}g = 0$$

$$\Rightarrow T = \frac{130g}{3} \quad (2)$$

T = tractive effort
of engine.

But Power = $T \cdot v \Rightarrow P = \left(\frac{130g}{3}\right) 20 = \frac{2600}{3} g$

(8)(ii):



At max speed $v \Rightarrow T' - R_3 = 0$
 $a = 0$

$$\Rightarrow T' = k v^2$$

$$\Rightarrow T' = \frac{g}{30} v^2 \quad (4)$$

Same Power $\Rightarrow T' v = \frac{2600}{3} g$

$$\Rightarrow T' = \frac{2600}{3v} g \quad (5)$$

(4), (5) $\Rightarrow$

$$\frac{g}{30} v^2 = \frac{2600}{3v} g \Rightarrow v^3 = 26000$$

$$\Rightarrow v = \sqrt[3]{26000}$$

$$\Rightarrow v = 29.624 \text{ m/s}$$

Power = $\frac{2600}{3} g$