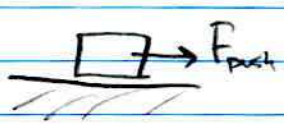
Version A

Quiz 4 Solutions

(1) 

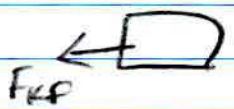
so $F_{sf}^{max} = \mu_s N = (0.5)(40) = 20N$

so $F_{push} < F_{sf}^{max}$, so $F_{sf} = F_{push} = 12N$

(2) (c) 

so $a = -\mu_k g$, pointing against the motion

(3) $V_f = V_0 + at \rightarrow 0 = (15 m/s) + (a_f)(4s)$ $\quad a_f = -3.75 m/s^2$

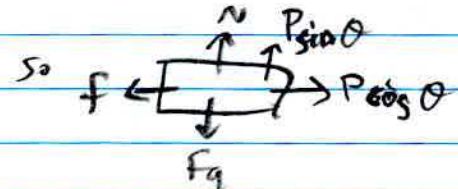


so $F_{kf} = -\mu_k (m g) = m a_f$

$a_f = -\mu_k g = -3.75 m/s^2$

$\mu_k = 0.38$

(4) const. speed means $\sum F = 0$

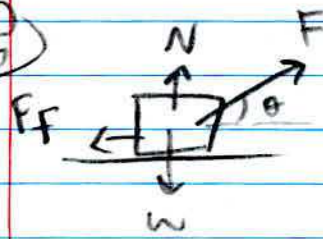


so x) $P\cos\theta = f$

ie $P > F$

y) $N + P\sin\theta = F_g$

ie $N < F_g$

(5) 

$F_f = F_{sf}^{max} = \mu_s N$

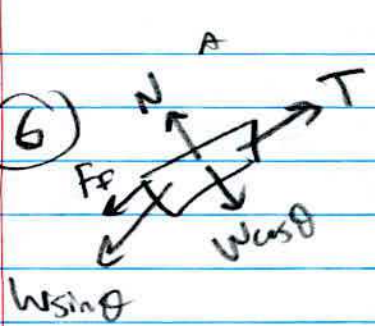
x) $F\cos\theta = \mu_s N$

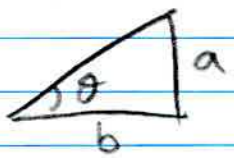
y) $N + F\sin\theta = W \rightarrow N = W + F\sin\theta$

plug (y) → (x): $F\cos\theta = \mu_s (W + F\sin\theta) \rightarrow F(\cos\theta - \mu_s \sin\theta) = \mu_s W$

to minimize F, we need max of $(\cos\theta - \mu_s \sin\theta)$ $\quad \frac{d}{d\theta}(\cos\theta - \mu_s \sin\theta) = 0 \rightarrow \theta = 27°$

(6)





$\tan\theta = \frac{a}{b}$

$\theta = 36.9°$

A) $F_f + W\sin\theta = T \rightarrow F_f = W - W\sin\theta = 8N$

B) $T = W$

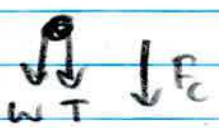
(7)

$F_f = F_c = \frac{mv^2}{R}$

to make the turn: $F_c = \frac{(100)(10)^2}{(100)} = 1000\,N$

$F_f < 1000\,N$, so it is not enough and the driver slides to the outside

(8)



so $W + T = F_c = \frac{mv^2}{R}$

here, $T \mapsto 0$ so $W = \frac{mv^2}{R} \rightarrow v = \sqrt{gR} = 2.6\,m/s$