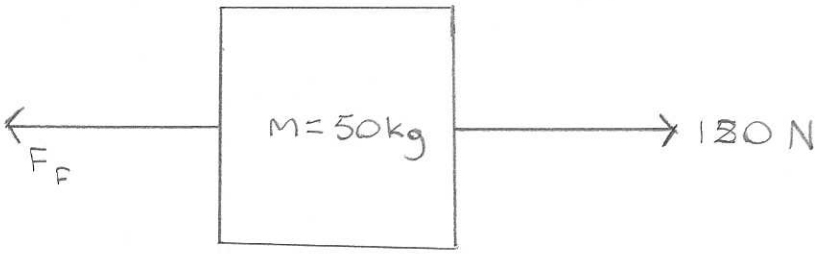
Quiz: FBD Motion

Total: /14

Question 1: (/6)

Shrek finds donkey in a cart (total mass 50 kg) on the side of the road. He starts to pull the cart along a smooth road with a coefficient of friction 0.2 with a force of 120 N [FWD]. If he accelerated to a speed of 15 km/h, how far did the cart move during acceleration?



Knowns

$V_i = 0$

$F_P = 120\,N$

$F_f = 24\,N$

$V_f = 15\,km/h = 4.1\bar{6}\,m/s$

$F_p - F_f = ma$

$120 - 120(0.2) = 50a$

$120 - 24 = 50a$

$96 = 50a$

$1.92 = a$

$a = 1.92\,m/s^2$

$V_f^2 = V_i^2 + 2ad$

$4.17^2 = 0^2 + 2(1.92)d$

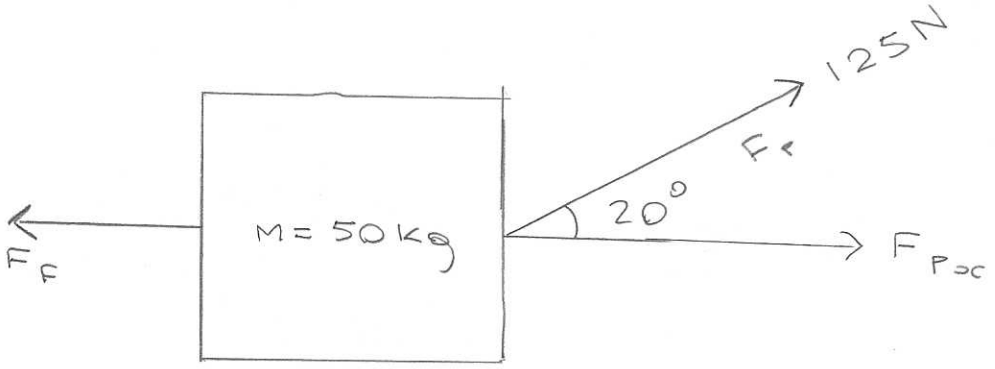
$\frac{17.40}{3.84} = \frac{3.84d}{3.84}$

$4.53 = d$

$d = 4.53\,m$

Question 2: (/8)

Continued from Question 1 - so hey guess what? This is a multiple motion question. Shrek maintains a constant speed after his initial acceleration, then breaks into a sprint. He at this point is pulling on the cart with a force of 125 N (FWD 20 UP) and maintains this for 10s. How fast is he going at this point?



knowns

$F_p = 125\ N$

$F_{pdc} = 51.01\ N$

$t = 10s$

$V_i = 4.17\ m/s$

$a = 0.82\ m/s^2$

$V_f = 12.37\ m/s$

$F_{pdc} = 125 \cos 20^\circ$

$= 51.01\ N$

$\Sigma F = ma$

$F_{pdc} - F_c = ma$

$51.01 - 51.01(0.2) = 50a$

$51.01 - 10.202 = 50a$

$\frac{40.808}{50} = \frac{50a}{50}$

$0.82 = a$

$a = 0.82\ m/s^2$

$V_f = V_i + at$

$V_f = 4.17 + 0.82(10)$

$V_f = 4.17 + 8.2$

$V_f = 12.37\ m/s$