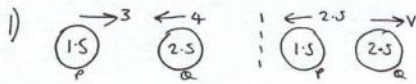


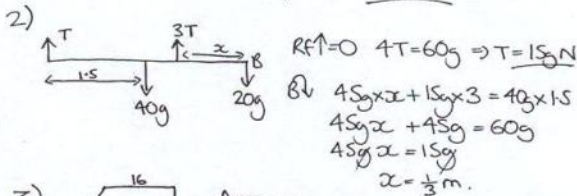
M1 JAN 05



Momentum before =  $1.5 \times 3 + 2.5 \times (-4) = -5.5 \text{ N s}$   
Momentum after =  $1.5 \times (-2.5) + 2.5 \times v = 2.5v - 3.75$

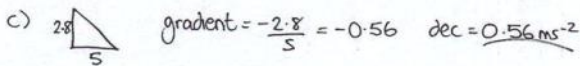
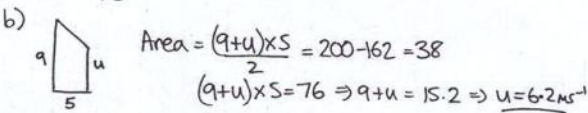
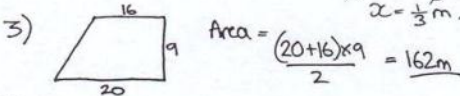
$2.5v - 3.75 = -5.5 \Rightarrow 2.5v = -1.75 \Rightarrow v = -0.7 \text{ ms}^{-1}$

- b) Unchanged  
c) Mom P before =  $4.5 \text{ N s}$   
Mom P after =  $-3.75 \text{ N s}$   
Impulse =  $8.25 \text{ N s}$



$R \uparrow = 0 \quad 4T = 60g \Rightarrow T = 15g \text{ N}$

$4.5g \times x + 1.5g \times 3 = 40g \times 1.5$   
 $4.5g \times x + 4.5g = 60g$   
 $4.5g \times x = 55.5g$   
 $x = \frac{55.5}{4.5} = 12.3 \text{ m}$



b)  $u = 20 \quad s = 30 \quad a = -3$   
 $v^2 = u^2 + 2as \Rightarrow v^2 = 400 + 2(-3)(30) \Rightarrow v = 14.8 \text{ ms}^{-1}$

c)  $0.3 \left( \frac{m}{s} \right) \rightarrow 0 \quad R \uparrow = ma \Rightarrow 0 - 0.3 = m \times -3$   
 $-0.3 = -3m \Rightarrow m = 0.1 \text{ kg}$

d) momentum before =  $0.1 \times 14.8 = 1.48$   
Impulse = change in momentum =  $2.4$   
momentum after =  $1.48 - 2.4 = -0.92$

$-0.92 = mv \Rightarrow v = \frac{-0.92}{0.1} = -9.2 \quad \leftarrow 9.2 \text{ ms}^{-1}$

$0 \left( \frac{m}{s} \right) \rightarrow 0.3 \quad R \uparrow = 0 - 0.3 = 0.1a \quad a = \frac{-0.3}{0.1} = -3 \text{ ms}^{-1}$   
as expected

$\bar{u} = 9.2 \quad \bar{a} = -3 \quad \bar{v} = 0$

$v = u + at \Rightarrow 0 = 9.2 - 3t \quad t = \frac{9.2}{3} = 3.06 \text{ sec}$

7)  $Vel = \frac{\text{change in pos}}{\text{time}} = \frac{9i + 24j}{3} = 3i + 8j \text{ kmh}^{-1}$

b)  $p = (20i + 10j) + t(3i + 8j) = (20 + 3t)i + (10 + 8t)j$

$q = (14i - 6j) + t(0i + 12j) = 14i + (-6 + 12t)j$

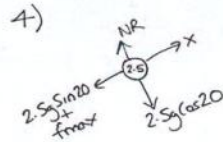
c)  $d = (14 - (20 + 3t))i + ((-6 + 12t) - (10 + 8t))j$

$d = (-6 - 3t)i + (-16 + 4t)j$

$d^2 = (-6 - 3t)^2 + (-16 + 4t)^2 = (36 + 36t + 9t^2) + (256 - 128t + 16t^2)$

$d^2 = 292 - 92t + 25t^2$

d)  $225 = 292 - 92t + 25t^2 \Rightarrow (t - 1)(25t - 67) = 0 \quad t = 2.68$

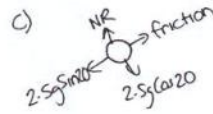


a)  $R \uparrow = 0 \quad NR = 2.5g \cos 20 = 23$

b)  $R \uparrow = 0 \quad X = 2.5g \sin 20 + f_{\text{max}}$

$f_{\text{max}} = \mu NR = 0.4 \times 23 = 9.21$

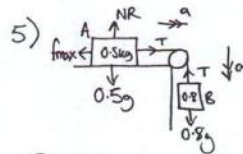
$X = 8.38 + 9.21 = 17.59 \text{ N}$



$f_{\text{max}} = 9.21$

$\leftarrow 2.5g \sin 20 = 8.38$

$\Rightarrow$  friction =  $8.38$  as this is less than  $9.21 \text{ N}$



$u = 0 \quad s = 0.4 \quad t = 0.5$

$s = ut + \frac{1}{2}at^2 \Rightarrow 0.4 = \frac{1}{2}a(0.5)^2$

$a = 3.2 \text{ ms}^{-2}$

(B)  $R \uparrow = ma \Rightarrow 0.8g - T = 0.8 \times 3.2 \Rightarrow T = 5.28 \text{ N}$

(A)  $R \uparrow = ma \Rightarrow T - f_{\text{max}} = 0.5 \times 3.2 \Rightarrow f_{\text{max}} = 5.28 - 1$   
 $f_{\text{max}} = 3.68 \text{ N}$

$R \uparrow = 0 \Rightarrow NR = 4.9 \text{ N} \quad f_{\text{max}} = \mu NR \Rightarrow \mu = \frac{3.68}{4.9} = 0.75$

d) Inextensible  $\Rightarrow$  same acceleration for A and B.

6)  $u = 20 \quad v = 16 \quad s = 24$

$v^2 = u^2 + 2as \Rightarrow 16^2 = 20^2 + 2a(24) \Rightarrow 48a = -144$

$a = -3$

dec =  $3 \text{ ms}^{-2}$