07 May 2011
22:27

M1 JAN02 (1)

1) (0.3) ↓8 (0.3) ↑6 (=-6)
Mom before = 0.3×8 = 2.4 Ns
Mom after = 0.3×-6 = -1.8 Ns
Impulse = 4.2 Ns

2) 1800 (4) 1200 (0) → 3000 (v)

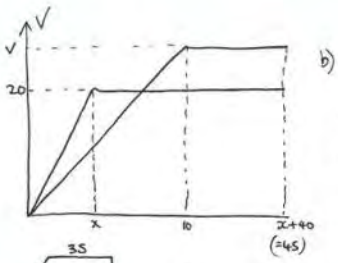
Total mom before = 1800×4 = 7200 Ns
Total mom after = 3000v

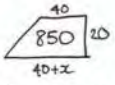
7200 = 3000v ⇒ v = 2.4 ms⁻¹

b) Momentum before R = 7200 Ns ⇒ Impulse = 7200
Momentum after R = 0
Impulse = force × time 7200 = Res × 8
Res = 900 N

3) u=12 v=60 t=4
v=u+at ⇒ 60=12+4a ⇒ 4a=48 ⇒ a=12 ms⁻²
b) $S=\frac{(u+v)t}{2} \Rightarrow S=\frac{72\times4}{2}=144$ m
c) u=12 S=72 a=12
$v^2=u^2+2as \Rightarrow v^2=144+24\times72 \Rightarrow v=43.3$ ms⁻¹

(2)

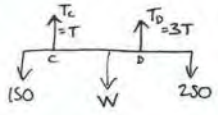
4) 

b) 

$\frac{(40+(40+x))}{2}\times20=850$
$(80+x)10=850$
$80+x=85$
x = 5 sec

c) 

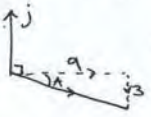
$\frac{(35+45)}{2}\times v=850$
80v = 1700 ⇒ v = 21.25 ms⁻¹

5) 

Rf ↑=0 ⇒ 4T = 400+W
A↻ W×5+250×10 = T×1+3T×4
5W+2500 = 22T
W = 4T−400 ⇒ 5W = 20T−2000
⇒ 20T−2000+2500 = 22T
2T = 500 ⇒ T = 250 N
c) W = 4(250)−400 = 600 N
d) weight acts at the middle of the girder.

(3)

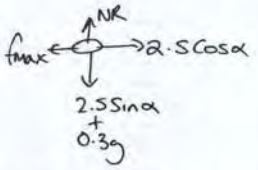
6) Rf = (6i+2j)+(3i−5j) = 9i−3j N

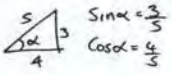
b) 

angle = 90+A
$=90+\tan^{-1}(\frac{3}{9})$
= 108°

c) acc = $\frac{\text{change in vel}}{\text{time}}$ ⇒ Rf = ma.
(9i−3j) = 3a a = 3i−j ms⁻²

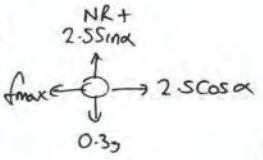
d) Vel = (Initial vel)+t(acc)
Vel = (−2i+j)+2(3i−j) = 4i−j ms⁻¹
$=\sqrt{4^2+1^2}=4.12$ ms⁻¹

7) 

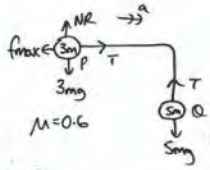
$\tan\alpha=\frac{3}{4}$


$\sin\alpha=\frac{3}{5}$
$\cos\alpha=\frac{4}{5}$
NR = 2.5×3/5 + 0.3g = 4.44 N
fmax = μNR ⇒ fmax = 4.44μ.
$\overrightarrow{Rf}=0 \Rightarrow 2.5\times\frac{4}{5}=f_{max} \Rightarrow f_{max}=2$
$=\mu=\frac{2}{4.44}=0.45$

(4)

b) 

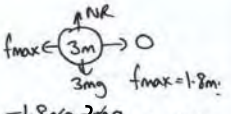
NR = 0.3g − 2.5×3/5
NR = 1.44
fmax = μNR = 0.6 SN
2.5 Cosα = 2.5×4/5 = 2 N
So the ring will move since $\overrightarrow{Rf}$ = 1.3 SN

8) 

(P) T − fmax = 3ma
(Q) 5mg − T = 5ma +
5mg − fmax = 8ma.
5mg − 1.8mg = 8ma
3.2g = 8a
$a=\frac{3.2}{8}g=\frac{2}{5}g$ m

(P) NR = 3mg
fmax = μNR = 1.8mg
c) T = 3ma + fmax
$T=3m\times\frac{2}{5}g+1.8mg=3mg$ N

d) u↓=0 $v^2=u^2+2as$
a↓=2/5 g $v^2=\frac{4}{5}gh$
s = h $v=\sqrt{\frac{4}{5}gh}$ ms⁻¹



−1.8×g = 3ma a = −0.6g

$u=\sqrt{\frac{4}{5}gh}$ v=0 a = −0.6g
$V^2=u^2+2as \Rightarrow 0=\frac{4}{5}gh-1.2gs$ $S=\frac{\frac{4}{5}gh}{1.2g}=\frac{2h}{3}$