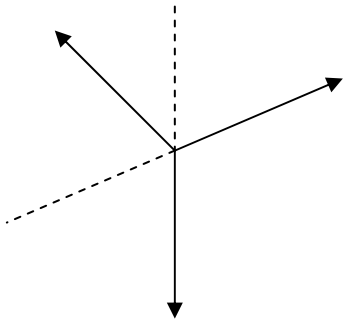
MATHEMATICS M1

1.(a) Using $v^2 = u^2 + 2as$ with $v = 0$, $u = 10.5$, $a = (-)9.8$ M1
$0 = 10.5^2 - 2 \times 9.8s$ A1
$s =$ <u>5.625 m</u> A1

1.(b) Using $s = ut + 0.5at^2$ with $t = 5$, $u = 10.5$, $a = (-)9.8$ M1
$s = 10.5 \times 5 - 0.5 \times 9.8 \times 5^2$ A1
$s = -70$ A1
Height of cliff is <u>70m</u>

2.(a) $T =$ <u>30g</u> = (<u>294 N</u>) B1

2.(b)



B1

2.(c) Resolve 'horizontally' to obtain equation M1
$T_1 \sin 45^\circ = T_2 \sin 60^\circ$ A1 B1

$$\frac{T_1}{\sqrt{2}} = T_2 \sqrt{\frac{3}{2}}$$

Resolve 'vertically' to obtain equation M1
$T_1 \cos 45^\circ + T_2 \cos 60^\circ = 294$ A1

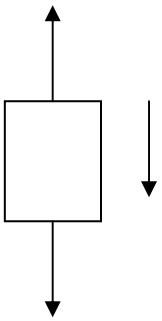
$$T_2 \sqrt{\frac{3}{2}} \frac{1}{\sqrt{2}} + \frac{1}{2} T_2 = 294$$ m1

$(1 + \sqrt{3})\ T_2 = 294 \times 2$

$T_2 = 215.223 = 215\,\text{N}$ cao A1

$T_1 = 215.223 \times \sqrt{\frac{3}{2}} = 264\,\text{N}$ cao A1

3.(a)



N2L $5600g - T = 5600a$ dim. correct M1

$a = \dfrac{5600 \times 9.8 - 50400}{5600}$ A1

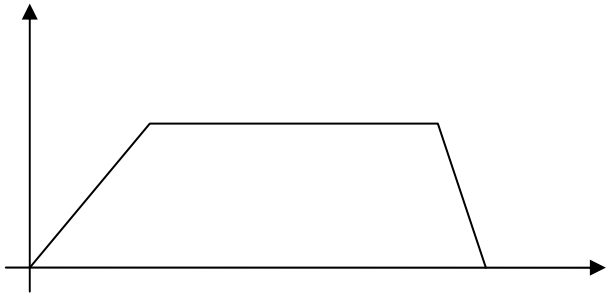
$a = 0.8 \text{ms}^{-2}$

3.(b) Using $V = u + at$ with $u = 0$, $a = 0.8$, $t = 8$ M1

$V = 0.8 \times 8$

$V = 6.4 \text{ ms}^{-1}$ A1

3.(c)



M1 A1 A1

3.(d) Distance S = area under graph M1

$S = 0.5(25 + 40) \times 6.4$ any correct area B1

$S = \underline{208 \text{ m}}$ A1

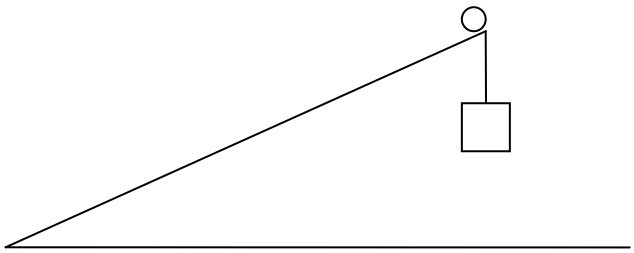
3.(e)

We require $a = -\dfrac{6.4}{(40 - 8 - 25)} = -\dfrac{6.4}{7}$ B1

Therefore Max $T = 5600\left(9.8 + \dfrac{6.4}{7}\right)$ M1

Max $T = \underline{60000 \text{ N}}$ A1

4.



N2L applied to B		M1
	$9g - T = 9a$	A1
N2L applied to A, weight resolved		M1
	$T - 5g \sin\alpha = 5a$	A1
Adding	$9g - 5 \times 0.21g = 14a$	m1
	$a = \dfrac{7.95 \times 9.8}{14} = \underline{5.565\,\text{ms}^{-2}}$	A1
	$T = 9(9.8 - 5.565) = \underline{38.115\text{ N}}$	A1

5.(a) Using $v^2 = u^2 + 2as$ with $v = 0$, $u = 9$, $s = 75$ M1
$0 = 9^2 + 2 \times 75a$ A1
$a = \underline{-0.54\ \text{ms}^{-1}}$ A1

5.(b) Using $s = 0.5(u + v)t$ with $v = 0$, $u = 9$, $s = 75$ M1
$75 = 0.5(0 + 9)t$ A1
$t = 16\dfrac{2}{3}$ A1

5.(c) $R = 80g = (784\text{ N})$ B1
$F = 80 \times 0.54 = (43.2\text{ N})$ M1 A1
$\mu = \dfrac{F}{R} = \underline{0.055}$ (to 2 sig.figs.) M1 A1

6.

(a) $I = 2(6 + 4)$ M1
$I = \underline{20\ \text{Ns}}$ A1

(b) Conservation of momentum M1
$12 + 5u = -8 + 5v$ A1
$v - u = 4$
Restitution M1
$v + 4 = -0.75(u - 6)$ A1
$4v + 3u = 2$
Solving simultaneously m1
$4v - 4u = 16$
$4v + 3u = 2$
$7u = -14$
$u = \underline{-2\ \text{ms}^{-1}}$ cao A1
$v = \underline{2\ \text{ms}^{-1}}$ cao A1

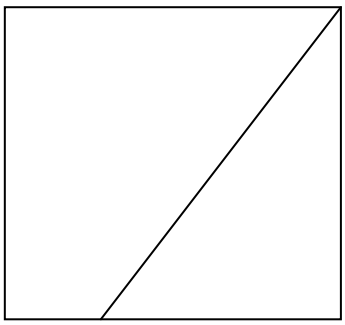
8.

(a) Moment about P all forces, dim cor eq. M1
$40g \times 0.8 + 70g \times 2.3 = R_Q \times 1.4$ A1 B1
$R_Q = \underline{1351\ \text{N}}$ A1

Resolve vertically $R_P + R_Q = 45g + 40g + 70g$ M1
$R_P = \underline{168\ \text{N}}$ A1

(b) If A leaves the bench, the bench would tip about Q as it cannot remain in equilibrium with B at end Y. This is because clockwise moment is greater then anti-clockwise moment.
B1 R1

8.



(a)

	Area	from AB(x)	from AE (y)	
$ABCD$	81	4.5	4.5	B1
CDE	27	$3 + 6 \times 2/3$	$9 \times 1/3$	B1
$ABCE$	54	$\bar{x}$	$\bar{y}$	

Moments about AB M1

$81 \times 4.5 = 27 \times 7 + 54\ \bar{x}$ ft c's values A1

$\bar{x} = \underline{3.25 \text{ cm}}$ cao A1

Moments about AE M1

$81 \times 4.5 = 27 \times 3 + 54\ \bar{y}$ ft c's values A1

$\bar{y} = \underline{5.25 \text{ cm}}$ cao A1

(b) $\theta = \tan^{-1}\left(\dfrac{9 - \bar{y}}{9 - \bar{x}}\right)$ correct triangle M1

$\theta = \tan^{-1}\left(\dfrac{15}{23}\right)$ ft x, y A1

$\theta = 33.1^{o}$ ft x, y A1