Advanced M1 Paper 1
Mark Scheme

Question	Answer	Marks
1	$(\uparrow)$, $T\cos 30 + F\cos 60 = 2g$ $(\rightarrow)$, $T\cos 60 - F\cos 30 = 0$ $F = g = 9.8$ $T = \sqrt{3}g = 17$ or 17.0 OR $(\uparrow)$, $F = 2g\cos 60$ $(\rightarrow)$, $T = 2g\cos 30$ $F = g = 9.8$ $T = \sqrt{3}g = 17$ or 17.0	M1 A1 M1 A1 M1 A1 M1 A1 M1 A1 M1 A1 M1 A1 M1 A1 **(8)**
2(a)	$(\uparrow)$ $R + 200\sin 15^o + T\sin 25^o = 20g$ $(\leftarrow)$ $200\cos 15^o - T\cos 25^o - F = 0$ $F = 0.3R$ Solving for T (192.31..) $T = 190$ or 192	M1 A2 M1 A2 B1 **DM1** A1 **(9)**
2(b)	The mass of the block is concentrated at a point. oe **N.B.** Must mention either mass or weight and 'acting at a point' or 'concentrated at a point'.	B1 **(1)**
3	$5mg - T = 5m\cdot\frac{1}{4}g$ $T = \frac{15}{4}mg$ $T - kmg = km\cdot\frac{1}{4}g$ $k = 3$ Distance of A above ground $s_1 = \frac{1}{2}\cdot\frac{1}{4}g\cdot 1.2^2 = 0.18g\ (\approx 1.764)$ Speed on reaching ground $v = \frac{1}{4}g\cdot 1.2 = 0.3g\ (\approx 2.94)$ For B under gravity $(0.3g)^2 = 2gs_2 \Rightarrow s_2 = \frac{(0.3)^2}{2}g\ (\approx 0.441)$ $S = 2s_1 + s_2 = 3.969 \approx 4.0$ (m)	M1 A1 A1 M1 A1 A1 M1 A1 M1 A1 M1 A1 A1 **(13)**

Question	Answer	Marks
4	$F = \mu R$ $R = 2g\cos\alpha$ $1.4^2 = 2\alpha \cdot 0.5 = \alpha = 1.96\ \text{ms}^{-2}$ $3g - T = 3\alpha$ or -3α $T = 23.5$ N or 24 N $T - 2g\sin\alpha - F = 2\alpha$ or -2α $\mu = 0.5$	B1 M1 A1 M1 A1 M1 A1 A1 M1 A1 A1 **DM1** A1 **(13)**
5(a)	$(\downarrow) 0.4g - T = 0.4a$ $(\uparrow) T - 0.3g = 0.3a$ solving for a $a = 1.4\ \text{ms}^{-2}$, $g/7$ $(\uparrow) v = u + at$ $v = 0.5$ x 1.4 $= 0.7$ $(\uparrow) s = ut + \frac{1}{2}at^2$ $s = 0.5$ x 1.4 x 0.5^2 $= 0.175$ $(\downarrow) s = ut + \frac{1}{2}at^2$ $1.175 = -0.7t + 4.9t^2$ $4.9t^2 - 0.7t - 1.175 = 0$ $t = \dfrac{0.7 \pm \sqrt{0.7^2 + 19.6 \text{ x } 1.175}}{9.8}$ $= 0.5663..$or $-...$ $0.5 + 0.566 = 1.066$ Ans 1.07 s	M1 A1 M1 A1 **DM1** A1 M1 A1 ft on a M1 A1 ft on a **DM1** A1 ft **DM1** A1 cao A1 cao **(15)**
5(b)	Tension is the same on **either side of the pulley**, tension across the pulley is the same. B0 for tension is same for A and B or is the same for both strings etc B1 for any equivalent statement. B0 for incorrect extras.	B1 **(1)**

Question	Answer	Marks
6	$R = 4g\cos\alpha$	M1 A1
	$T - 0.5g = 0.5a$	M1 A1
	$4g\sin\alpha - T - F = 4a$	M1 A1
	(OR: $4g\sin\alpha - F - 0.5g = 4.5a$)	
	$F = \frac{1}{2}R$; $\sin\alpha = \frac{4}{5}$ or $\cos\alpha = \frac{3}{5}$	B1; B1
	Eliminating a or finding a	M1
	Solving for T (must have had an a)	M1
	$T = \frac{2g}{3}$ N or 6.5N or 6.53N	A1
	Magnitude $= 2T\cos\left(\frac{90-\alpha}{2}\right)$	M1 A1
	$= 2 \text{ x } \frac{2g}{3} \text{ x } \frac{3}{\sqrt{10}}$ (0.94868..)	**A1 ft on *T***
	$= 12\text{N}$ or 12.4N $\left(\frac{4g}{\sqrt{10}}\right)$	A1
		(15)