

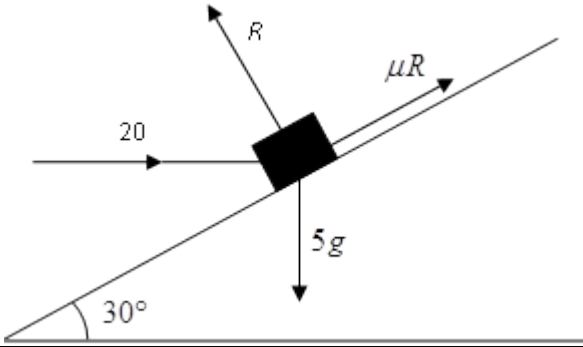
A level Mathematics Practice Paper – Statics of a particle – Mark scheme

Question	Scheme	Marks
1(a)	Resolving horizontally: $5 = T \cos 65^\circ$	M1A1
	$T = 12, 11.8, \text{ or better (N)}$	A1
		(3)
1(b)	Resolving vertically: $W = T \cos 25^\circ$	M1A1
	$= 11.8 \cos 25^\circ = 11, 10.7 \text{ or better (N)}$	A1
		(3)
		(6 marks)
2(a)	Resolving horizontally: $T \cos 30^\circ = 6 \cos 50^\circ$	M1A1
	$T = 4.45 \text{ (N)}, 4.5 \text{ (N)}, \text{ or better}$	A1
		(3)
2(b)	Resolving vertically: $W = 6 \cos 40^\circ + T \cos 60^\circ$	M1A1
	$= 6.82 \text{ (N)}, 6.8 \text{ (N)}, \text{ or better}$	A1
		(3)
		(6 marks)
3		
	Resolve horizontally: $T_A \cos 35^\circ = T_B \cos 25^\circ$	M1A1
	Resolve vertically: $T_A \sin 35^\circ + T_B \sin 25^\circ = 8$	M1A1
	Equation in one unknown: $T_B \frac{\cos 25^\circ}{\cos 35^\circ} \sin 35^\circ + T_B \sin 25^\circ = 8$	DM1A1
	or $T_A \sin 35^\circ + T_A \frac{\cos 35^\circ}{\cos 25^\circ} \sin 25^\circ = 8$	
	$T_A = 8.4, 8.37, 8.372 \text{ (N) or better}$	A1
	$T_B = 7.6, 7.57, 7.567 \text{ (N) or better}$	A1
		(8 marks)

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Question	Scheme	Marks
4(a)		
	$\uparrow \quad 2X + X = 4.5g$	M1 A1
	<p align="center">Leading to $X = \frac{3g}{2}$ or 14.7 or 15 (N)</p>	A1
		(3)
4(b)	$M(A) \quad 4.5g \times AG = (2X) \times 0.8 + X \times 2.4$	M1 A2 ft (1,0)
	$AG = \frac{4}{3} \text{ (m)}, 1.3, 1.33, \dots$	A1
		(4)
		(7 marks)
5	$T \cos \alpha - F = 2g \cos 60^\circ$	M1 A1
	$T \sin \alpha + R = 2g \cos 30^\circ$	M1 A1
	$F = \frac{1}{3}R$	B1
	<p>eliminating F and R</p>	DM1
	$T = g\left(1 + \frac{1}{\sqrt{3}}\right), 1.6g \text{ (or better), } 15.5, 15 \text{ (N)}$	DM1 A1
		(8)

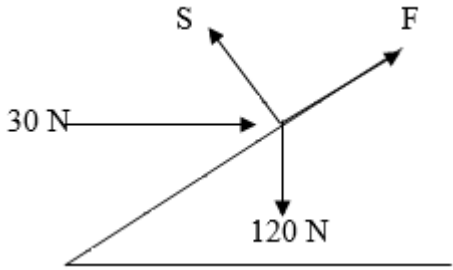
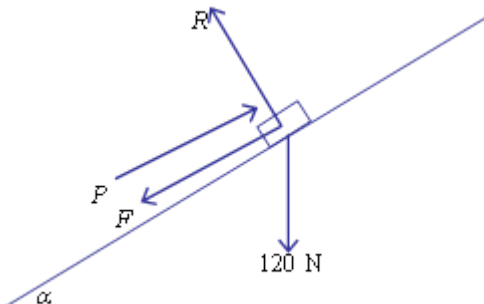
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Question	Scheme	Marks
<p>6(a)</p>		
	<p>⊥ plane $R = 20 \cos 60^\circ + 5g \cos 30^\circ$</p> <p align="center">$= 52.4 \text{ (N) or } 52$</p>	<p>M1 A2(1,0)</p> <p align="center">A1</p>
		(4)
<p>6(b)</p>	<p align="center">$F_r = \mu R$</p> <p> plane $F + 20 \cos 30^\circ = 5g \cos 60^\circ$</p> <p align="center">Leading to $\mu = 0.137 \text{ or } 0.14$</p>	<p align="center">B1</p> <p>M1 A2(1, 0)</p> <p align="center">A1</p>
		(5)
		(9 marks)
<p>7</p>	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">↖</div> <input style="width: 150px; height: 20px;" type="text"/> </div> <div style="margin-top: 5px;"> <input style="width: 150px; height: 20px;" type="text"/> </div> <div style="margin-top: 5px;"> <input style="width: 150px; height: 20px;" type="text"/> </div> <div style="margin-top: 5px;"> <input style="width: 150px; height: 20px;" type="text"/> </div> <div style="margin-top: 5px;"> <input style="width: 150px; height: 20px;" type="text"/> </div> <div style="margin-top: 5px;"> <input style="width: 150px; height: 20px;" type="text"/> </div> <p align="center">GIVEN ANSWER</p> <div style="margin-top: 5px;"> <input style="width: 150px; height: 20px;" type="text"/> </div> <p>OR</p> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">→</div> <input style="width: 150px; height: 20px;" type="text"/> </div> <div style="margin-top: 5px;"> <input style="width: 150px; height: 20px;" type="text"/> </div> <div style="margin-top: 5px;"> <input style="width: 150px; height: 20px;" type="text"/> </div> <div style="margin-top: 5px;"> <input style="width: 150px; height: 20px;" type="text"/> </div> <div style="margin-top: 5px;"> <input style="width: 150px; height: 20px;" type="text"/> </div> <div style="margin-top: 5px;"> <input style="width: 150px; height: 20px;" type="text"/> </div> <p align="center">GIVEN ANSWER</p> <div style="margin-top: 5px;"> <input style="width: 150px; height: 20px;" type="text"/> </div>	<p align="center">M1 A1</p> <p align="center">M1 A1</p> <p align="center">B1</p> <p align="center">B1</p> <p align="center">M1 A1</p> <p align="center">A1</p> <p align="center">OR</p> <p align="center">M1 A1</p> <p align="center">M1 A1</p> <p align="center">B1</p> <p align="center">B1</p> <p align="center">M1 A1</p> <p align="center">A1</p>
		(9 marks)

A level Mathematics Practice Paper – Statics of a particle – Mark scheme

Question	Scheme	Marks
8(a)	$7 + 5 + p = 0$ or $-9 + 6 + q = 0$	M1
	$p = -12$	A1
	$q = 3$	A1
		(3)
8(b)	$\mathbf{R} = 12\mathbf{i} - 3\mathbf{j}$	
	$ \mathbf{R} = \sqrt{(12^2 + (-3)^2)} = \sqrt{153}$ or $3\sqrt{17}$ or 12.4 or better (N)	M1 A1
		(2)
8(c)	$\tan \theta = \frac{3}{12}$	M1
	$\theta = 14.03^\circ \dots$	A1
	Angle with \mathbf{j} is 104° , to the nearest degree cao	A1
		(3)
		(8 marks)
9	$F = \mu R$ $(\nwarrow), R = 10 \sin \alpha + 5g \cos \alpha \quad (45.2)$ $(\nearrow), F = 5g \sin \alpha - 10 \cos \alpha \quad (21.4)$ $\mu = \frac{g \sin \alpha - 2 \cos \alpha}{2 \sin \alpha + g \cos \alpha} = 0.47 \text{ or } 0.473$	B1 M1 A2 M1 A2 M1 A1
		(9 marks)
10	μR $R = 2g \cos 20^\circ + 40 \cos 60^\circ$ $F = 40 \cos 30^\circ - 2g \cos 70^\circ$ $\mu = \frac{40 \cos 30^\circ - 2g \cos 70^\circ}{2g \cos 20^\circ + 40 \cos 60^\circ}$ $= 0.73 \text{ or } 0.727$	B1 M1 A2 M1 A2 M1 M1 A1
		(10 marks)

A level Mathematics Practice Paper – Statics of a particle – Mark scheme

Question	Scheme	Marks
11(a)		
	Resolving perpendicular to the plane:	
	<input type="text" value="The picture can't be displayed."/>	M1 A1 A1
	= 114 *	A1
		(4)
11(b)		
	<input type="text" value="The picture can't be displayed."/>	M1 A1
	<input type="text" value="The picture can't be displayed."/>	A1
	<input type="text" value="The picture can't be displayed."/>	M1
	Resolving parallel to the plane:	
	In equilibrium: <input type="text" value="The picture can't be displayed."/>	M1 A(2,1,0)
	= <input type="text" value="The picture can't be displayed."/>	A1
		(8)
11(c)	<input type="text" value="The picture can't be displayed."/> OR <input type="text" value="The picture can't be displayed."/>	M1 A1
	So <input type="text" value="The picture can't be displayed."/> acting up the plane.	A1
		(3)
		(15 marks)

A level Mathematics Practice Paper – Statics of a particle – Mark scheme

	Source paper	Question number	New spec references	Question description	New AOs
1	M1 2014R	1		Statics of a particle	1.1b, 3.1b
2	M1 2014	1		Statics of a particle	1.1b, 3.1b
3	M1 2013R	2		Statics of a particle	1.1b, 3.1b
4	M1 2012	2		Statics of a particle, Moments	1.1b, 2.2a, 3.1b
5	M1 2013	3		Statics of a particle	1.1b, 1.2, 3.1b, 3.4
6	M1 2012	3		Statics of a particle	1.1b, 1.2, 3.1b
7	M1 2011	3		Statics of a particle	1.1b, 1.2, 3.1b
8	M1 Jan 2012	3		Statics of a particle	1.1a, 1.1b, 3.1b
9	M1 2017	4		Statics of a particle	1.1b, 1.2, 2.2a, 3.1b
10	M1 2016	5		Statics of a particle	1.1b, 1.2, 2.2a, 3.1b
11	M1 Jan 2011	6		Statics of a particle	1.1b, 1.2, 2.2a, 3.1b