

Question		Answer	Marks	AO	Guidance	
11	(a)	$R_D \times k_1 \sin 50 = 0.5g \times k_2$ or $R_D \times k_1 \cos 50 = 0.5g \times k_2$ (see second guidance column)	M1	3.3	Attempt at moments about A – at least two terms (one term for the weight and one term with a component of R_D) – must be written as an equation to score any marks in this part (see Answer column for the only acceptable forms)	with $k_1, k_2 > 0$ but not = ± 1
		$6(R_D \sin 50) = \dots$	A1	1.1	Correct moment for the contact force at D	
		$\dots 3(0.5g \cos 50) - 1(0.5g \sin 50)$	A1	3.1b	Correct moment for the weight of the lamina (See Appendix) (e.g. $0.5g \times (3 - \tan 50) \cos 50$ or $0.5g \times \cos 50 \times 1.808\dots$ etc. e.g. $0.5g \times \sqrt{10} \sin(40 - \arctan(\frac{1}{3}))$ or $0.5g \times \sqrt{10} \sin(21.565\dots)$ etc.) – if value stated with no or unclear working, then must see at least 5.6953... to award this mark - if moment stated as 5.6993... then A0 (and A0 for the next mark)	For reference 5.695360...
		$R_D = \frac{1.5g \cos 50 - 0.5g \sin 50}{6 \sin 50} = 1.24 \text{ (N)}$	A1	2.2a	AG – as this answer is given then working must be checked carefully – all previous marks must have been awarded	1.23912743... A fully correct equation followed by stating 1.24 can score full marks
			[4]			

Question		Answer	Marks	AO	Guidance	
11	(b)	$R(\uparrow): R_A = 0.5g$ $R(\rightarrow): 1.24 = F_A$	B1*	3.3	Resolving horizontally and vertically (possibly implied by later working) – must be using given 1.24 (or a more accurate correct value) only (so not their incorrect value from part (a))	If taking moments about another point e.g. D , then the corresponding equation(s) must be correct Using the exact value or 1.24 for R_D leads to the same answer to 3 significant figures
		$1.24 = 0.5g\mu$	M1dep*	3.4	Use of $F = \mu R$ or $F \leq \mu R$ with 0.5g and 1.24 (or better) for F	
		$\mu = 0.253$	A1	2.2a	awrt 0.253 If final answer is $\mu \geq 0.253$ then A0	
			[3]			

Additional Guidance for 11(a)

There are many ways that candidates are correctly approaching this part:

For example,

$$6(R_D \sin 50) = 3(0.5g \cos 50) - (0.5g \sin 50)$$

$$6(R_D \sin 50) = 0.5g \times (3 - \tan 50) \cos 50$$

$$6(R_D \sin 50) = 0.5g \times \sqrt{10} \sin(40 - \arctan(\frac{1}{3}))$$

$$6(R_D \sin 50) = 0.5g \times \sqrt{10} \cos(140 - \arctan(3))$$

$$6(R_D \sin 50) = 0.5g \times \sqrt{10} \cos(50 + \arctan(\frac{1}{3}))$$

Any of these followed by the correct answer of 1.24 would score full marks (we do not need to see any intermediate working). **If these exact expressions are not seen then sufficient working with values that are correct to at least 3 significant figures should be awarded full marks (and those that have 2 significant figures with sufficient working should get partial credit), e.g.**

- $6(R_D \sin 50) = 9.448977... - 3.7536177...$ so seeing $6(R_D \sin 50) = 9.45 - 3.75$ followed by 1.24 is **M1 A1 A1 A1**
- $6(R_D \sin 50) = 9.4 - 3.8$ followed by 1.24 is **M1 A1 A1 A0** (leads to 1.22 not 1.24)
- $6(R_D \sin 50) = 5.7(0)$ is **no marks** (assume working backwards from the **AG** and no indication that the RHS contains a weight component)
- $6(R_D \sin 50) = 0.5g \times \cos 50 \times 1.808246...$ so seeing $6(R_D \sin 50) = 0.5g \times \cos 50 \times 1.81$ followed by 1.24 is **M1 A1 A1 A1**
- $6(R_D \sin 50) = 0.5g \times \cos 50 \times 1.80$ followed by 1.24 is **M1 A1 A1 A0** (leads to 1.23 not 1.24)
- $6(R_D \sin 50) = 0.5g \times 0.643 \times 1.81$ followed by 1.24 is **M1 A1 A1 A1**
- $6(R_D \sin 50) = 0.5g \times 0.64 \times 1.8$ followed by 1.24 is **M1 A1 A1 A0** (leads to 1.23 not 1.24)
- $6(R_D \sin 50) = 0.5g \times 1.16$ followed by 1.24 is **M1 A1 A0 A0** (assume working backwards from the given answer on the RHS)
- $6(R_D \sin 50) = 0.5g \times \sqrt{10} \sin(40 - 18.434948...)$ so seeing $6(R_D \sin 50) = 0.5g \times 3.16 \times \sin(21.6)$ followed by 1.24 is **M1 A1 A1 A1**
- $6(R_D \sin 50) = 0.5g \times 3.16 \times \sin(22)$ followed by 1.24 is **M1 A1 A1 A0** (leads to 1.26 not 1.24)
- $6(R_D \sin 50) = 0.5g \times 3.2 \times \sin(22)$ followed by 1.24 is **M1 A1 A1 A0** (leads to 1.28 not 1.24)
- $6(R_D \sin 50) = 0.5g \times \sqrt{10} \cos(68.4349...)$ so seeing $6(R_D \sin 50) = 0.5g \times \sqrt{10} \times \cos(68)$ followed by 1.24 is **M1 A1 A1 A0** (leads to 1.26 not 1.24)