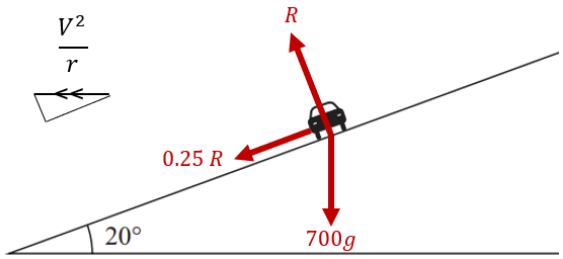
Question Number	Answer	Mark
1(a)		
	Form an equation in R only	M1
	$R\cos 20° = 700g + 0.25R\sin 20°$	A1 A1
	$(R =)\ 8030$ or $8000\ (N)$	A1
		(4)
1(b)	N2L horizontally	M1
	$\frac{700V^2}{60} = R\sin 20° + 0.25R\cos 20°$	A1 A1
	$(V =)\ 19.9$ or 20	A1
		(4)
		(8)
	Notes for Question 1	
	See note at end for marking parts (a) and (b) together. Penalise the use of $g = 9.81$ ms^{-2} once per question (first occurrence). Penalise over/under accuracy once per question (first occurrence).	
1(a)		
M1	Method to resolve vertically and form an equation in R only using $F = 0.25R$ All required terms present and no extras. Dimensionally correct. Condone sign errors and sin/cos confusion. Condone m if correctly replaced later. Alternative equations, must use $r = 60$: Perp to slope: $R - 700g\cos 20° = \frac{700V^2}{60}\sin 20°$ Parallel to slope: $0.25R + 700g\sin 20° = \frac{700V^2}{60}\cos 20°$	
A1	Unsimplified equation in R only with at most one error.	
A1	Correct unsimplified equation in R only.	
A1	3 sf or 2 sf only	
1(b)		
M1	Use equation for circular motion to form an equation in V and R only, using $r = 60$. All required terms present and no extras. Dimensionally correct. Only the relevant terms are resolved but condone sin/cos confusion. Condone sign errors.	
A1	Unsimplified equation in V and R with at most one error.	
A1	Correct unsimplified equation in V and R only.	
A1	3 sf or 2 sf	
	Note for marking (a) and (b) together.	

	M1A1A1: First relevant equation in V and R. Following rules as above for terms. (A1A0 for an equation with at most one error.) A1: correct R M1A1A1: Second relevant equation in V and R. Following rules as above for terms. (A1A0 for an equation with at most one error.) A1: correct V	

2. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

A particle is moving along the x-axis.

At time t seconds, $t \geqslant 0$

- the particle has velocity $v\,\text{m s}^{-1}$ in the positive x direction
- the particle has acceleration $\left(3 - \frac{8}{2t+3}\right)\text{m s}^{-2}$ in the positive x direction

When $t = 0$, the particle passes through the origin with velocity $2(\ln 3)\,\text{m s}^{-1}$ in the positive x direction.

(a) Use algebraic integration to show that $v = pt + q\ln(2t+3) + r\ln 3$, where p, q and r are constants to be found.

(4)

(b) Use algebraic integration to find the distance of the particle from the origin at time $t = 3$, giving your answer to 3 significant figures.

(4)