Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Mark Schemes
Q1.

Question Number	Answer	Additional guidance	Mark
(i)	a description to include: add weight / mass (1) to the weight hanger (1)	ignore references to friction here by inclining runway allow (component of) gravity to act on trolley	**(2)** AO 1 2

Question Number	Answer	Additional guidance	Mark
(ii)	a description to include: transfer mass (1) between trolley and hanger (1)	allow weight(s) for mass mass removed from trolley = mass added to hanger for 2 marks	**(2)** AO 1 2

Question Number	Answer	Additional guidance	Mark
(iii)	an explanation that links: raise one end of the runway (1) (so that) trolley (not attached to weight hanger) rolls at constant speed / just starts to move / (force of) gravity (on the trolley) balances forces of friction (1)	credit methods for reducing friction directly (e.g. oil wheels, runway etc.) to reduce (effects of) friction allow credit for identifying magnitude of frictional forces and subtracting or using graph	(2) AO 3 3b

Q2.

	Answer	Additional guidance	Mark
(i)	selection and substitution (1) (a =) $\frac{82 (- 0)}{36}$ evaluation (1) 2.3 (m/s^2)	**note: this is a "show that" question** accept any value that rounds to 2.3 (m/s^2) accept 2.2 (m/s^2) for 1 mark maximum answer of 2 (m/s^2) without a substitution scores 0 marks	(2) AO2

	Answer	Additional guidance	Mark
(ii)	substitution (1) $82^2 (- 0^2) = 2 \times 2.3 \times x$ rearrangement (1) $(x) = \frac{82^2 (- 0^2)}{2 \times 2.3}$ evaluation (1) 1500 (m)	allow substitution and rearrangement in either order accept 2, 2.2, 2.27, 2.3 for "a" throughout $(x) = \frac{v^2 (- u^2)}{2 \times a}$ ignore sign accept 1460 (m) allow answers in the ranges: 1460 (m) to 1481 (m) 1520 (m) to 1530 (m) 1680 (m) to 1700 (m) award full marks for correct answer without working	**(3)** **AO2**

	Answer	Additional guidance	Mark
(iii)	one statement from take off aborted (1) mechanical/engine failure (1) acceleration reduced (1) weather related reasons (1) larger mass / heavier plane / extra passengers (1) (longer runway required) for landing (1)	any other sensible suggestion	**(1)** **AO3**

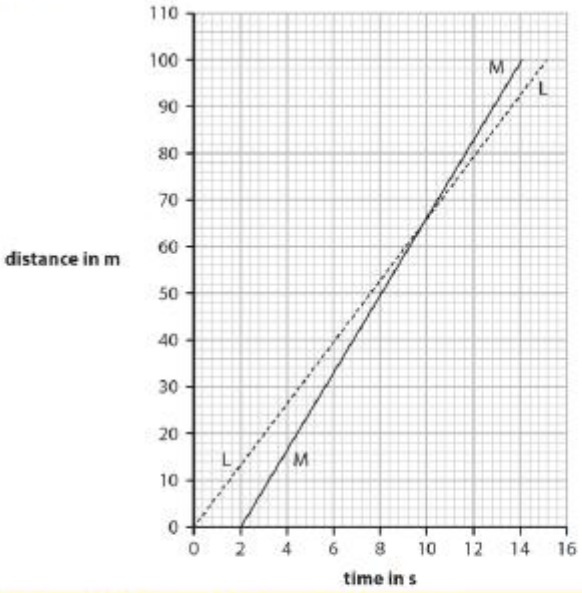
Q3.

Question Number	Answer	Additional guidance	Mark
(i)	single arrow towards centre of the circle applied to the object (1)	judge by eye	**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	an explanation including velocity is a vector (1) (because) direction changes (1)	velocity has (magnitude and) direction / velocity is speed in a (certain) direction	**(2)**

Q4.

Question number	Answer	Additional guidance	Mark
(i)	66 (m)	allow values between 64 and 68 inclusive	**1 AO3.2**
		allow values between 32 and 36 inclusive as the distance L has to run after M overtakes in this context	

Question number	Answer	Additional guidance	Mark
(ii)	select (1) $v = \frac{x}{t}$	allow any identifiable distance from graph divided by any identifiable time from graph e.g. $\frac{100}{15.2}$  	**2** **AO2.1**
	evaluation (1) 6.6 (m/s)	allow values that round to between 6.5 (m/s) and 6.7 (m/s) for example 6.666 (m/s) or 6.579 (m/s)	
		award full marks for correct answer without working	