

Cambridge International AS & A Level

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

MATHEMATICS

9709/43

Paper 4 Mechanics

May/June 2023

1 hour 15 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- Where a numerical value for the acceleration due to gravity (g) is needed, use 10 m s^{-2} .

INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

- Find the two possible values of the speed of P after the collision. [3]

Cambridge Math & Physics

cambridgeemp.com

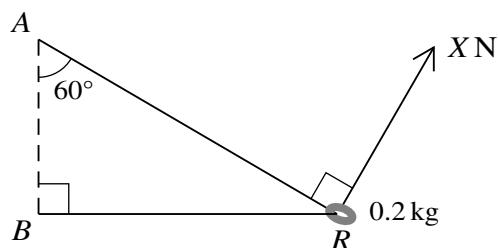
- 2 A car of mass 1500 kg is towing a trailer of mass m kg along a straight horizontal road. The car and the trailer are connected by a tow-bar which is horizontal, light and rigid. There is a resistance force of F N on the car and a resistance force of 200 N on the trailer. The driving force of the car's engine is 3200 N, the acceleration of the car is 1.25 ms^{-2} and the tension in the tow-bar is 300 N.

Find the value of m and the value of F .

[4]

Cambridge Math & Physics

cambridgeemp.com



Calculate the tension in the string and the value of X . [5]

Kambridge Math & Physics
kambridgemp.com

- 4** A lorry of mass $15\,000\text{ kg}$ moves on a straight horizontal road in the direction from A to B . It passes A and B with speeds 20 m s^{-1} and 25 m s^{-1} respectively. The power of the lorry's engine is constant and there is a constant resistance to motion of magnitude 6000 N . The acceleration of the lorry at B is 0.5 times the acceleration of the lorry at A .

- (a)** Show that the power of the lorry's engine is 200 kW , and hence find the acceleration of the lorry when it is travelling at 20 m s^{-1} . [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

The lorry begins to ascend a straight hill inclined at 1° to the horizontal. It is given that the power of the lorry's engine and the resistance force do not change.

- (b)** Find the steady speed up the hill that the lorry could maintain. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (a)** Show that $k = 0.1$. [3]

For $t > 9$, the velocity $v \text{ m s}^{-1}$ of the particle is given by $v = 0.2(t - 9)^2 + 1.8$.

- (b)** Show that the distance travelled in the first 9 seconds is one tenth of the distance travelled between $t = 9$ and $t = 18$. [4]

- (c) Find the greatest acceleration of the particle during the first 10 seconds of its motion. [3]

- 6** An elevator is pulled vertically upwards by a cable. The elevator accelerates at 0.4 m s^{-2} for 5 s, then travels at constant speed for 25 s. The elevator then decelerates at 0.2 m s^{-2} until it comes to rest.
- (a) Find the greatest speed of the elevator and hence draw a velocity-time graph for the motion of the elevator. [3]

.....

.....

.....

Kambridge Math & Physics
kambridgemp.com

- (b) Find the total distance travelled by the elevator. [2]

.....

.....

.....

.....

.....

.....

.....

The mass of the elevator is 1200 kg and there is a crate of mass m kg resting on the floor of the elevator.

- (c) Given that the tension in the cable when the elevator is decelerating is 12 250 N, find the value of m . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (d) Find the greatest magnitude of the force exerted on the crate by the floor of the elevator, and state its direction. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

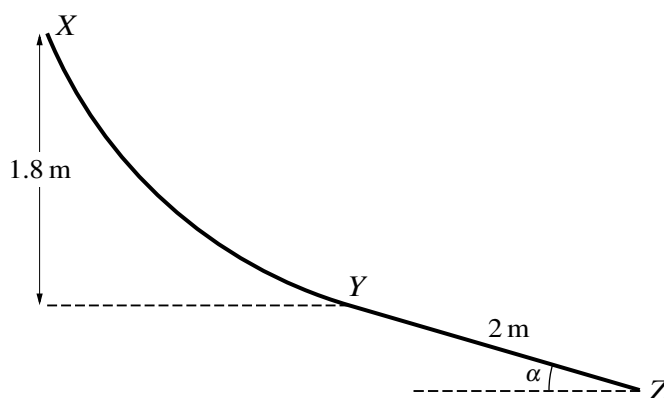
.....

.....

.....

.....

.....



The diagram shows the vertical cross-section XYZ of a rough slide. The section YZ is a straight line of length 2 m inclined at an angle of α to the horizontal, where $\sin \alpha = 0.28$. The section YZ is tangential to the curved section XY at Y , and X is 1.8 m above the level of Y . A child of mass 25 kg slides down the slide, starting from rest at X . The work done by the child against the resistance force in moving from X to Y is 50 J.

- (a) Find the speed of the child at Y . [4]

Cambridge Math & Science

- Kambridge Math & Physics
kbridgemp.com

Kambridge Math & Physics

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.