



# Cambridge International AS & A Level

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## MATHEMATICS

9709/43

Paper 4 Mechanics

May/June 2026

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. Do **not** use correction fluid or tape.
- 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  $10 \text{ m s}^{-2}$ .

### 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.



- 1 A particle is projected vertically upwards with speed  $u \text{ ms}^{-1}$  from a point on horizontal ground. The height of the particle above the ground after 4 seconds is equal to its height above the ground after 6 seconds.

(a) Find the value of  $u$ .

[2]

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(b) Find the greatest height of the particle above the ground.

[2]

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- 2 A particle  $P$  moves in a straight line. The velocity of  $P$  at time  $t$  s is  $v \text{ ms}^{-1}$ , where

$$v = 2t^2 - 6t - 3.$$

- (a) Find the time at which the acceleration of  $P$  is zero. [2]

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- (b) Given that  $P$  is not at rest in the interval  $0 \leq t \leq 3$ , find the distance travelled by  $P$  in this interval. [4]

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- 3 A block of mass  $m$  kg is pulled up a rough plane inclined at an angle of  $30^\circ$  to the horizontal by a constant force of magnitude 20 N. This force acts parallel to a line of greatest slope of the plane. The acceleration of the block is  $2 \text{ ms}^{-2}$ . The coefficient of friction between the block and the plane is 0.4.

Find the value of  $m$ .

[4]

[illegible]



- 4 A train is travelling along a straight track with constant acceleration  $a \text{ m s}^{-2}$ . It passes through points  $A$ ,  $B$  and  $C$  on the track in that order. The distances  $AB$  and  $BC$  are 280 m and 170 m respectively. The speed of the train at  $B$  is  $32 \text{ m s}^{-1}$ . The time it takes the train to travel from  $A$  to  $B$  is  $2t$  s and from  $B$  to  $C$  is  $t$  s.

Find the value of  $a$  and the value of  $t$ .

[5]





- 5 A lorry of mass 13 500 kg is towing a trailer of mass 2500 kg along a straight horizontal road. The lorry and the trailer are connected by a light rigid tow-bar which is parallel to the road.
- (a) At a particular instant, the power of the lorry's engine is 80 kW and the resistance forces on the lorry and trailer are 2400 N and 400 N respectively. At this instant, the speed of the lorry is  $25 \text{ m s}^{-1}$ .

Find the tension in the tow-bar.

[5]

[illegible]



The lorry and trailer now descend a straight hill inclined at an angle of  $5^\circ$  to the horizontal. As the lorry and trailer descend from a point  $A$  to a point  $B$  on the hill, the speed of the lorry increases from  $27 \text{ ms}^{-1}$  to  $30 \text{ ms}^{-1}$ . The lorry's engine is no longer working at  $80 \text{ kW}$  and instead the work done by the driving force of the lorry as it travels from  $A$  to  $B$  is  $55 \text{ kJ}$ . The resistance forces on the lorry and trailer are now  $2500 \text{ N}$  and  $500 \text{ N}$  respectively.

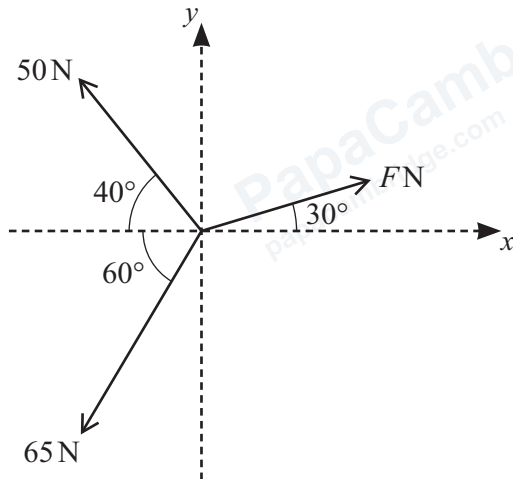
- (b) Find the distance  $AB$ .

[5]

[illegible]



6



Three coplanar forces of magnitudes  $F$  N, 65 N and 50 N act at a point in the directions shown in the diagram.

- (a)** It is initially given that  $F = 40$ .

Find the magnitude and direction of the resultant force.

[5]

[illegible]





- (b)** It is given instead that the value of  $F$  is such that the component of the resultant force in the  $y$ -direction is zero.

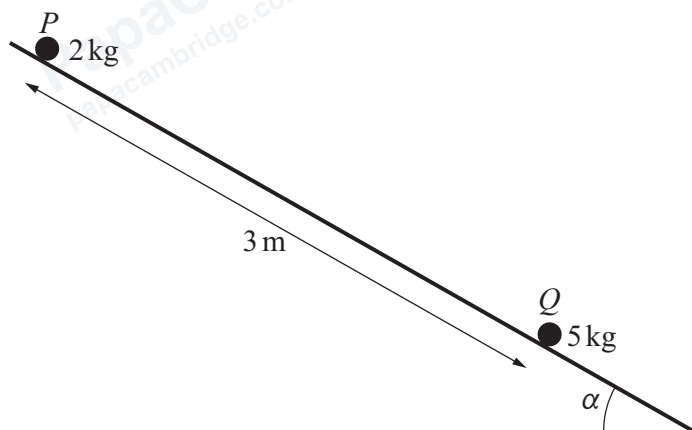
Find the magnitude and direction of the resultant force.

[3]

[illegible]



7



Particles  $P$  and  $Q$  have masses 2 kg and 5 kg respectively. The particles are initially held at rest 3 m apart on the same line of greatest slope of a rough plane. The plane is inclined at an angle  $\alpha$  to the horizontal, where  $\sin \alpha = 0.28$  (see diagram). The coefficient of friction between  $P$  and the plane and the coefficient of friction between  $Q$  and the plane are both 0.2.

Particle  $P$  is projected directly towards  $Q$  with speed  $8 \text{ ms}^{-1}$ . At the same instant,  $Q$  is projected directly towards  $P$  with speed  $u \text{ ms}^{-1}$ . The particles collide  $0.25 \text{ s}$  after they are projected.

- (a) Show that the acceleration of  $P$  is  $0.88 \text{ ms}^{-2}$ , and find the value of  $u$ . [8]

[illegible]



- (b) When the particles collide,  $P$  rebounds up the plane, and  $Q$  rebounds down the plane with speed  $0.5 \text{ ms}^{-1}$ .

Find the distance that  $P$  travels from the point of collision, until it comes to instantaneous rest. [5]





If you use the following page to complete the answer to any question, the question number must be clearly shown.

[illegible]

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