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CANDIDATE NAME

CENTRE NUMBER | | | | | |

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8720963317

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 $10\,\text{m}\,\text{s}^{-2}$.

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.

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1 A particle is projected vertically upwards with speed $u\,\text{m}\,\text{s}^{-1}$ 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]

(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 m s^{-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 $0 \leqslant t \leqslant 3$, 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° 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 $2\,\text{m}\,\text{s}^{-2}$. The coefficient of friction between the block and the plane is 0.4.

Find the value of m. [4]

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4 A train is travelling along a straight track with constant acceleration $a\,\text{m}\,\text{s}^{-2}$. 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 $32\,\text{m}\,\text{s}^{-1}$. 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]

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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 $25\,\text{m}\,\text{s}^{-1}$.

Find the tension in the tow-bar. [5]

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

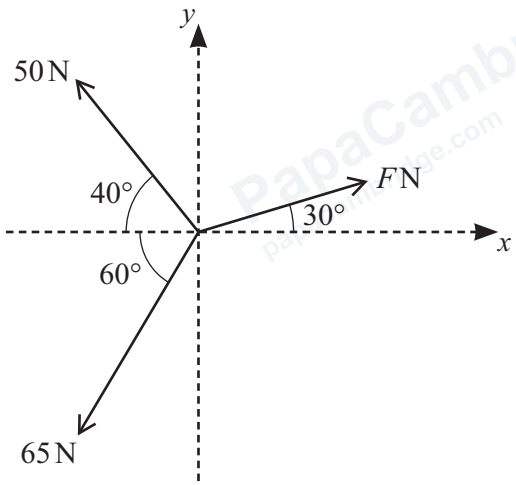
(b) Find the distance AB. [5]

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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]

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(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.

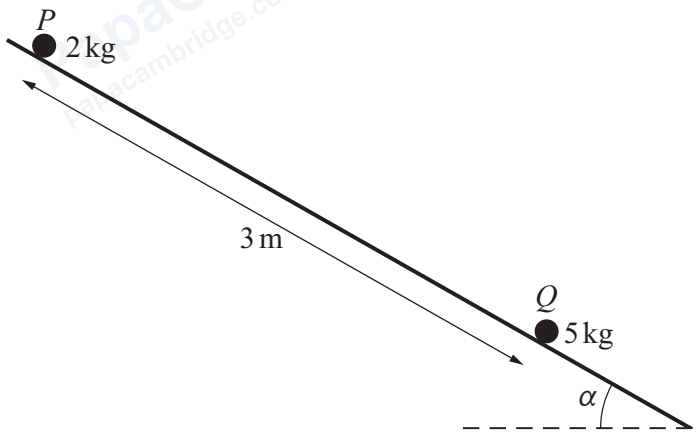
Find the magnitude and direction of the resultant force. [3]

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

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

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

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

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Additional page

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