



Cambridge International AS & A Level

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MATHEMATICS**9709/43**

Paper 4 Mechanics

October/November 2024**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 [].

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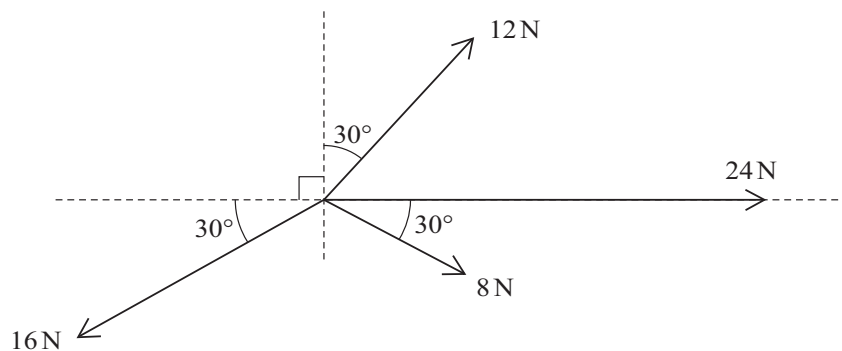


- 1 An athlete has mass m kg. The athlete runs along a horizontal road against a constant resistance force of magnitude 24 N. The total work done by the athlete in increasing his speed from 5 m s^{-1} to 6 m s^{-1} while running a distance of 50 metres is 1541 J.

Find the value of m .

[4]

[illegible]



Coplanar forces of magnitudes 16 N, 12 N, 24 N and 8 N act at a point in the directions shown in the diagram.

Find the magnitude and direction of the single additional force acting at the same point which will produce equilibrium. [6]

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- 3 A car of mass 1600 kg travels up a slope inclined at an angle of $\sin^{-1} 0.08$ to the horizontal. There is a constant resistance of magnitude 240 N acting on the car.

- (a) It is given that the car travels at a constant speed of 32 m s^{-1} .

Find the power of the engine of the car.

[3]

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- (b) Find the acceleration of the car when its speed is 24 m s^{-1} and the engine is working at 95% of the power found in (a). [3]

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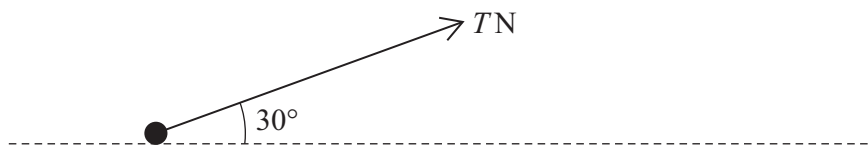
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A particle of mass 12 kg is going to be pulled across a rough horizontal plane by a light inextensible string. The string is at an angle of 30° above the plane and has tension $T\text{ N}$ (see diagram). The coefficient of friction between the particle and the plane is 0.5 .

- (a) Given that the particle is on the point of moving, find the value of T . [5]

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- (b) Given instead that the particle is accelerating at 0.2 m s^{-2} , find the value of T . [3]

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- 6 A particle moves in a straight line. It starts from rest, at time $t = 0$, and accelerates at $0.6t \text{ m s}^{-2}$ for 4 s, reaching a speed of $V \text{ m s}^{-1}$. The particle then travels at $V \text{ m s}^{-1}$ for 11 s, and finally slows down, with constant deceleration, stopping after a further 5 s.

(a) Show that $V = 4.8$. [1]

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(b) Sketch a velocity-time graph for the motion. [3]

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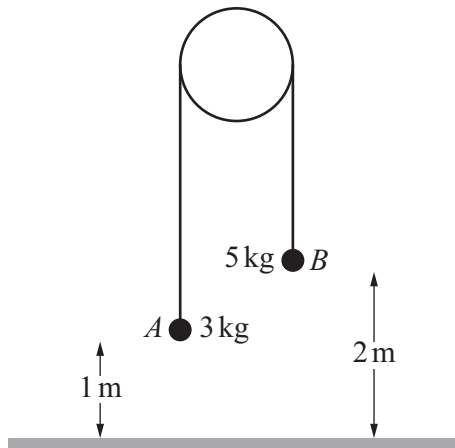


[2]

[illegible]

[4]

[illegible]



Two particles, A and B , of masses 3 kg and 5 kg respectively, are connected by a light inextensible string that passes over a fixed smooth pulley. The particles are held with the string taut and its straight parts vertical. Particle A is 1 m above a horizontal plane, and particle B is 2 m above the plane (see diagram).

The particles are released from rest. In the subsequent motion, A does not reach the pulley, and after B reaches the plane it remains in contact with the plane.

- (a) Find the tension in the string and the time taken for B to reach the plane. [6]

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(b) Find the time for which A is at least 3.25 m above the plane. [4]



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