

Candidate Name

Candidate Number

Centre Name

Centre Number


**Paper 2: Mechanics**

For Examination June 2023

(1 hour and 15 minutes)

It is necessary to respond on the answer sheets provided alongside this question paper. Additionally, you must have a soft pencil (preferably of type B or HB), a clean eraser and a dark blue or black pen.

**Instructions**

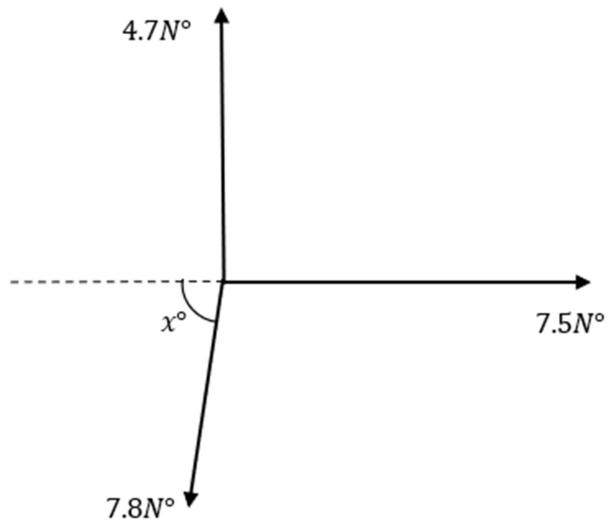
- Answer all questions
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the spaces at the top of the page
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks 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  $9.81\text{ms}^{-2}$ .

**Information**

The Total for this paper is **50**

The number of marks for each question or part question is shown in brackets [ ].

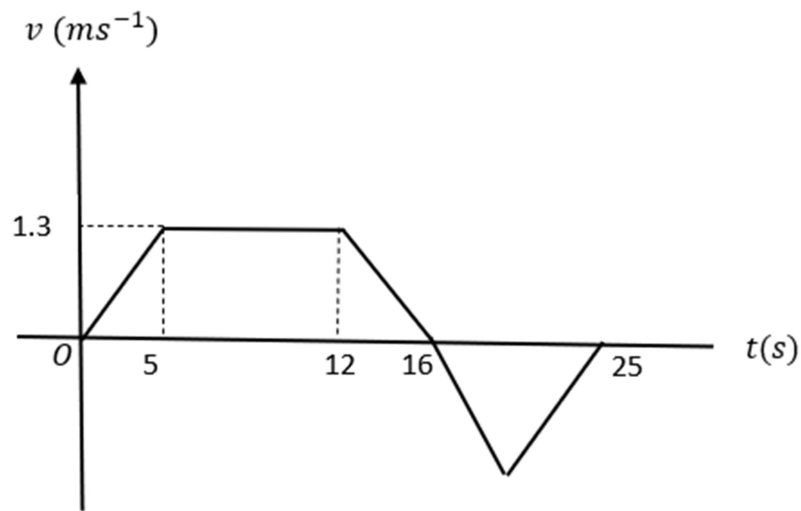
1.



The three coplanar forces shown in the diagram have magnitudes  $4.7\text{ N}$ ,  $7.5\text{ N}$  and  $7.8\text{ N}$ . The forces act at a point. Given that the resultant of the three forces is in the same direction as the force of magnitude  $7.5\text{ N}$ , find the value of  $x^\circ$  and the magnitude of the resultant. [4]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

2.



The diagram shows the velocity-time graph for the motion of a lawn mower. The mower moves forward for 16 s and returns to the start position after 9 s.

**(a)** Find the acceleration of the mower during the first 5 s of motion.

[1]

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**(b)** Find the distance the mower moves forward.

[2]

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**(c)** Find the greatest speed of the mower during the return to its starting position, giving your answer to three significant figures.  
[2]

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3. A car of mass  $4000\text{ kg}$  is travelling up a hill which is inclined at  $4^\circ$  to the horizontal. The power developed by the car's engine is constant, and there is a constant resistance to motion of  $1200\text{ N}$ .

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

**(b)** Find the steady speed at which the car moves up the hill if the power is  $300\text{ kW}$  and the resistance remains  $1200\text{ N}$ .

[2]

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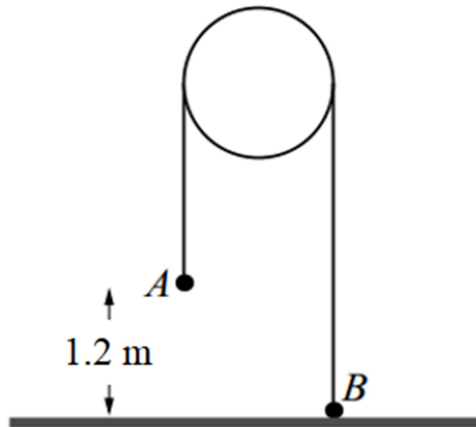
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4.



Particles  $A$  and  $B$ , of masses  $0.2\text{ kg}$  and  $0.1\text{ kg}$  respectively. Figure 1 shows  $A$  and  $B$  are attached to the ends of a light inextensible string which passes over a fixed smooth pulley. The system is at rest with  $B$  held on the horizontal floor, the string taut and its straight parts vertical.  $A$  is at a height of  $1.2\text{ m}$  above the floor.  $B$  is released and the system begins to move.  $B$  does not reach the pulley.

**(a)** Find the acceleration of the particles and the tension in the string before  $A$  reaches the floor.

[5]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[illegible]



[illegible]

6. A particle  $P$  moves in a straight line passing through a point  $O$ . At time  $t$  s, the velocity of  $P$  after leaving  $O$  is given by

$$v = 0.3t - 0.03t^2.$$

**(a)** Find the distance and acceleration of the particle when  $t = 3$ .

[4]

[illegible]

[illegible]

The diagram shows a mechanical system. A horizontal rod of length 2 m has a mass of 1.4 kg at its left end, labeled A. The right end of this rod is connected to a pivot point P. From point P, another rod of length 1 m is inclined downwards at an angle of 30° to the horizontal. A mass of 2.2 kg is attached to the inclined rod at a point B, which is 1 m from the pivot P. The inclined rod is supported by a vertical wall at its bottom end.

Find the total distance travelled by A.  
[9]

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[illegible]

**END**