EXAMINATION PRACTICE 1

CANDIDATE NAME	ENGLISH	CHINESE

Date | **Candidate No.**

MATHEMATICS **9709/04**
Paper 4 Mechanics

30 Minutes

You must answer on this question paper.

You will need: List of formulae (MF19)

READ THESE INSTRUCTIONS FIRST

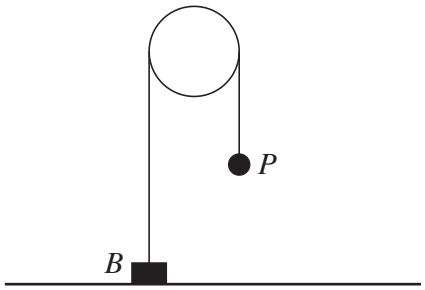
- Answer **all** questions.
- Write your name, date & class on all the work you hand in.
- Write in dark blue or black pen.
- You may use an HB pencil for any diagrams or graphs.
- Do not use staples, paper clips, glue, or correction fluid.
- Write your answer to each question in the space provided.
- 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.
- Where a numerical value for the acceleration due to gravity is needed, **use 10 m s^{-2}**.
- 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.

INFORMATION

- The total mark for this paper is **26**.
- The number of marks for each question or part question is shown in brackets [ ].

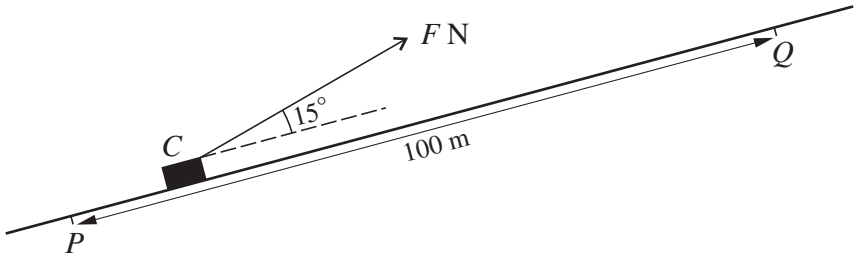
This document has **6** pages. Blank pages are indicated.

1



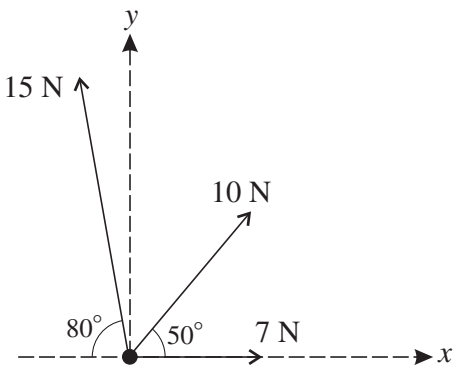
A block B of mass 5 kg is attached to one end of a light inextensible string. A particle P of mass 4 kg is attached to other end of the string. The string passes over a smooth pulley. The system is in equilibrium with the string taut and its straight parts vertical. B is at rest on the ground (see diagram). State the tension in the string and find the force exerted on B by the ground. [3]

2



A crate C is pulled at constant speed up a straight inclined path by a constant force of magnitude F N, acting upwards at an angle of 15° to the path. C passes through points P and Q which are 100 m apart (see diagram). As C travels from P to Q the work done against the resistance to C's motion is 900 J, and the gain in C's potential energy is 2100 J. Write down the work done by the pulling force as C travels from P to Q, and hence find the value of F. [3]

3



Forces of magnitudes 7 N, 10 N and 15 N act on a particle in the directions shown in the diagram.

(i) Find the component of the resultant of the three forces

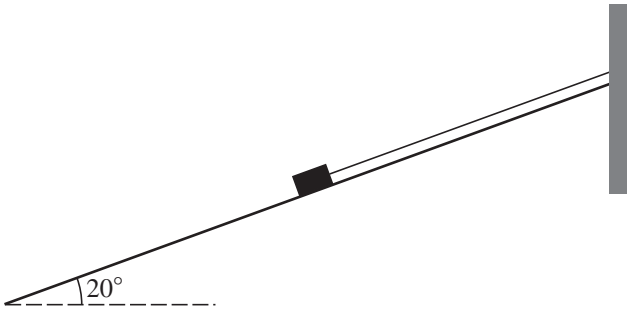
(a) in the x-direction,

(b) in the y-direction.

[3]

(ii) Hence find the direction of the resultant. [2]

4



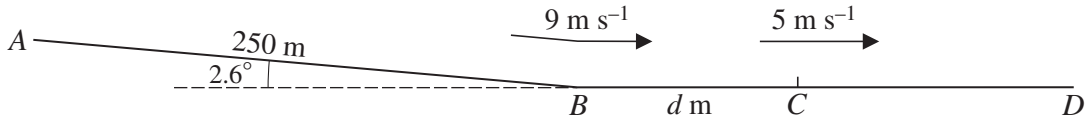
A block of mass 8 kg is at rest on a plane inclined at 20° to the horizontal. The block is connected to a vertical wall at the top of the plane by a string. The string is taut and parallel to a line of greatest slope of the plane (see diagram).

(i) Given that the tension in the string is 13 N, find the frictional and normal components of the force exerted on the block by the plane. [4]

The string is cut; the block remains at rest, but is on the point of slipping down the plane.

(ii) Find the coefficient of friction between the block and the plane. [2]

5



A cyclist and his machine have a total mass of 80 kg. The cyclist starts from rest at the top A of a straight path AB, and freewheels (moves without pedalling or braking) down the path to B. The path AB is inclined at 2.6° to the horizontal and is of length 250 m (see diagram).

(i) Given that the cyclist passes through B with speed $9\,\text{m s}^{-1}$, find the gain in kinetic energy and the loss in potential energy of the cyclist and his machine. Hence find the work done against the resistance to motion of the cyclist and his machine. [3]

The cyclist continues to freewheel along a horizontal straight path BD until he reaches the point C, where the distance BC is d m. His speed at C is $5\,\text{m s}^{-1}$. The resistance to motion is constant, and is the same on BD as on AB.

(ii) Find the value of d. [3]

The cyclist starts to pedal at C, generating 425 W of power.

(iii) Find the acceleration of the cyclist immediately after passing through C. [3]