

Paper Reference 8FM0–25
Pearson Edexcel
Level 3 GCE

Further Mathematics
Advanced Subsidiary
Further Mathematics options
25: Further Mechanics 1
(Part of options C, E, H and J)

Thursday 16 May 2019 – Afternoon

MATERIALS REQUIRED FOR EXAMINATION

**Mathematical Formulae and Statistical Tables (Green),
calculator**

ITEMS INCLUDED WITH QUESTION PAPERS

Answer Book

Q61869RA

Candidates may use any calculator allowed by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

INSTRUCTIONS

In the boxes on the Answer Book, write your name, centre number and candidate number.

Answer ALL questions and ensure that your answers to parts of questions are clearly labelled.

Answer the questions in the Answer Book – there may be more space than you need.

Do NOT write on the Question Paper.

You should show sufficient working to make your methods clear. Answers without working may not gain full credit.

Unless otherwise indicated, whenever a numerical value of g is required, take $g = 9.8 \text{ m s}^{-2}$ and give your answer to either 2 significant figures or 3 significant figures.

INFORMATION

A booklet ‘Mathematical Formulae and Statistical Tables’ is provided.

The total mark for this part of the examination is 40

There are 4 questions.

The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.

ADVICE

Read each question carefully before you start to answer it.

Try to answer every question.

Check your answers if you have time at the end.

1. A lorry of mass **16 000 kg** moves along a straight horizontal road.

The lorry moves at a constant speed of **25 m s^{-1}**

In an initial model for the motion of the lorry, the resistance to the motion of the lorry is modelled as having constant magnitude **16 000 newtons**.

- (a) Show that the engine of the lorry is working at a rate of **400 kW**
(4 marks)

(continued on the next page)

1. continued.

The model for the motion of the lorry along the same road is now refined so that when the speed of the lorry along the same road is $V \text{ m s}^{-1}$, the resistance to the motion of the lorry is modelled as having magnitude $640V$ newtons.

Assuming that the engine of the lorry is working at the same rate of 400 kW

- (b) use the refined model to find the speed of the lorry when it is accelerating at 2.1 m s^{-2}
(6 marks)

(Total for Question 1 is 10 marks)

2. Two particles, **A** and **B**, of masses $2m$ and $3m$ respectively, are moving on a smooth horizontal plane.

The particles are moving in opposite directions towards each other along the same straight line when they collide directly.

Immediately before the collision the speed of **A** is $2u$ and the speed of **B** is u

In the collision the impulse of **A** on **B** has magnitude $5mu$

- (a) Find the coefficient of restitution between **A** and **B**
(9 marks)
- (b) Find the total loss in kinetic energy due to the collision.
(4 marks)

(Total for Question 2 is 13 marks)

3. A particle, **P**, of mass **m kg** is projected with speed 5 m s^{-1} down a line of greatest slope of a rough plane.

The plane is inclined to the horizontal at an angle α , where $\sin \alpha = \frac{3}{5}$

The total resistance to the motion of **P** is a force of magnitude $\frac{1}{5} mg$

Use the work–energy principle to find the speed of **P** at the instant when it has moved a distance 8 metres down the plane from the point of projection.

(Total for Question 3 is 7 marks)

4. Three particles, **P**, **Q** and **R**, are at rest on a smooth horizontal plane.

The particles lie along a straight line with **Q** between **P** and **R**

The particles **Q** and **R** have masses m and km respectively, where k is a constant.

Particle **Q** is projected towards **R** with speed u and the particles collide directly.

The coefficient of restitution between each pair of particles is e

- (a) Find, in terms of e , the range of values of k for which there is a second collision.

(9 marks)

(continued on the next page)

4. continued.

Given that the mass of **P** is km and that there is a second collision,

(b) write down, in terms of **u**, **k** and **e**, the speed of **Q** after this second collision.

(1 mark)

(Total for Question 4 is 10 marks)

TOTAL FOR FURTHER MECHANICS 1 IS 40 MARKS

END OF PAPER
