CM

AS Level Maths Question Countdown

5 days until the 1st exam

Information

- Each of the ten sheets will contain five pure questions and two applied questions.

Pure questions

- Two of the pure questions will be 'standard'.
- Two of the pure questions will be 'problems'.
- The last pure question will involve modelling.

Applied questions

- One of the questions will focus on statistics.
- One of the questions will focus on mechanics.
- On alternate days, the statistics question will look at the large data set. Note that these questions may be brief as opposed to full length exam questions.

Notes to self

Pure questions – standard

1 The equation $mx^2 + (3 - m)x + 1 = 0$, $m \neq 0$, has equal roots.

Showing your working clearly, determine the possible values of m.

2 The curve C_1 has the equation $y = x^3 - 4x$.

The curve C_2 has the equation $y = -\frac{4}{x}$.

(a) Show that the x coordinates of the points of intersection of the two curves satisfy

$$x^4 - 4x^2 + 4 = 0$$

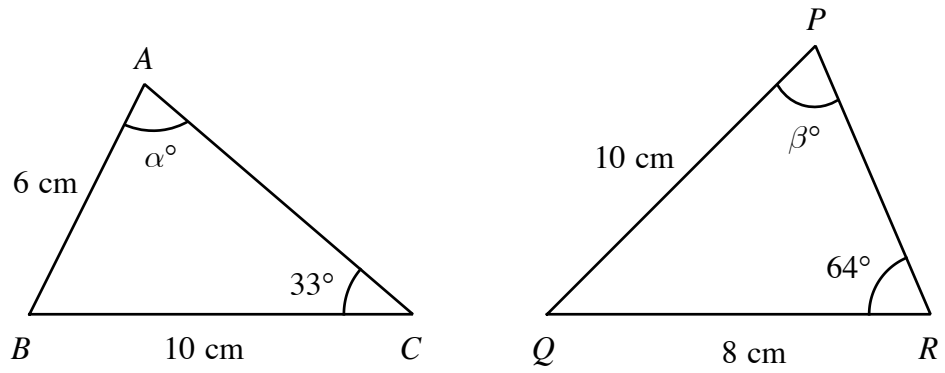
(b) Hence find the **exact** coordinates of intersection of the curves.

(c) On the same axes, sketch the curves C_1 and C_2.

On your sketch, show clearly the coordinates of any points where the curve crosses or meets the coordinate axes.

Pure questions – problems

3



Triangle ABC is such that $AB = 6$ cm, $BC = 10$ cm and the angle $ACB = 33^\circ$.
Angle $BAC = \alpha^\circ$.

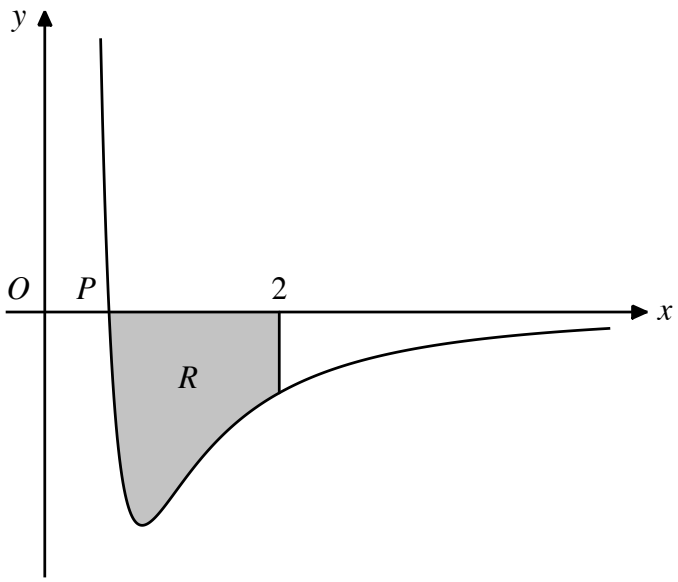
Triangle PQR is such that $PQ = 10$ cm, $QR = 8$ cm and the angle $PRQ = 64^\circ$.
Angle $QPR = \beta^\circ$.

The diagram above shows possible sketches of the triangle ABC and the triangle PQR.

(a) Find the two possible values of α.

(b) Show that the there is only one possible value of β.

4



The diagram above shows a sketch of the curve C with equation $y = \mathrm{f}(x)$, where

$$\mathrm{f}(x) = \frac{3}{x^3} - \frac{6}{x^2}, \quad x > 0$$

The curve C crosses the x axis at the point P.

(a) Verify that the coordinates of P are $(0.5, 0)$.

The region R, shown shaded in the diagram, is bounded by C, the x axis and the line $x = 2$.

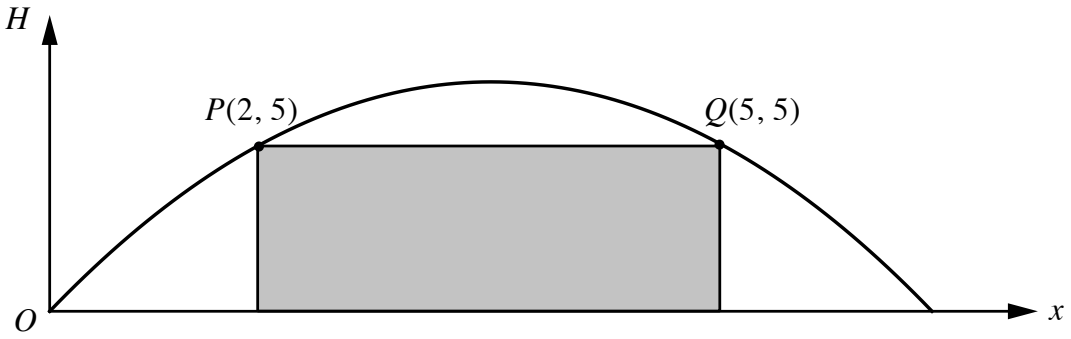
(b) Showing your working clearly, find the area of R.

(c) Using your working in part (b), or otherwise, evaluate

(i) $\displaystyle\int_{0.5}^{2} 3\mathrm{f}(x)\,\mathrm{d}x$ (ii) $\displaystyle\int_{1.5}^{3} \mathrm{f}(x-1)\,\mathrm{d}x$

Pure questions – modelling

5



A ball is kicked from a point O on a horizontal ground in such a way that it just clears a rectangular obstacle.

A model is created for how the height of the ball, H metres, varies with its horizontal displacement, x metres, from O.

In this model, the point O is taken to be the origin of a fixed coordinate system. The trajectory of the ball is then modelled to pass through the points $P(2, 5)$ and $Q(5, 5)$ which represent the corners of the obstacle.

The ball moves in a vertical plane.

The diagram above shows the trajectory of the ball as described by the model.

(a) Write down the height and length of the obstacle according to the model.

(b) Find a quadratic equation linking H and x that models this situation.

(c) Hence, find the greatest height reached by the ball above the ground.

(d) State **one** limitation of the model.

Applied questions – mechanics

6 A particle with mass 2 kg is in equilibrium the action of three forces in Newtons given by

$$\mathbf{F}_1 = 7\mathbf{i} + 2\mathbf{j} \qquad \mathbf{F}_2 = -5\mathbf{i} - 3\mathbf{j} \qquad \mathbf{F}_3 = a\mathbf{i} + b\mathbf{j}$$

(a) Find the values of a and b.

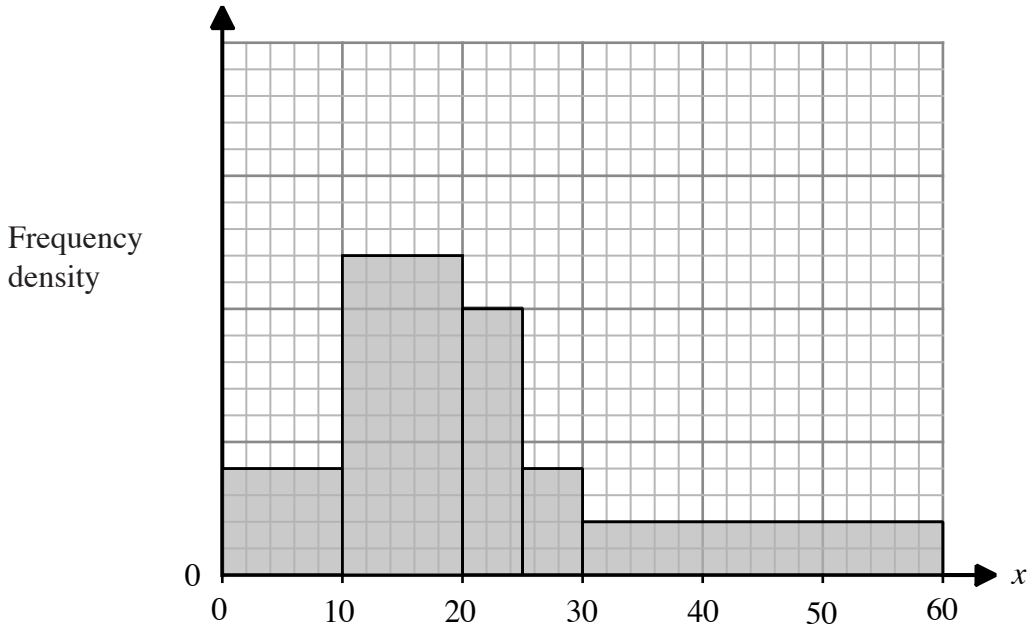
Another force given by $\mathbf{F}_4 = 2\mathbf{i} - 5\mathbf{j}$ is applied to the particle.

(b) Determine the magnitude and direction of the acceleration on the particle after $\mathbf{F}_4$ is applied.

Give your direction as a bearing.

Applied questions – statistics

7



Data is collected about a variable x and is summarised in a grouped frequency table.

The diagram above shows the histogram for the data.

(a) Use the histogram to complete the partially filled grouped frequency table below.

x	Frequency
0 – 10	20
10 – 20	
20 – 25	
25 – 30	10
30 – 60	

(b) Hence use linear interpolation to find the median of the data.