CM

AS Level Maths Question Countdown

2 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 Sketch the curve with equation $y = \dfrac{3}{x+1} - 2$. On your sketch, show clearly the coordinates of any points where the curve meets the coordinate axes **and** state the equations of any asymptotes.

2 The curve C has the equation $y = \mathrm{f}(x)$, where

$$\mathrm{f}'(x) = x + 7 - \frac{\sqrt{x} - 2x}{x}, \quad x > 0$$

The curve passes through the point $(4, 20)$.

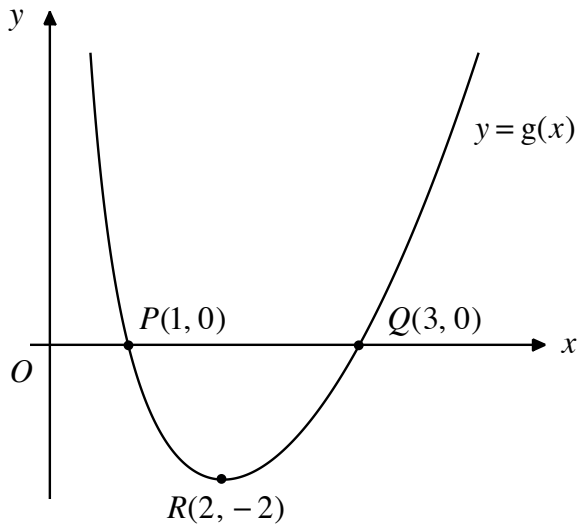
(a) Find y in terms of x, showing your method clearly.

The line l is tangent to C at the point P which has x coordinate 1.
The line l meets the y axis at the point Q.

(b) Find the exact distance PQ.

Pure questions – problems

3



The diagram above shows a sketch of the curve with equation $y = \mathrm{g}(x)$.

The curve meets the x axis at the points $P(1, 0)$ and $Q(3, 0)$.
The point $R(2, -2)$ is a turning point on the curve.
The y axis is an asymptote to the curve.

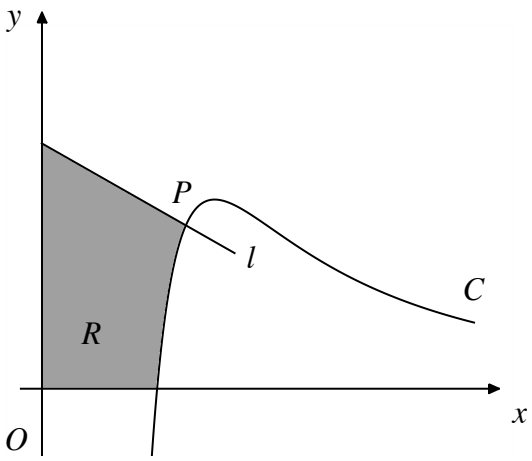
(a) State the roots of $\mathrm{g}(2x) = 0$.

(b) Write down the equation of the asymptote to curve $y = \mathrm{g}(x - 3)$.

(c) Write down the values of k for which the equation $4\,\mathrm{g}(x) = k$ has two real roots.

(d) Sketch the curve with equation $y = -\mathrm{g}'(x)$, showing clearly the coordinates of any intersections with the coordinate axes.

4



The diagram above shows a sketch of the curve C with equation $y = \frac{5}{x^2} - \frac{4}{x^3}, \quad x > 0$.

The point P has x coordinate 1 and lies on C.
The line l is normal to C at P.

The region R, shown shaded in the diagram, is bounded by C, the line l and the y axis.

Showing your method clearly, find the exact area of the shaded region R.

Pure questions – modelling

5 The height of water, H m, in a tank at time t s is modelled to vary according to

$$H = (2 - 0.008t)^2, \quad t \geqslant 0$$

(a) Write down the initial height of water in the tank according to the model.

(b) Find the rate of decrease of H when $t = 60$.

(c) Determine the time taken, in minutes, for the tank to empty.

(d) Hence write down the range of values of t for which the model is valid.

Applied questions – mechanics

6 A particle P moves in a straight line with a constant acceleration of a m s^{-2}. At time $t = 0$, the velocity of the particle is u m s^{-1} and the displacement of the particle is 0.

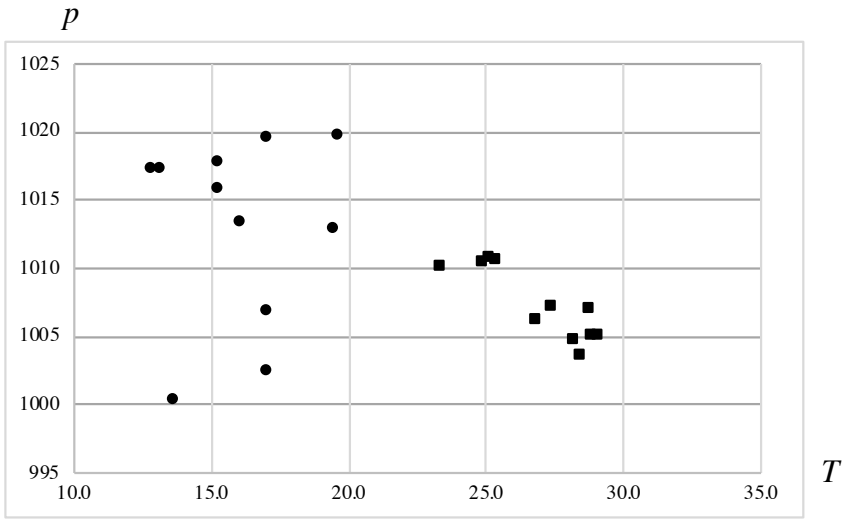
(a) Prove that the velocity, v m s^{-1}, of P at time t can be given by $v = u + at$.

(b) Prove that the displacement, s m, of P at time t can be given by $s = ut + 0.5at^2$.

(c) Using the results in parts (a) and (b), deduce that $v^2 - u^2 = 2as$.

Applied questions – statistics

7



Tanya is investigating the relationship between daily mean temperature, t °C, and pressure, p hPa. For her investigation, she uses two locations from the large data set and a simple random sample of 10 days. One of her locations is in the UK and the other location is overseas.

She obtains her data and plots it on a scatter graph. Her scatter graph is shown above. She uses circles to plot the data from one of her locations and squares to plot the data from the other location.

(a) (i) Using your knowledge of the large data set, suggest Tanya's overseas location.

(ii) Explain why it is not possible to suggest Tanya's UK location from the available data.

Tanya claims that "as temperature increases, the pressure lowers."

(b) (i) State one way in which Tanya's data provides evidence for her claim.

(ii) State one way in which Tanya's data provides evidence against her claim.

(c) Suggest how Tanya can make better use of the large data set to test her claim.