CM

AS Level Maths Question Countdown

7 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 curve C has equation $y = 2x^3 - x + 2$.

Prove, from first principles, that $\frac{dy}{dx} = 6x^2 - 1$.

2 Express $\frac{1+\sqrt{45}}{(1-\sqrt{5})^2}$ in the form $a + b\sqrt{5}$, where a and b are constants to be found.

Show your working clearly.

Pure questions – problems

3 For $0 \leqslant \theta \leqslant 360°$, solve the equation $8\sin x = 5\tan x$.

4 The line l_1 passes through the points $A(4, 6)$ and $B(-2, 8)$.

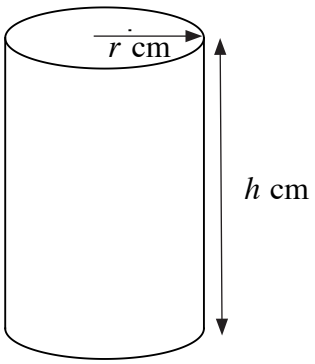
The line l_2 is perpendicular to l_1 and passes through the point $(1, 4)$.
The line l_2 meets the coordinate axes at the points P and Q.

Given that PQ is a diameter of the circle C, find the equation of the circle C.

Give your answer in the form $(x - a)^2 + (y - b)^2 = k$, where a, b and k are constants to be found.

Pure questions – modelling

5



The diagram above shows a right circular cylinder with radius r cm and height h cm.

Given that the area of the cylinder is 120 cm^2,

(a) show that the volume, V cm^3, of the cylinder can be given by $V = 60r - \pi r^3$.

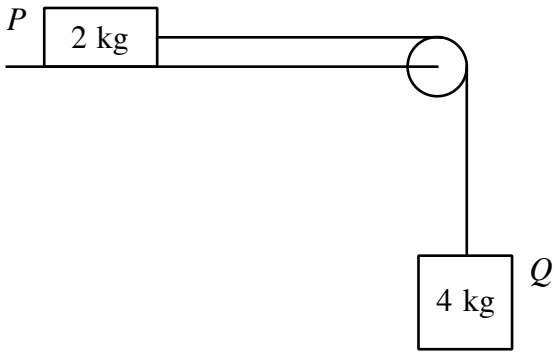
(b) Use calculus to find the exact value of r for which V is stationary.

(c) Prove that this value of r gives a maximum value of V.

(d) Hence determine the ratio $\frac{h}{r}$ when V is maximum.

Applied questions – mechanics

6



Particles P and Q have masses 2 kg and 4 kg respectively. Particle P is at rest on a rough horizontal table and attached to one end of a light inextensible string. The string passes over a small, smooth pulley which is fixed to the edge of the table. The other end of the string is connected to particle Q which hangs freely, vertically below the pulley. The resistance to motion of P from the table is modelled to have constant magnitude 3.2 N.

The system is released from rest.

(a) (i) Write down an equation of motion for particle P.

(ii) Write down an equation of motion for particle Q.

(b) Hence find the acceleration of the particles.

Particle Q is 2 m above the ground and hits the ground before P reaches the pulley,

(c) Find the time taken for Q to reach the ground.

(d) Explain how you have used the fact that Q hits the ground before P reaches the pulley in your answer to part (c).

Applied questions – statistics

7 For a random variable X, it is given that

$$P(X = x) = \frac{k}{x(x+1)}, \quad 1 \leqslant x \leqslant 4$$

where k is a constant.

(a) Find the value of k.

(b) Hence find $P(-2 \leqslant X \leqslant 2.5)$.