CM

AS Level Maths Question Countdown

3 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 Find the equation of the normal to the curve $y = x^3(3 - x)$ when $x = 1$.

Give your answer in the form $ax + by + c = 0$, where a, b and c are integers to be found.

2 $f(x) = x^3 - 2x^2 - 5x + 6$

(a) Show that $(x - 3)$ is a factor of $f(x)$.

(b) Express $f(x)$ as a product of three linear factors.

(c) Hence solve the equation

$$4^{3x} - 2(4^{2x}) - 5(4^x) + 6 = 0$$

Pure questions – problems

3 (a) Find, in ascending powers of x, the first 4 terms in the binomial expansion of

$$(2 + kx)^8$$

where k is a non-zero positive constant. Give each term in its simplest form.

Given that the coefficient of x^3 is 5 times greater than the coefficient of x^2 in this expansion,

(b) find the value of k.

4 (a) Prove the identity $\left(\frac{1}{\cos x} - \tan x\right)^2 \equiv \frac{1 - \sin x}{1 + \sin x}$.

(b) Hence, for $-180^\circ < x < 180^\circ$, solve the equation

$$\left(\frac{1}{\cos x} - \tan x\right)^2 = \frac{1}{5}$$

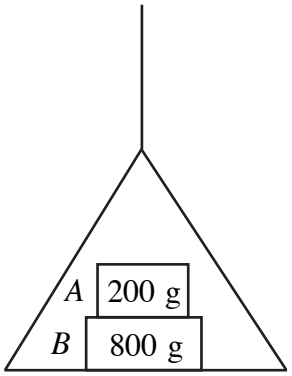
Pure questions – modelling

5 The mass of a radioactive substance, M grams, decreases exponentially with time. The initial mass of the substance is 120.0 g. Four years later, the mass of the substance is 72.4 g.

Find the mass of the substance 10 years after the initial value.

Applied questions – mechanics

6



A light lift is attached to a vertical light inextensible string. The lift carries the masses A and B. The mass of A is 200 g and the mass of B is 800 g. Mass A rests on top of mass B as shown in the diagram above. The lift is raised vertically at 3 m s^{-2}.

(a) Find the tension in the string.

(b) Calculate the magnitude of the force exerted on A by B.

(c) Write down the magnitude of the force exerted on B by A.

(d) Explain how you have used the fact that lift is light in your calculations.

Applied questions – statistics

7 A fair four-sided die has faces numbered 1, 2, 3 and 4. A coin is biased so that the probability of tossing heads is 20% . The die is thrown once and the number n that it lands on is recorded. The biased coin is then thrown $(n + 2)$ times. So, for example, if the die lands on 3, the coin is thrown 5 times.

(a) Find the probability that the die lands on 4 **and** the coin shows heads 4 times.

(b) Find the probability that the number the die lands on is the same as the number of times the coin shows heads.