IB Mathematics AA SL - Prediction Exams
May 2025 - Paper 2

Paper 2 | 9 questions | 90 mins | 80 marks

Section A

Question 1

CALCULATOR | Easy

[Maximum mark: 4]

Consider the function $f(x) = \frac{3x+4}{2x+k}$.

(a) Write down the domain of f in terms of k. [1]

(b) Find $f^{-1}(x)$ in terms of k. [2]

(c) Hence write down the value of k such that $f(x)$ is a self-inverse function. [1]

Question 2

CALCULATOR | Easy

[Maximum mark: 5]

Find the equations of the two tangents to the curve $y = 2x^2 - x + \frac{9}{2}$ that pass through the origin.

Question 3

CALCULATOR Medium

[Maximum mark: 5]

Chun Li has a bag with five 6-sided dice.

Four of them are normal fair dice and one of them is biased with a 6 showing on each of its faces.

She draws two out at random and rolls them.

(a) Find the probability a six shows on both dice. [3]

(b) Given a six shows on both dice find the probability one of the dice is the biased dice. [2]

Question 4

CALCULATOR Medium

[Maximum mark: 7]

A cyclist leaves town A on a bearing of 240° and rides 11 kilometers to town B.

The cyclist then travels d km on a bearing of 090° until he is exactly 6 km from town A.

Find the possible values of d.

Question 5

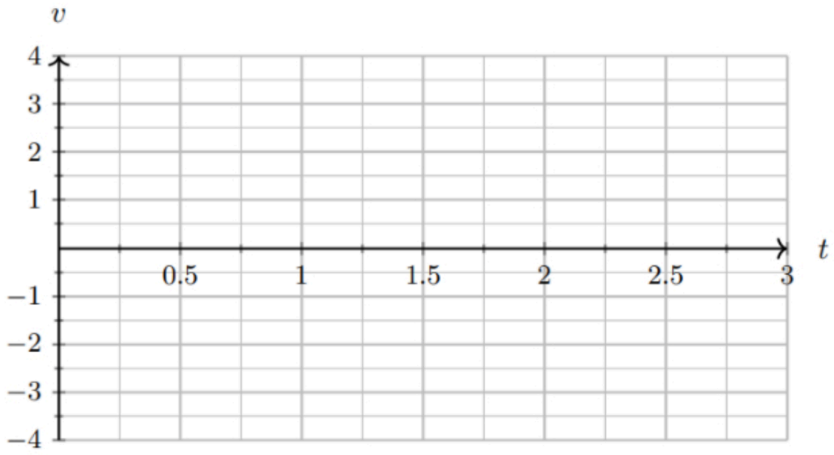
CALCULATOR Medium

[Maximum mark: 6]

A particle P moves along a straight line such that its displacement, in metres, after t seconds, from a fixed point O is given by

$$s(t) = 3e^{-(t+1)} \sin(4t + 4), \quad 0 \leq t \leq 2$$

(a) Sketch the graph of the velocity of P against t on the axes below. [2]



P reaches its maximum speed when $t = a$ seconds.

(b) Find a. [1]

(c) Hence or otherwise, find the distance travelled whilst the acceleration of P is negative. [3]

Question 6

CALCULATOR Medium

[Maximum mark: 5]

The amount, in milligrams, of a medicinal drug in the body t hours after it is injected is given by

$$D(t) = 240e^{-kt}$$

Where $k > 0$ and $t \geq 0$. Before the injection, it is assumed the amount of drug in the body is zero.

A patient is to be injected with the drug and, for this patient, it is known that it takes 5 hours for the amount of drug remaining in the body to have decreased by 65% of the initial dose.

The patient is regularly checked and is allowed to go home when the amount of drug remaining in the body is 10%, or less, of the initial dose.

The initial dose is given to the patient at 9 : 00 am.

Use this model to estimate, to the nearest hour, the earliest time the patient will be allowed to go home.

Section B

Question 7

CALCULATOR Medium

[Maximum mark: 13]

A geometric sequence, with common ratio r, has a first term of 81. The sum of the first four terms of the sequence is 195.

(a) (i) Find r.

(ii) Hence, find G_n, the sum of the first n terms of the geometric sequence. [3]

The first three terms of an arithmetic sequence, with a common difference of d, are $\log 96$, $\log 48$ and $\log 24$.

(b) Find d in the form $p \log q$ where $p, q \in \mathbb{Z}$. [2]

A_n is the sum of the first n terms of the arithmetic sequence.

(c) Show that $A_n = \log\left(3^n \times \left(\sqrt{2}\right)^{11n-n^2}\right)$. [5]

(d) Find the maximum value of n such that $|G_n| > |A_n|$. [3]

Question 8

CALCULATOR Hard ●●●●○

[Maximum mark: 18]

Lesta Laboratory conducts experiments on different metals.

A sample of a metal is taken, if the weight falls in a particular range then the sample is used in an experiment. Otherwise it is rejected.

One type of metal is *Alloy X*, for which the samples have a weight that is normally distributed with a mean of 19.6 grams and a standard deviation of 2.1 grams.

Lesta Laboratory will use a sample of *Alloy X* in an experiment if the weight is between 17 g and 23 g.

(a) Find the probability a randomly selected sample of *Alloy X* will be used in an experiment. [2]

Alloy Y is another type of metal used at *Lesta Laboratory*.

The weights, W_Y, of samples of *Alloy Y* are normally distributed with a mean of μ_Y and a standard deviation of σ_Y.

It is known that 3.061% of samples of *Alloy Y* weigh less than 35 g.

(b) Show that $\mu_Y = 35 + 1.872\sigma_Y$ [2]

It is also known that $\mathrm{P}(W_Y > 46) = 0.1714$.

(c) (i) Show that $\mu_Y = 46 - 0.9486\sigma_Y$

(ii) Hence write down the values of μ_Y and σ_Y. [3]

A sample of *Alloy Y* is used in an experiment if the weight of the sample lies within k standard deviations, σ_Y, of its mean, μ_Y. The probability of this occurring is 54.67%.

(d) (i) Find k.

(ii) If *Lesta Laboratory* takes 8 independent samples of *Alloy Y* what is the probability more than 5 are used in an experiment? [6]

Lesta Laboratory is testing some samples of metals for an experiment. They select 2 samples of *Alloy X* and 2 samples of *Alloy Y*.

(e) What is the probability there will be more samples of *Alloy X* than *Alloy Y* that can be used in the experiment? [5]

Question 9

CALCULATOR Hard

[Maximum mark: 17]

Juanita wants to borrow some money to buy an apartment.

She finds an offer allowing her to borrow \$480,000 over 10 years with an interest rate of $r\%$ P.A. compounded monthly. She repays the loan with a fixed amount p every month.

Juanita takes the loan out at the beginning of the month. At the end of the month, the interest is added **and then** she makes the monthly payment of p.

This continues until after 10 complete years, she has repaid the loan in its entirety.

Juanita wants to analyse three different scenarios in which she could repay the loan.

(a) In the first scenario her monthly payment is $p = \$5\,000$.

If $k = 1 + \dfrac{r}{1200}$

(i) Write down the number of payments that will be made over the entire 10 year term of the loan.

(ii) Show that

$$96k^{120} = \frac{k^{120} - 1}{k - 1}$$

(iii) Hence, or otherwise, find r. [6]

(b) In the second scenario Juanita uses the same values for p and r as part (a). She makes the monthly payments of p for 7 years and 4 months.

She then makes a final payment to clear the remaining balance of the loan.

(i) Find the number of payments she makes **before** the final payment.

(ii) Hence, find the final payment required to clear the remaining balance to 4 significant figures. [3]

(c) In the third scenario Juanita pays p per month for 5 complete years and then she increases her monthly loan repayment to $2p$ for the remaining 5 years.

Find the value of p, to the nearest dollar, for the third scenario. [8]