Mathematics: analysis and approaches

Standard level

Paper 1

1 hour 30 minutes

Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- You are not permitted access to any calculator for this paper.
- Section A: answer all questions. Answers must be written within the answer boxes provided.
- Section B: answer all questions in the answer booklet provided. Fill in your session number on the front of the answer booklet, and attach it to this examination paper and your cover sheet using the tag provided.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- A clean copy of the **mathematics: analysis and approaches formula booklet** is required for this paper.
- The maximum mark for this examination paper is **[80 marks]**.

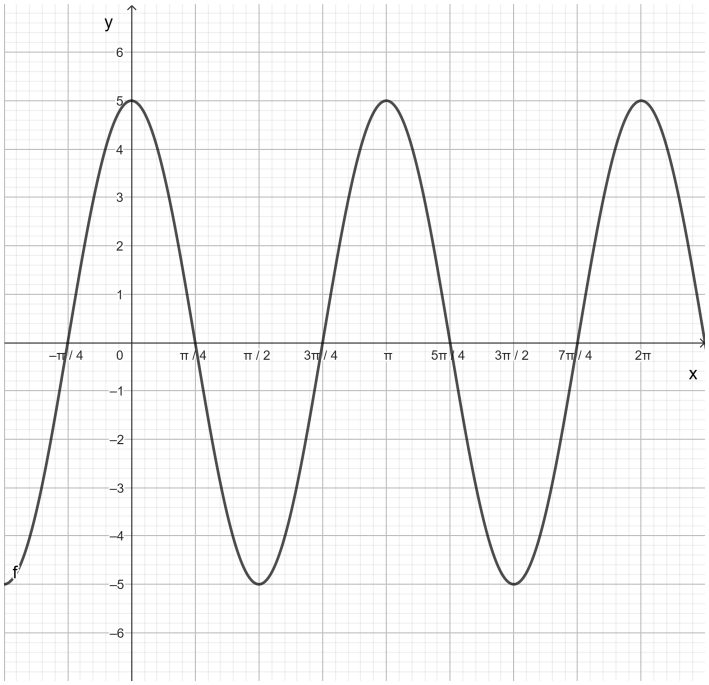
Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working

Section A

Answer **all** questions. Answers must be written within the answer boxes provided. Working may be continued below the lines, if necessary.

1. [Maximum mark: 7]

Consider the function $f(x) = acos(bx)$ with $a, b \in Z^+$. The following diagram shows part of the graph of f.



(a) Write down the value of a. [1]

(b) (i) Write down the period of f

(ii) Hence find the value of b. [3]

(c) Find the value of $f(\frac{\pi}{12})$. [3]

(This question continues on the following page)

(Question 1 continued)

2. [Maximum mark: 5]

Consider the functions $f(x) = x + 3$ and $g(x) = x^2 + h^2$, where h is a real constant.

(a) Write down an expression for $(g \circ f)(x)$. [2]

(b) Given that $(g \circ f)(2) = 34$, find the possibles values of h. [3]

3. [Maximum mark: 4]

Events A and B are independent. $P(A) = 0.4$ and $P(B) = 0.55$

(a) Find $P(A \cup B)$. [2]

(b) Find $P(B' \cap A)$. [2]

4. [Maximum mark 6]

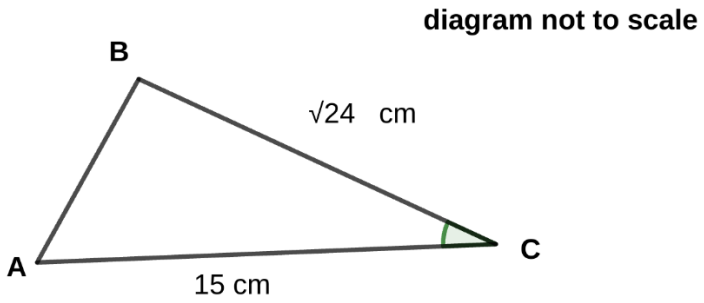
In an arithmetic sequence it is given that $S_4 = 24$ and $S_5 = 35$.

a) Find u_5. [2]

b) Find u_1 and the common difference d [4]

5. [Maximum mark 6]

In the following triangle ABC, BC = $\sqrt{24}$, AC = 15 cm, $cos\ \hat{ACB} = \frac{1}{5}$



Find the exact area of triangle ABC.

6.[Maximum mark: 7]

The binomial expansion of $(1 + kx)^m$ is given by $1 + \frac{8}{3}x + \frac{8}{3}x^2 + \ldots + k^m x^m$

where $m \in Z^+$ and $k \in Q$.

Find the value of m and the value of k.

Do **not** write solutions on this page.

Section B

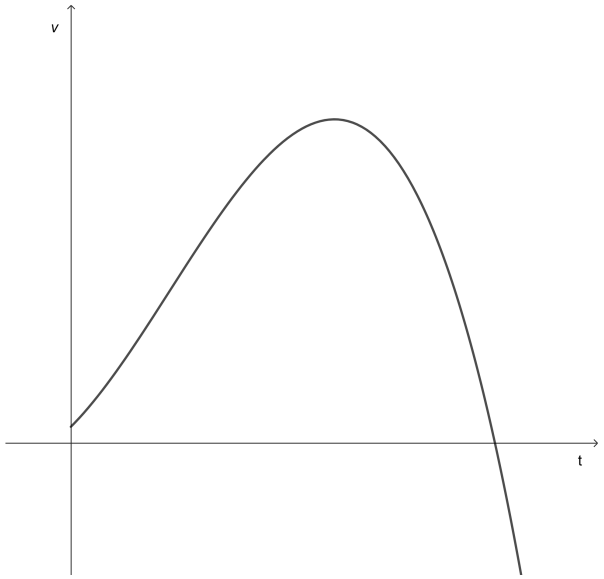
Answer **all** questions in the answer booklet provided. Please start each question on a new page.

7. [Maximum mark: 15]

An object moves along a straight line . It ′ s velocity, vms^{-1}, at time t seconds is given by

$v(t) = -\frac{1}{3}t^3 + \frac{3}{2}t^2 + 4t + 1$, for $0 \leq t \leq 8$

The object first comes to rest at $t = p$. The graph of v is shown in the following diagram:



At $t = 0$ the object is at the origin.

(a) Find the displacement of the object from the origin at $t = 1$. [5]

(b) Find an expression for the acceleration of the object. [2]

(c) Hence, find the greatest speed reached by the object before it comes to rest. [5]

(d) Write down an expression that represents the distance travelled by the object

in the first 8 seconds. Do not evaluate the expression. [3]

8. [Maximum mark: 15]

(a) Calculate each of the following logarithms:

(i) $log_3 \frac{1}{27}$

(ii) $log_8 2$

(iii) $log_{\sqrt{5}} \frac{1}{125}$ [7]

(b) It is given that $log_a b = 5$

(i) Find $log_b a$

(ii) Hence find the value of $5\ log_b \frac{\sqrt{a}}{b^4}$ [8]

9. [Maximum mark: 15]

A high school organized a running race to select the boys team to represent the school in an inter school competition. The times taken by the group of boys to complete the race are shown in the table below.

Time t minutes	$8 \leq t < 10$	$10 \leq t < 12$	$12 \leq t < 14$	$14 \leq t < 16$	$16 \leq t < 18$	$18 \leq t < 20$
Frequency	40	30	p	50	10	20
Cumulative Frequency	40	70	120	q	180	200

(a) Find the value of p and q [4]

(b) A boy is chosen at random

(i) Find the probability that a boy takes less than 12 minutes.

(ii) Find the probability that the time he takes is at least 16 minutes. [4]

c) Draw a cumulative frequency curve in the following diagram. [3]

A boy is selected to be part of the team if he takes less than x minutes to complete the race.

(d) Given that the 60% of the boys are not selected,

(i) find the number of boys that are selected

(ii) find the value of x [3]