



THE NCUK INTERNATIONAL FOUNDATION YEAR (IFY)

IFYHM001 Mathematics Part 1 Examination

Examination Session
Semester One

Time Allowed
2 hours 10 minutes
(Including 10 minutes reading time)

INSTRUCTIONS TO STUDENTS

SECTION A

Answer ALL questions. This section carries 40% of the exam marks.

SECTION B

Answer FOUR questions. This section carries 60% of the exam marks.

The marks for each part of the question are indicated in square brackets []

- **Answers must not be written during the first 10 minutes.**
- Write your Candidate Number clearly on the Answer Book in the space provided.
- Write your answers in the Answer Book provided. Additional sheets will be provided on request.
- Clearly write the number and parts of questions attempted at the start of each answer.
- **No** written material is allowed in the examination room.
- **No** mobile phones are allowed in the examination room.
- An approved calculator may be used in the examination.
- State the units where necessary.
- Where appropriate, working should be carried out to 4 significant figures and **answers given to 3 significant figures.**
- Full marks will only be given for full and detailed answers.
- Students will receive a formula book.

Section A

Answer ALL questions. This section carries 40 marks.

Question A1

Find the equation of the line perpendicular to the line $3x - 4y = 5$ and passing through the point $(6, -5)$. [4]

Question A2

Find the coordinates of the point where the line $4x - 5y = -3$ intersects the vertical line through the point $(3, -2)$. [3]

Question A3

Evaluate $\begin{pmatrix} 3 \\ -2 \end{pmatrix} + \begin{pmatrix} 2 & -5 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ -4 \end{pmatrix}$. [4]

Question A4

Solve the quadratic equation $6x^2 + x - 15 = 0$ for x . [4]

Question A5

Find the set of values of y for which $1 < 6 - 5y \leq 26$. [3]

Question A6

Find the coefficient of x^4 in the expansion of $(2x - 3)^6$. [3]

Question A7

Solve $\frac{\sqrt{x^5}}{\sqrt[3]{x^7}} = 3$ for x . [4]

Question A8

Solve the equation $e^{4x} + e^{2x} - 12 = 0$ for x giving your answer to 4 decimal places. [5]

Question A9

If $y = e^{3x} - 3x^{-2} + 4 \cos x$ find $\frac{dy}{dx}$ when $x = 1$ correct to 2 significant figures. [5]

Question A10

Find the value of $\int_0^1 \left(\frac{1}{2x+3} - 2e^x \right) dx$. [5]

Section B

Answer 4 questions. This section carries 60 marks.

Question B1

(a) (i) Find the inverse, \mathbf{A}^{-1} , of the matrix $\mathbf{A} = \begin{pmatrix} 2 & 3 \\ 9 & 11 \end{pmatrix}$. [4]

(ii) Use \mathbf{A}^{-1} to solve the following simultaneous equations for x and y : [3]

$$\begin{aligned} 2x + 3y &= 6 \\ 9x + 11y &= 17. \end{aligned}$$

(b) (i) Given that $x - 2$ is a factor of $f(x) = x^3 + px^2 + qx - 20$, use the factor theorem to show that $2p + q = 6$. [3]

(ii) When $f(x)$ is divided by $x + 3$ the remainder is -50 . Find the values of p and q . [5]

Question B2

(a) Three sequences are given by the recurrence relations:

$$u_{n+1} = \frac{12}{u_n} + 1, \text{ where } u_1 = 5;$$

$$v_{n+1} = \frac{1}{4}(3v_n^2 - 2v_n - 8), \text{ where } v_1 = 2;$$

$$w_{n+1} = w_n^2 - 2w_n + 3, \text{ where } w_1 = 1.$$

[6]

(i) Show that one of these sequences is convergent, one is divergent and one is periodic.

(ii) Find the limit of the convergent sequence. [2]

(b) The first, fourth and thirteenth terms of an arithmetic series are consecutive terms in a (non-constant) geometric series. The sixth term in the arithmetic series is 78.

Find the first term and the common difference of the arithmetic series. [7]

Question B3

(a) (i) For which values of x are the logarithms in the equation $\log_3(2x+1) = \log_9(3x+4)$ defined? [2]

(ii) Solve the equation $\log_3(2x+1) = \log_9(3x+4)$ for x . [5]

(b) The temperature, $\theta^\circ\text{C}$, of an oven is modelled by the equation $\theta = 18 + Ae^{-kt}$, where t is the time in minutes after the oven is switched off.

The temperature was 218°C when the oven was switched off.

The temperature was 138°C after 8 minutes.

(i) Find the values of the constants A and k . [5]

(ii) Use the model to predict the temperature after 12 minutes. [3]

Question B4

(a) Convert the angle 3.71 radians to degrees.

[2]

(b)

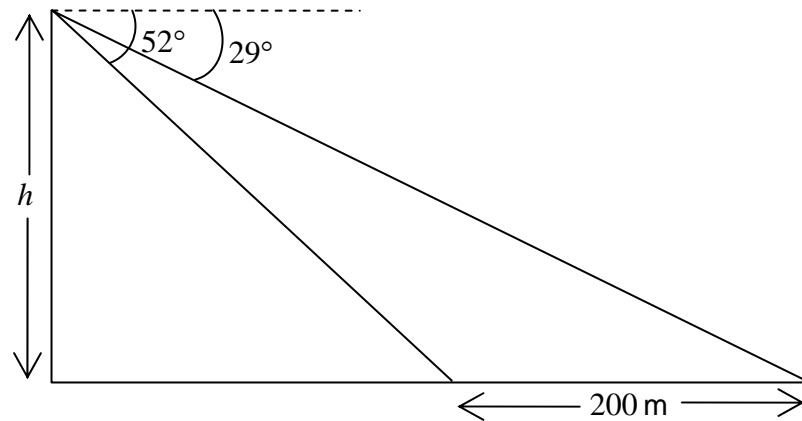


Figure 1

A man standing at the top of a cliff sees a lake on the plain below. The angle of declination of the nearer shore is 52° and that of the further shore is 29° , as shown in Figure 1. The distance across the lake is 200 m.

Find the height of the cliff.

[8]

(c)

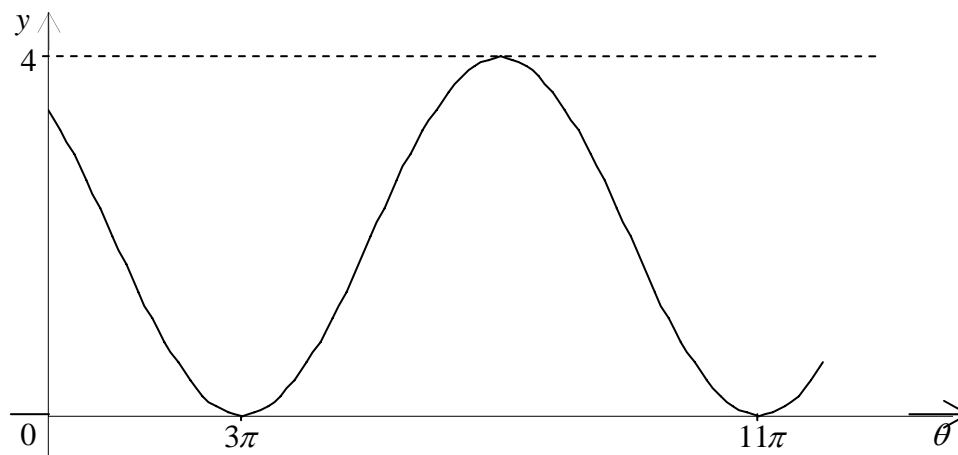


Figure 2

Find a formula which gives the graph shown in Figure 2 in the form $y = A \sin(B\theta + C) + D$.

[5]

Question B5

A curve has the equation $y = 3x^3 - 9x^2 + 5x + 4$.

- (i) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$. [3]
- (ii) Find the coordinates of the stationary points on the graph
 $y = 3x^3 - 9x^2 + 5x + 4$. [4]
- (iii) Find $\frac{d^2y}{dx^2}$ at the stationary points and hence determine whether each
 stationary point is a maximum or a minimum. [4]
- (iv) Find the equation of the tangent at $x = 1$. [4]

Question B6

- (i) Sketch the graph of $y = x^2 - 4x + 9$ for $0 \leq x \leq 5$. [3]

The point P lies on the curve and has x -coordinate equal to 1. The tangent to the curve at P cuts the x -axis at N .

- (ii) Find the equation of the line PN . [4]
- (iii) Show that the x -coordinate of N is 4. [1]
- (iv) Find the area between the curve and the x -axis for x between 1 and 4. [4]
- (v) Find the ratio with which the line PN divides the area found in part (iv). [3]

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