

Graphs

Difficulty: Hard

Question Paper 4

Level	IGCSE
Subject	Maths (0580/0980)
Exam Board	CIE
Topic	Graphs
Paper	Paper 4
Difficulty	Hard
Booklet	Question Paper 4

Time allowed: 101 minutes

Score: /88

Percentage: /100

Grade Boundaries:

CIE IGCSE Maths (0580)

A*	A	B	C	D
>83%	67%	51%	41%	31%

CIE IGCSE Maths (0980)

9	8	7	6	5	4
>95%	87%	80%	69%	58%	46%

Question 1

Answer the whole of this question on one sheet of graph paper.

$$f(x) = 1 - \frac{1}{x^2}, x \neq 0.$$

(a)

x	-3	-2	-1	-0.5	-0.4	-0.3	0.3	0.4	0.5	1	2	3
$f(x)$	p	0.75	0	-3	-5.25	q	q	-5.25	-3	0	0.75	p

Find the values of p and q . [2]

(b) (i) Draw an x -axis for $-3 \leq x \leq 3$ using 2 cm to represent 1 unit and a y -axis for $-11 \leq y \leq 2$ using 1 cm to represent 1 unit. [1]

(ii) Draw the graph of $y = f(x)$ for $-3 \leq x \leq -0.3$ and for $0.3 \leq x \leq 3$. [5]

(c) Write down an integer k such that $f(x) = k$ has no solutions. [1]

(d) **On the same grid**, draw the graph of $y = 2x - 5$ for $-3 \leq x \leq 3$. [2]

(e) (i) Use your graphs to find solutions of the equation $1 - \frac{1}{x^2} = 2x - 5$. [3]

(ii) Rearrange $1 - \frac{1}{x^2} = 2x - 5$ into the form $ax^3 + bx^2 + c = 0$, where a , b and c are integers. [2]

(f) (i) Draw a tangent to the graph of $y = f(x)$ which is parallel to the line $y = 2x - 5$. [1]

(ii) Write down the equation of this tangent. [2]

Question 2

Answer the whole of this question on a sheet of graph paper.

(a)
$$f(x) = \frac{12}{x+1}$$

x	0	1	2	3	4	5	6	7	8	9	10	11
$f(x)$	p	6	4	3	2.4	2	1.71	q	1.33	r	1.09	1

- (i) Calculate the values of p , q and r . [3]
- (ii) Draw the graph of $y = f(x)$ for $0 \leq x \leq 11$.
Use a scale of 1cm to 1 unit on each axis. [5]
- (iii) By drawing a suitable line, find an estimate of the gradient of the graph at the point (3, 3). [3]
- (b) On the same grid draw the graph of $y = 8 - x$ for $0 \leq x \leq 8$. [2]
- (c) (i) Show that the equation $f(x) = 8 - x$ simplifies to $x^2 - 7x + 4 = 0$. [2]
- (ii) **Use your graph** to solve this equation, giving your answers correct to 1 decimal place. [2]

Question 3

Answer all of this question on a sheet of graph paper.

(a) $f(x) = x^2 - x - 3$.

x	-3	-2	-1	0	1	2	3	4
$f(x)$	p	3	-1	-3	q	-1	3	r

(i) Find the values of p , q and r . [3]

(ii) Draw the graph of $y = f(x)$ for $-3 \leq x \leq 4$.
Use a scale of 1 cm to represent 1 unit on each axis. [4]

(iii) By drawing a suitable line, estimate the gradient of the graph at the point where $x = -1$. [3]

(b) $g(x) = 6 - \frac{x^3}{3}$.

x	-2	-1	0	1	2	3
$g(x)$	8.67	u	v	5.67	3.33	-3

(i) Find the values of u and v . [2]

(ii) On the same grid as **part (a) (ii)** draw the graph of $y = g(x)$ for $-2 \leq x \leq 3$. [4]

(c) (i) Show that the equation $f(x) = g(x)$ simplifies to $x^3 + 3x^2 - 3x - 27 = 0$. [1]

(ii) Use your graph to write down a solution of the equation $x^3 + 3x^2 - 3x - 27 = 0$. [1]

Question 4

Answer the whole of this question on a sheet of graph paper.

t	0	1	2	3	4	5	6	7
$f(t)$	0	25	37.5	43.8	46.9	48.4	49.2	49.6

- (a) Using a scale of 2 cm to represent 1 unit on the horizontal t -axis and 2 cm to represent 10 units on the y -axis, draw axes for $0 \leq t \leq 7$ and $0 \leq y \leq 60$.
Draw the graph of the curve $y = f(t)$ using the table of values above. [5]
- (b) $f(t) = 50(1 - 2^{-t})$.
- (i) Calculate the value of $f(8)$ and the value of $f(9)$. [2]
- (ii) Estimate the value of $f(t)$ when t is large. [1]
- (c) (i) Draw the tangent to $y = f(t)$ at $t = 2$ and use it to calculate an estimate of the gradient of the curve at this point. [3]
- (ii) The function $f(t)$ represents the speed of a particle at time t .
Write down what quantity the gradient gives. [1]
- (d) (i) On the same grid, draw $y = g(t)$ where $g(t) = 6t + 10$, for $0 \leq t \leq 7$. [2]
- (ii) Write down the range of values for t where $f(t) > g(t)$. [2]
- (iii) The function $g(t)$ represents the speed of a second particle at time t .
State whether the first or second particle travels the greater distance for $0 \leq t \leq 7$.
You **must** give a reason for your answer. [2]

Question 5

Answer the whole of this question on a sheet of graph paper.

x	04	03	02	01	0	1	2	3	4
$f(x)$	08	4.5	8	5.5	0	05.5	08	04.5	8

- (a) Using a scale of 2 cm to represent 1 unit on the x -axis and 2 cm to represent 4 units on the y -axis, draw axes for $-4 \leq x \leq 4$ and $-8 \leq y \leq 8$.
Draw the curve $y = f(x)$ using the table of values given above. [5]
- (b) Use your graph to solve the equation $f(x) = 0$. [2]
- (c) On the same grid, draw $y = g(x)$ for $-4 \leq x \leq 4$, where $g(x) = x + 1$. [2]
- (d) Write down the value of
- (i) $g(1)$,
 - (ii) $fg(1)$,
 - (iii) $g^{01}(4)$,
 - (iv) the **positive** solution of $f(x) = g(x)$. [4]
- (e) Draw the tangent to $y = f(x)$ at $x = 3$. Use it to calculate an estimate of the gradient of the curve at this point. [3]