

AS Level Mathematics B (MEI)
H630/01 Pure Mathematics and Mechanics

Question Set 5

1 Celia states that $n^2 + 2n + 10$ is always odd when n is a prime number.

Prove that Celia's statement is false.

[2]

2 Fig. 2 shows a quadrilateral ABCD. The lengths AB and BC are 5 cm and 6 cm respectively. The angles ABC, ACD and DAC are 60° , 60° and 75° respectively.

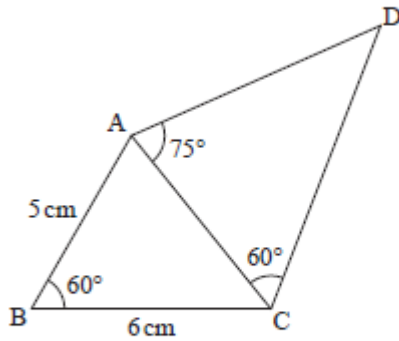


Fig. 2

Calculate the exact value of the length AD.

[4]

3 Fig. 3 shows a triangle PQR. The vector \overrightarrow{PQ} is $i + 7j$ and the vector \overrightarrow{QR} is $4i - 12j$.

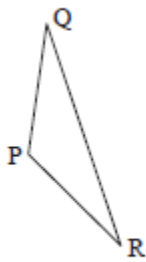


Fig. 3

(a) Show that the triangle PQR is isosceles.

[3]

(b) Find the position vector of S.

[2]

4

Fig. 4.1 shows part of the curve $y = x^{\frac{1}{2}}$. P is the point (1, 1) and Q is the point on the curve with x -coordinate $1+h$.

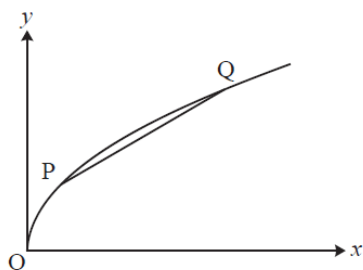


Fig. 4.1

Table 4.2 shows, for different values of h , the coordinates of P, the coordinates of Q, the change in y from P to Q and the gradient of the chord PQ.

x for P	y for P	h	x for Q	y for Q	change in y	gradient PQ
1	1	1				
1	1	0.1	1.1	1.048 809	0.048 809	0.488 088
1	1	0.01	1.01	1.004 988	0.004 988	0.498 756
1	1	0.001	1.001	1.000 500	0.000 500	0.499 875

Table 4.2

- (a) Fill in the missing values for the case $h=1$ in the copy of Table 4.2 below. Give your answers correct to 6 decimal places where necessary. [1]

x for P	y for P	h	x for Q	y for Q	change in y	gradient PQ
1	1	1				
1	1	0.1	1.1	1.048 809	0.048 809	0.488 088
1	1	0.01	1.01	1.004 988	0.004 988	0.498 756
1	1	0.001	1.001	1.000 500	0.000 500	0.499 875

- (b) Explain how the sequence of values in the last column of Table 4.2 relates to the gradient of the curve $y = x^{\frac{1}{2}}$ at the point P. [1]
- (c) Use calculus to find the gradient of the curve at the point P. [2]

5

In this question you must show detailed reasoning.

A curve has equation $y = 4x^3 - 6x^2 - 9x + 4$.

- (a) Sketch the gradient function for this curve, clearly indicating the points where the gradient is zero. [4]
- (b) Find the set of values of x for which the gradient function is decreasing. Give your answer using set notation. [2]

6

The point A has coordinates $(-1, -2)$ and the point B has coordinates $(7, 4)$. The perpendicular bisector of AB intersects the line $y + 2x = k$ at P.

Determine the coordinates of P in terms of k .

[7]

7

In this question you must show detailed reasoning.

- (a) A student is asked to solve the inequality $x^{\frac{1}{2}} < 4$.

The student argues that $x^{\frac{1}{2}} < 4 \Leftrightarrow x < 16$, so that the solution is $\{x : x < 16\}$.

Comment on the validity of the student's argument.

[1]

- (b) Solve the inequality $\left(\frac{1}{2}\right)^x < 4$.

[3]

- (c) Show that the equation $2 \log_2(x+8) - \log_2(x+6) = 3$ has only one root.

[5]

8

In this question you must show detailed reasoning.

Fig. 8 shows part of the graph of $y = x^2 + \frac{1}{x^2}$.

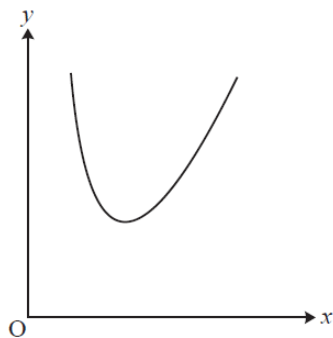


Fig. 8

The tangent to the curve $y = x^2 + \frac{1}{x^2}$ at the point $\left(2, \frac{17}{4}\right)$ meets the x-axis at A and meets the y-axis at B. O is the origin.

- (a) Find the exact area of the triangle OAB.

[6]

- (b) Use calculus to prove that the complete curve has two minimum points and no maximum point.

[6]

Total Marks for Question Set 5: 49 marks



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact The OCR Copyright Team, The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge