

A Level Mathematics B (MEI)

H640/02 MEI Pure Mathematics and Statistics

Pure

Question Set 3

- 1 Given that $y = (x^2 + 5)^{12}$,
- (a) Find $\frac{dy}{dx}$. [2]
- (b) Hence find $\int 48x(x^2 + 5)^{11} dx$. [2]

- 2 Fig. 2 shows the graph of $y = \sqrt{1+x^3}$.

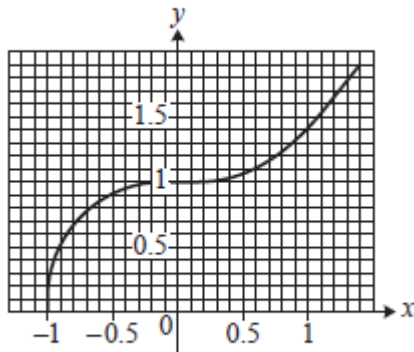


Fig. 2

- (a) Use the trapezium rule with $h = 0.5$ to find an estimate of $\int_{-1}^0 \sqrt{1+x^3} dx$, giving your answer correct to 6 decimal places. [3]
- (b) State whether your answer to part (a) is an under-estimate or an over-estimate, justifying your answer. [1]

- 3 Find $\int \frac{32}{x^5} \ln x dx$. [4]

- 4 The area of a sector of a circle is 36.288 cm^2 . The angle of the sector is θ radians and the radius of the circle is r cm.

- (a) Find an expression for θ in terms of r . [1]

The perimeter of the sector is 24.48 cm.

- (b) Show that $\theta = \frac{24.48}{r} - 2$. [1]

- (c) Find the possible values of r . [3]

- 5 You are given that

$$f(x) = 2x + 3 \quad \text{for } x < 0 \quad \text{and}$$

$$g(x) = x^2 - 2x + 1 \quad \text{for } x > 1.$$

- (a) Find $gf(x)$, stating the domain. [3]

- (b) State the range of $gf(x)$. [1]

- (c) Find $(gf)^{-1}(x)$. [5]

6

Fig. 6 shows the graph of $y = x^2 - 4x + x \ln x$.

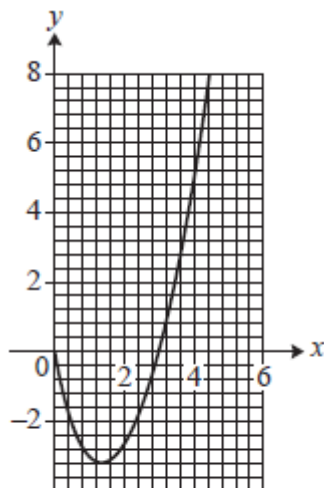


Fig. 6

- (a) Show that the x -coordinate of the stationary point on the curve may be found from the equation $2x - 3 + \ln x = 0$. [4]
- (b) Use an iterative method to find the x -coordinate of the stationary point on the curve $y = x^2 - 4x + x \ln x$, giving your answer correct to 4 decimal places. [4]

7

The population of Melchester is 185 207. During a nationwide flu epidemic the number of new cases in Melchester are recorded each day. The results from the first three days are shown in Fig. 7.

Day	1	2	3
Number of new cases	8	24	72

Fig. 7

A doctor notices that the numbers of new cases on successive days are in geometric progression.

- (a) Find the common ratio for this geometric progression. [1]
- The doctor uses this geometric progression to model the number of new cases of flu in Melchester.
- (b) According to the model, how many new cases will there be on day 5? [1]
- (c) Find a formula for the total number of cases from day 1 to day n inclusive according to this model, simplifying your answer. [1]
- (d) Determine the maximum number of days for which the model could be viable in Melchester. [3]
- (e) State, with a reason, whether it is likely that the model will be viable for the number of days found in part (d). [1]

Total Marks for Question Set 3: 41

Resource Materials

Question Set No: 3

Fig. 2

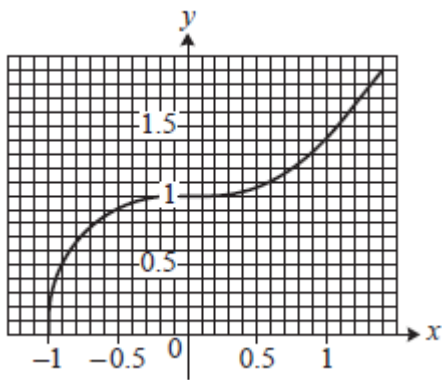


Fig. 6

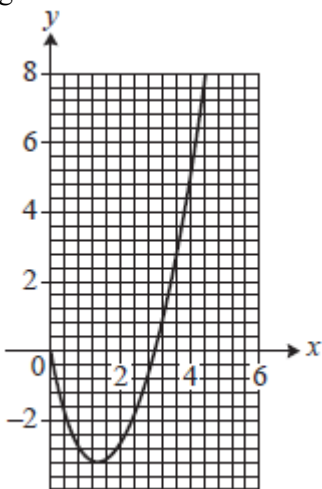


Fig. 7

Day	1	2	3
Number of new cases	8	24	72

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