

Section D (Mathematics 1)

Marks

Answer all the questions.

Answer these questions in a separate answer book, showing clearly the section chosen.

- D1. Differentiate with respect to x :

$$y = \frac{\cos x}{1 - \sin x}, \quad x \neq (2n + \frac{1}{2})\pi.$$

Simplify your answer as far as possible.

3

- D2. Use Gaussian elimination to solve

$$\begin{aligned} x + y - z &= 3 \\ 2x - y + z &= 0 \\ x + y - \frac{1}{2}z &= 1. \end{aligned}$$

4

- D3. Express in partial fractions

$$\frac{3x^2 + 2}{(x + 2)^2},$$

where $x \neq -2$.

5

- D4. Expand $(3x - 2y)^4$.

3

Hence find the term in the expansion of $(3x - \frac{2}{x})^4$ which is independent of x .

1

- D5. (a) Integrate $\frac{2e^x}{1 + e^x}$ with respect to x .

2

(b) Use the substitution $u = 1 - \sin x$ to evaluate $\int_0^{\pi/6} \frac{\cos x}{(1 - \sin x)^{3/2}} dx$.

5

- D6. The function f is defined by $f(x) = \frac{x^3 - 8x^2 + 16x + 4}{x^2 - 8x + 16}$, for $x \neq 4$.

(a) Show that $y = f(x)$ can be written in the form

$$ax + \frac{b}{(x - b)^2},$$

stating the values of a and b .

2

Hence write down equations for the asymptotes.

2

(b) Find the coordinates of the turning point of $y = f(x)$ and justify its nature.

4

(c) Given that the only root of $f(x) = 0$ lies between -1 and 0 , sketch the graph of $y = f(x)$ showing all its main features.

1

[END OF SECTION D]

[Turn over