

- 1 The equation of a polynomial is given by $f(x) = 2x^3 + 13x^2 + 8x - 48$.
- (i) Show that $2x - 3$ is a factor of $f(x)$. [1]
- (ii) Factorise $f(x)$ completely. $(2x-3)(x+4)^2$ [3]
- (iii) Hence, solve the equation $2e^{3y} + 13e^{2y} = -8e^y + 48$.
Leave your answer in exact form. $y = \ln(3/2)$ [2]
- 2 (i) Find the value of a , of b and of c in the identity
 $x^3 - 4x^2 + x + c = (x-1)(ax^2 - 3x + b)$ $a=1$ $b=-2$ $c=2$ [4]
- (ii) Is $(x + 1)$ a factor of $3x^{2023} + 4x^{2022} + 1$? Justify your answer. [2]
NO.
- 3 The polynomial $f(x)$ has a remainder of 8 when divided by $x + 1$, and a remainder of -16 when divided by $x - 7$. Find the remainder when $f(x)$ is divided by $x^2 - 6x - 7$. $-3x+5$ [5]
- 4 By using long division, find the quotient when $3x^5 - 2x^4 + x^2 - 2$ is divided by $x^2 + 1$.
 $(3x^3 - 2x^2 - 3x + 3)$ remainder $= 3x - 5$ [3]
- 5 (a) Given that $\log_4 x = a$ and $\log_{\frac{1}{8}} y = b$. Express $\log_2 \sqrt[4]{xy}$ in terms of a and b .
 $(2a - 3b)/4$ [4]
- (b) To solve the equation $x^2 e^{2x-1} = e^3$ graphically, the graph of $y = \ln x$ and a straight line can be plotted. The x -coordinate of the point of intersection will give the solution. Find the equation of the straight line to be plotted. [2]
 $y = -x + 2$
- 6 Solve the following equations.
- (a) $\log_5(x-5) - \log_5(x-8) = 1 + \log_5\left(\frac{4}{15}\right)$. $x=17$ [3]
- (b) $2\log_4 x - 5 = 12\log_x 4$. $x=256$ or $1/8$ [4]
- (c) $16(2^{2-x}) = (2^{1-2x})(6^{2x})$. $x = \ln(32)/\ln(18) = 1.2$ [3]

- 7 The housing board of a country issued a bond in January 2021 with a yield of 2.75% per year. Peter invested \$20 000 in the bond in January 2021. The total amount, \$ A , that he will receive after t years is given by $A = 20000(1.0275)^t$.

- (i) How much will Peter receive in January 2026? 22,905 [1]
Give your answer to the nearest dollar.
- (ii) How many years will it take for the amount invested by Peter to exceed \$45 000? Give your answer to the nearest whole number. [3]

$$t = \ln(2.25) / \ln(1.0275) = 29.89 = 30 \text{ years}$$

End of Paper