

Question 1 (15 marks) Commence each question on a SEPARATE page

- a. If $P(x) = (x - 3).Q(x) + R(x)$ and $P(3) = 0$, find the numerical value of $R(x)$. **1**
- b. Find the value of k for which $(x + 2)$ is a factor of $2x^3 + kx^2 + 5x - 2$ and find the other factor. **3**
- c. Solve $x^3 + 4x^2 - 8 = 0$. **3**
- d. If α , β and λ are the roots of $x^3 - 5x^2 - 3x + 2 = 0$, find the value of $\alpha^2\beta\lambda + \alpha\beta^2\lambda + \alpha\beta\lambda^2$. **2**
- e. The polynomial $P(x) = x^3 + bx^2 + cx + d$ has roots 0, 2, and -2. **2**
Find b , c , and d .
- f. Consider the equation $x^3 - 8x^2 + 19x - 12 = 0$. **4**
One of the roots of this equation is equal to the sum of the other two roots.
Find the values of the three roots.

Question 2 (15 marks) Commence each question on a SEPARATE page

- a. Find the value of t so that $t + 5$, $4t + 3$ and $8t - 2$ will form successive terms of an arithmetic sequence. **2**
- b. How many terms of the sequence $6, -12, 24, \dots$ are required to give a sum of 1026? **2**
- c. Find the sum of the first 20 terms of an arithmetic sequence whose 8th term is 6 and its 12th term is 9. **3**
- d. i. Which of the following two sequences has a limiting sum and why? **1**
- (α) $2 + \frac{2}{\sqrt{2}+1} + \frac{2}{(\sqrt{2}+1)^2} + \dots$
- (β) $2 + \frac{2}{\sqrt{2}+1} + \frac{2}{(\sqrt{2}+1)^2} + \dots$
- ii. Hence find the exact value of the limiting sum of the sequence selected in part i. **2**
- Answer with a rational denominator.
- e. Find the sixth term of the sequence whose sum to n terms is $2n^2 + n$. **2**
- f. A superannuation fund pays an interest rate of 9.25% per annum compounded annually. **3**
- Ben decides to invest \$5000 in the fund at the beginning of each year commencing on 1st January 2007.
- What will be the value of Ben's superannuation on 31st December 2027?

Question 3 (15 marks) Commence each question on a SEPARATE page

- a. Solve for x : $4^x - 8(2^x) + 15 = 0$ **2**
- b. For what values of m does the line $y = mx - 12$ touch the parabola $y = 2x^2 - x - 10$. **3**
- c. A parabola has equations $x = 4t^2$ and $y = 8t$. Find the coordinates of its **3**
- focus
 - equation of its directrix.
- d. Prove that $kx^2 - (k + 1)x + 1 = 0$ has rational roots if k is rational. **2**
- e. Find a , b and c if $a + b(x - 1) + cx(x - 1) = 5x^2 + x - 2$. **3**
- f. If α and β are the roots of $x^2 + hx + k = 0$, find the relationship between h and k if $\alpha = 2\beta$. **2**