Chapter (4) Factors and Polynomials

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1. The polynomial p(x) is $x^4 - 2x^3 - 3x^2 + 8x - 4$.

   (i) Show that p(x) can be written as (x - 1)$(x^3 - x^2 - 4x + 4)$. [1]

   (ii) Hence write p(x) as a product of its linear factors, showing all your working. [4]

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2. It is given that p(x) = $2x^3 + ax^2 + 4x + b$, where *a* and *b* are constants. It is given also that 2*x* + 1 is a factor of p(x) and that when p(x) is divided by *x* - 1 there is a remainder of -12.

(i) Find the value of *a* and of *b*. [5]

(ii) Using your values of *a* and *b*, write p(x) in the form (2*x*+1)q(x), where q(x) is a quadratic expression. [2]

(iii) Hence find the exact solutions of the equation p(x) = 0. [2]

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3. A polynomial p(x) is $ax^3 + 8x^2 + bx + 5$, where *a* and *b* are integers. It is given that 2*x*-1 is a factor of p(x) and that a remainder of –25 is obtained when p(x) is divided by *x* + 2.

   (i) Find the value of *a* and of *b*. [5]

   (ii) Using your values of *a* and *b*, find the exact solutions of p(x) = 5. [2]

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4. **Without using a calculator**, solve the equation $6c^3 - 7c^2 + 1 = 0$. [5]

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5. The cubic equation $x^3 + ax^2 + bx - 36 = 0$ has a repeated positive integer root.

   (i) If the repeated root is $x = 3$ find the other positive root and the value of *a* and of *b*. [4]

   (ii)There are other possible values of *a* and *b* for which the cubic equation has a repeated positive integer root. In each case state all three integer roots of the equation. [4]

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6. The remainder obtained when the polynomial p(*x*) = $x^3 + ax^2 - 3x + b$ is divided by *x* + 3 is twice the remainder obtained when p(*x*) is divided by $x - 2$. Given also that p(x) is divisible by *x* + 1, find the value of *a* and of *b*. [5]

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7. **Do not use a calculator in this question.**

   It is given that $x+4$ is a factor of $p(x) = 2x^3 + 3x^2 + ax - 12$. When p(x) is divided by $x-1$ the remainder is b.

   (i) Show that a =-23 and find the value of the constant b. [2]

   (ii) Factorise p(x) completely and hence state all the solutions of p(x) = 0. [4]

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8. It is given that $x + 3$ is a factor of the polynomial $p(x) = 2x^3 + ax^2 - 24x + b$. The remainder when $p(x)$ is divided by $x - 2$ is -15. Find the remainder when $p(x)$ is divided by $x + 1$. [6]

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9. $p(x) = 2x^3 + 5x^2 + 4x + a$

$q(x) = 4x^2 + 3ax + b$

Given that p(x) has a remainder of 2 when divided by $2x + 1$ and that q(x) is divisible by $x + 2$,

(i) find the value of each of the constants a and b. [3]

Given that r(x) = p(x) - q(x) and using your values of a and b,

(ii) find the exact remainder when r(x) is divided by $3x - 2$. [3]

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10. The polynomial p(x) = $ax^3 + 17x^2 + bx - 8$ is divisible by 2x-1 and has a remainder of -35 when divided by x + 3.

(i) By finding the value of each of the constants a and b, verify that a = b. [4]

Using your values of a and b,

(ii) find p(x) in the form (2x-1)q(x), where q(x) is a quadratic expression, [2]

(iii) factorise p(x) completely, [1]

(iv) solve $a\,sin^3\theta + 17\,sin^2\theta + b\,sin\theta - 8 = 0$ for $0 < \theta < 180$. [3]