ADDITONAL MATHEMATICS

2002 – 2011

CLASSIFIED REMAINDER THEOREM

Compiled & Edited
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5 **(i)** Show that $2x - 1$ is a factor of $2x^3 - 5x^2 + 10x - 4$. [2]

For Examiner's Use

(ii) Hence show that $2x^3 - 5x^2 + 10x - 4 = 0$ has only one real root and state the value of this root. [4]

5 The expression $x^3 + 8x^2 + px - 25$ leaves a remainder of R when divided by $x - 1$ and a remainder of $-R$ when divided by $x + 2$.

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(i) Find the value of p. [4]

(ii) Hence find the remainder when the expression is divided by $x + 3$. [2]

2 The function f is such that $f(x) = 4x^3 - 8x^2 + ax + b$, where a and b are constants. It is given that $2x - 1$ is a factor of $f(x)$ and that when $f(x)$ is divided by $x + 2$ the remainder is 20. Find the remainder when $f(x)$ is divided by $x - 1$. [6]

(a) The expression $f(x) = x^3 + ax^2 + bx + c$ leaves the same remainder, R, when it is divided by $x + 2$ and when it is divided by $x - 2$.

(i) Evaluate b. [2]

$f(x)$ also leaves the same remainder, R, when divided by $x - 1$.

(ii) Evaluate a. [2]

$f(x)$ leaves a remainder of 4 when divided by $x - 3$.

(iii) Evaluate c. [1]

(b) Solve the equation $x^3 + 3x^2 = 2$, giving your answers to 2 decimal places where necessary. [5]

3 It is given that $x - 1$ is a factor of $f(x)$, where $f(x) = x^3 - 6x^2 + ax + b$.

(i) Express b in terms of a. [2]

(ii) Show that the remainder when $f(x)$ is divided by $x - 3$ is twice the remainder when $f(x)$ is divided by $x - 2$. [4]

3 It is given that $2x - 1$ is a factor of the expression $4x^3 + ax^2 - 11x + b$ and that the remainder when the expression is divided by $x + 2$ is 25. Find the remainder when the expression is divided by $x + 1$. [6]

4 Solve the equation $x^3 - 4x^2 - 11x + 2 = 0$, expressing non-integer solutions in the form $a \pm b\sqrt{2}$, where a and b are integers. [6]

1 Given that $4x^4 - 12x^3 - b^2x^2 - 7bx - 2$ is exactly divisible by $2x + b$,

(i) show that $3b^3 + 7b^2 - 4 = 0$, [2]

(ii) find the possible values of b. [5]

2 The expression $6x^3 + ax^2 - (a + 1)x + b$ has a remainder of 15 when divided by $x + 2$ and a remainder of 24 when divided by $x + 1$. Show that $a = 8$ and find the value of b. [5]

10 The remainder when $2x^3 + 2x^2 - 13x + 12$ is divided by $x + a$ is three times the remainder when it is divided by $x - a$.

(i) Show that $2a^3 + a^2 - 13a + 6 = 0$. [3]

(ii) Solve this equation completely. [5]

6 The cubic polynomial f(x) is such that the coefficient of x^3 is 1 and the roots of f(x) = 0 are -2, $1 + \sqrt{3}$ and $1 - \sqrt{3}$.

(i) Express f(x) as a cubic polynomial in x with integer coefficients. [3]

(ii) Find the remainder when f(x) is divided by $x - 3$. [2]

(iii) Solve the equation f($-x$) = 0. [2]

6 Solve the equation $x^2(2x + 3) = 17x - 12$. [6]

5 **(i)** Show that $2x - 1$ is a factor of $2x^3 - 5x^2 + 10x - 4$. [2]

(ii) Hence show that $2x^3 - 5x^2 + 10x - 4 = 0$ has only one real root and state the value of this root. [4]

2 The expression $x^3 + ax^2 - 15x + b$ has a factor $x - 2$ and leaves a remainder of 75 when divided by $x + 3$. Find the value of a and of b. [5]

8 **(a)** The remainder when the expression $x^3 - 11x^2 + kx - 30$ is divided by $x - 1$ is 4 times the remainder when this expression is divided by $x - 2$. Find the value of the constant k. [4]

(b) Solve the equation $x^3 - 4x^2 - 8x + 8 = 0$, expressing non-integer solutions in the form $a \pm \sqrt{b}$, where a and b are integers. [5]

4 A function f is such that $f(x) = ax^3 + bx^2 + 3x + 4$. When $f(x)$ is divided by $x - 1$, the remainder is 3. When $f(x)$ is divided by $2x + 1$, the remainder is 6. Find the value of a and of b. [5]

6 Solve the equation $2x^3 + 3x^2 - 32x + 15 = 0$. [6]

2 The expression $x^3 + ax^2 - 15x + b$ has a factor $x - 2$ and leaves a remainder of 75 when divided by $x + 3$. Find the value of a and of b. [5]

5 The expression $x^3 + 8x^2 + px - 25$ leaves a remainder of R when divided by $x - 1$ and a remainder of $-R$ when divided by $x + 2$.

(i) Find the value of p. [4]

(ii) Hence find the remainder when the expression is divided by $x + 3$. [2]

6 The cubic polynomial f(x) is such that the coefficient of x^3 is –1 and the roots of the equation f(x) = 0 are 1, 2 and k. Given that f(x) has a remainder of 8 when divided by $x - 3$, find

(i) the value of k,

(ii) the remainder when f(x) is divided by $x + 3$.

[6]

3 The expression $x^3 + ax^2 + bx - 3$, where a and b are constants, has a factor of $x - 3$ and leaves a remainder of 15 when divided by $x + 2$. Find the value of a and of b. [5]

9 The function $f(x) = x^3 - 6x^2 + ax + b$, where a and b are constants, is exactly divisible by $x - 3$ and leaves a remainder of –55 when divided by $x + 2$.

(i) Find the value of a and of b. [4]

(ii) Solve the equation f(x) = 0. [4]

10 The cubic polynomial f(x) is such that the coefficient of x^3 is 1 and the roots of f(x) = 0 are 1, k and k^2. It is given that f(x) has a remainder of 7 when divided by $x - 2$.

(i) Show that $k^3 - 2k^2 - 2k - 3 = 0$. [3]

(ii) Hence find a value for k and show that there are no other real values of k which satisfy this equation. [5]

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