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The Remainder Theorem; The Factor Theorem

(Gaeaf 2005)

4. (a) Find all the factors of the polynomial

$$3x^3 + 2x^2 - 19x + 6. \quad [6]$$

- (b) Find the remainder when $3x^3 + 2x^2 - 19x + 6$ is divided by $x + 1$. [3]

(Haf 2005)

3. (a) Given that $x - 1$ is a factor of $3x^3 + 5x^2 + ax - 4$, show that $a = -4$. [2]

- (b) Solve the equation $3x^3 + 5x^2 - 4x - 4 = 0$. [4]

- (c) Calculate the remainder when $3x^3 + 5x^2 - 4x - 4$ is divided by $x + 1$. [2]

(Gaeaf 2006)

6. (a) Given that when the polynomial $ax^3 - x^2 - 7x + 6$ is divided by $x - 2$ the remainder is 4, show that $a = 2$. [2]

- (b) Solve the equation $2x^3 - x^2 - 7x + 6 = 0$. [5]

(Haf 2006)

5. The polynomial

$$f(x) \equiv px^3 - x^2 + qx - 6$$

has $x - 3$ as a factor. When $f(x)$ is divided by $x - 2$, the remainder is -20 .

- (a) Show that $p = 2$ and find the value of q . [6]

- (b) Factorise $f(x)$. [3]

(Gaeaf 2007)

3. When $9x^3 + 6x^2 - 5x + p$ is divided by $x - 1$, the remainder is 8.

- (a) Show that $p = -2$. [2]

- (b) Factorise $9x^3 + 6x^2 - 5x - 2$. [5]

(Haf 2007)

3. (a) Given that $x - 3$ is a factor of $x^3 - 5x^2 - 2x + p$, show that $p = 24$. [2]

- (b) Solve the equation

$$x^3 - 5x^2 - 2x + 24 = 0. \quad [4]$$

- (c) Find the remainder when $x^3 - 5x^2 - 2x + 24$ is divided by $x - 2$. [2]

(Gaeaf 2008)

8. (a) When the polynomial $6x^3 + ax^2 - 3x - 2$ is divided by $x + 2$, the remainder is -24 . Show that $a = 5$. [2]
- (b) Factorise $6x^3 + 5x^2 - 3x - 2$. [5]

(Haf 2008)

7. The polynomial $4x^3 + px^2 - 11x + q$ has $x - 2$ as a factor. When the polynomial is divided by $x + 1$, the remainder is 9.
- (a) Show that $p = -4$ and $q = 6$. [6]
- (b) Factorise $4x^3 - 4x^2 - 11x + 6$. [3]

(Gaeaf 2009)

7. (a) Find the remainder when $x^3 - 17$ is divided by $x - 3$. [2]
- (b) Solve the equation $6x^3 - 7x^2 - 14x + 8 = 0$. [6]

(Haf 2009)

8. (a) When $ax^3 - 12x^2 - 6x + 5$ is divided by $x + 1$, the remainder is -3 . Find the value of the constant a . [2]
- (b) Factorise $8x^3 - 14x^2 - 7x + 6$. [5]

(Gaeaf 2010)

8. The polynomial $f(x)$ is defined by

$$f(x) = 2x^3 + 11x^2 + 4x - 5.$$

- (a) (i) Evaluate $f(-2)$.
(ii) **Using your answer to part (i)**, write down **one** fact which you can deduce about $f(x)$. [2]
- (b) Solve the equation $f(x) = 0$. [6]

(Haf 2010)

8. (a) Given that $x + 2$ is a factor of $12x^3 + kx^2 - 13x - 6$, write down an equation satisfied by k . Hence show that $k = 19$. [2]
- (b) Factorise $12x^3 + 19x^2 - 13x - 6$. [3]
- (c) Find the remainder when $12x^3 + 19x^2 - 13x - 6$ is divided by $2x - 1$. [2]

(Gaeaf 2011)

7. (a) Find the remainder when $x^3 - 3$ is divided by $x + 2$. [2]
- (b) Solve the equation $6x^3 + x^2 - 11x - 6 = 0$. [6]

(Haf 2011)

8. The polynomial $px^3 - x^2 - 31x + q$ has $x + 2$ as a factor. When the polynomial is divided by $x - 1$, the remainder is -36 .
- (a) Show that $p = 6$ and $q = -10$. [6]
- (b) Factorise $6x^3 - x^2 - 31x - 10$. [3]

(Gaeaf 2012)

8. (a) When $ax^3 - 21x - 10$ is divided by $x - 3$, the remainder is 35. Write down an equation satisfied by a and hence show that $a = 4$. [2]
- (b) Factorise $4x^3 - 21x - 10$. [5]

(Haf 2012)

8. (a) Solve the equation $6x^3 - 19x^2 + 11x + 6 = 0$. [6]
- (b) When $x^3 - 53$ is divided by $x - a$, the remainder is 11. Find the value of the constant a . [2]

(Gaeaf 2013)

8. (a) Given that $x + 2$ is a factor of $px^3 + 18x^2 - 4x - 8$, write down an equation satisfied by p . Hence show that $p = 9$. [2]
- (b) Solve the equation $9x^3 + 18x^2 - 4x - 8 = 0$. [4]

(Haf 2013)

8. Solve the equation $8x^3 - 2x^2 - 7x + 3 = 0$. [6]

(Gaeaf 2014)

9. (a) When $ax^3 + 13x^2 - 10x - 24$ is divided by $x + 3$, the remainder is -39 . Write down an equation satisfied by a and hence show that $a = 6$. [2]
- (b) Solve the equation $6x^3 + 13x^2 - 10x - 24 = 0$. [6]

(Haf 2014)

8. Solve the equation $6x^3 - 13x^2 + 4 = 0$. [6]

(Haf 2015)

8. (a) Given that $x - 3$ is a factor of $px^3 - 13x^2 - 19x + 12$, write down an equation satisfied by p . Hence show that $p = 6$. [2]
- (b) Solve the equation $6x^3 - 13x^2 - 19x + 12 = 0$. [4]

(Haf 2016)

9. The polynomial $f(x)$ is given by

$$f(x) = 8x^3 + 2x^2 - 41x + 10.$$

- (a) Factorise $f(x)$. [5]
- (b) Hence or otherwise, evaluate $f(2.25)$. [2]

(Haf 2017)

7. (a) Given that $x - 2$ is a factor of $kx^3 + 2x^2 - 41x + 10$, write down an equation satisfied by k . Hence show that $k = 8$. [2]
- (b) Factorise $8x^3 + 2x^2 - 41x + 10$. [3]
- (c) Find the remainder when $8x^3 + 2x^2 - 41x + 10$ is divided by $2x + 1$. [2]

(Haf 2018)

8. (a) (i) Find one real root of the equation $8x^3 + 7x^2 - 13x + 10 = 0$.
- (ii) Show that the root you have found is the only real root of the equation

$$8x^3 + 7x^2 - 13x + 10 = 0. \quad [7]$$

- (b) When $x^3 - 80$ is divided by $x - a$, the remainder is 45. Find the value of the constant a . [2]

(Haf 2019)

8. The polynomial $px^3 - 13x^2 + qx + 12$ has $x - 3$ as a factor. When the polynomial is divided by $x + 2$, the remainder is -50 .
- (a) Write down two equations satisfied by p and q . Hence, show that $p = 6$ and $q = -19$. [6]
- (b) Factorise $6x^3 - 13x^2 - 19x + 12$. [3]