



Polynomial Division and Factor Theorem Exam Questions (from OCR 4722)

Note: Some of these questions were designed to be attempted using the Remainder Theorem which is no longer on the A-Level maths specification. These question can still be attempted using polynomial division.

Q1, (Jan 2006, Q8i)

The cubic polynomial  $2x^3 + kx^2 - x + 6$  is denoted by  $f(x)$ . It is given that  $(x + 1)$  is a factor of  $f(x)$ .

- (i) Show that  $k = -5$ , and factorise  $f(x)$  completely. [6]

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Q2, (Jan 2007, Q8)

The polynomial  $f(x)$  is defined by  $f(x) = x^3 - 9x^2 + 7x + 33$ .

- (i) Find the remainder when  $f(x)$  is divided by  $(x + 2)$ . [2]  
(ii) Show that  $(x - 3)$  is a factor of  $f(x)$ . [1]  
(iii) Solve the equation  $f(x) = 0$ , giving each root in an exact form as simply as possible. [6]

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(OCR 4722, Jun 2007, Q9i)

The polynomial  $f(x)$  is given by

$$f(x) = x^3 + 6x^2 + x - 4.$$

- (i) (a) Show that  $(x + 1)$  is a factor of  $f(x)$ . [1]  
(b) Hence find the exact roots of the equation  $f(x) = 0$ . [6]

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Q4 (Jun 2008, Q4)

The cubic polynomial  $ax^3 - 4x^2 - 7ax + 12$  is denoted by  $f(x)$ .

- (i) Given that  $(x - 3)$  is a factor of  $f(x)$ , find the value of the constant  $a$ . [3]  
(ii) Using this value of  $a$ , find the remainder when  $f(x)$  is divided by  $(x + 2)$ . [2]

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Q5 (Jun 2009, Q7)

The polynomial  $f(x)$  is given by  $f(x) = 2x^3 + 9x^2 + 11x - 8$ .

- (i) Find the remainder when  $f(x)$  is divided by  $(x + 2)$ . [2]  
(ii) Use the factor theorem to show that  $(2x - 1)$  is a factor of  $f(x)$ . [2]  
(iii) Express  $f(x)$  as a product of a linear factor and a quadratic factor. [3]  
(iv) State the number of real roots of the equation  $f(x) = 0$ , giving a reason for your answer. [2]



**Q6 (Jan 2012, Q5)**

The cubic polynomial  $f(x)$  is defined by  $f(x) = 2x^3 + 3x^2 - 17x + 6$ .

- (i) Find the remainder when  $f(x)$  is divided by  $(x - 3)$ . [2]
- (ii) Given that  $f(2) = 0$ , express  $f(x)$  as the product of a linear factor and a quadratic factor. [4]
- (iii) Determine the number of real roots of the equation  $f(x) = 0$ , giving a reason for your answer. [2]

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**Q7 (Jun 2013, Q9)**

The cubic polynomial  $f(x)$  is defined by  $f(x) = 4x^3 - 7x - 3$ .

- (i) Find the remainder when  $f(x)$  is divided by  $(x - 2)$ . [2]
- (ii) Show that  $(2x + 1)$  is a factor of  $f(x)$  and hence factorise  $f(x)$  completely. [6]
- (iii) Solve the equation

$$4 \cos^3 \theta - 7 \cos \theta - 3 = 0$$

for  $0 \leq \theta \leq 360$ . Give each solution for  $\theta$  in an exact form. [4]

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**Q8 (Jun 2014, Q7)**

The cubic polynomial  $f(x)$  is defined by  $f(x) = 12 - 22x + 9x^2 - x^3$ .

- (i) Find the remainder when  $f(x)$  is divided by  $(x + 2)$ . [2]
- (ii) Show that  $(3 - x)$  is a factor of  $f(x)$ . [1]
- (iii) Express  $f(x)$  as the product of a linear factor and a quadratic factor. [3]
- (iv) Hence solve the equation  $f(x) = 0$ , giving each root in simplified surd form where appropriate. [3]