

Lesson 2

A-Level Pure Mathematics, Year 1 Additional Mathematics The Algebra of Polynomials

2.1 Algebraic Long Division Of Polynomials

Example

$$f(x) = x^3 + 12x^2 + 47x + 60$$

- (i) Show by algebraic long division that $f(x)$ is divisible by $(x + 5)$
- (ii) Hence factorise $f(x)$ completely
- (iii) Hence sketch the graph of $f(x)$

Teaching Video : <http://www.NumberWonder.co.uk/v9029/2a.mp4> (Part 1)
<http://www.NumberWonder.co.uk/v9029/2b.mp4> (Part 2)



<= Part 1

Part 2 =>



[4, 2, 2 marks]

2.2 Exercise

*Any solution based entirely on graphical
or numerical methods is not acceptable*

Marks Available : 46

Question 1

$$f(x) = x^3 + 7x^2 + 14x + 8$$

- (i) Show by algebraic long division that $f(x)$ is divisible by $(x + 4)$
- (ii) Hence factorise $f(x)$ completely
- (iii) Hence sketch the graph of $f(x)$

[4, 2, 2 marks]

Question 2

$$f(x) = x^3 + 7x^2 - 9x - 63$$

- (i) Show by algebraic long division that $f(x)$ is divisible by $(x + 3)$
- (ii) Hence factorise $f(x)$ completely
- (iii) Hence sketch the graph of $f(x)$

Be careful with minus signs

e.g. $(-9x) - (12x) = -21x$

[4, 2, 2 marks]

Question 3

$$f(x) = x^3 + 3x^2 - 4x - 12$$

- (i) Show by algebraic long division that $f(x)$ is divisible by $(x - 2)$
- (ii) Hence factorise $f(x)$ completely.
- (iii) Hence sketch the graph of $f(x)$.

Be **VERY** careful with minus signs !

e.g. $(-4x) - (-10x) = 6x$

[4, 2, 2 marks]

Question 4

$$f(x) = x^3 + 6x^2 + 3x - 10$$

Notice that the function “ends” in -10

As a result the likely factors are $(x \pm 1)$, $(x \pm 2)$, $(x \pm 5)$ or $(x \pm 10)$

- (i) Show by algebraic long division that $f(x)$ is NOT divisible by $(x + 1)$
- (ii) Try other possibilities from the list, until you find a factor that divides $f(x)$
- (iii) Hence factorise $f(x)$ completely
- (iv) Hence sketch the graph of $f(x)$

[4, 4, 2, 2 marks]

Question 5

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

- (i) Use the -6 to list the likely factors of $f(x)$
- (ii) By algebraic long division, find a factor of $f(x)$ of the form $(x + a)$ where a is an integer.
- (iii) Hence factorise $f(x)$ completely
- (iv) Hence sketch the graph of $f(x)$

[2, 4, 2, 2 marks]

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Teachers may obtain detailed worked solutions to the exercises by email from mhh@shrewsbury.org.uk