

2 Pure Mathematics 2 – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)
modulus	绝对值	_____
polynomial	多项式	_____
degree	次数	_____
remainder theo-	余数定理	_____
rem		_____
remainder	余数	_____
factor theorem	因式定理	_____

Recall

At IGCSE you worked with algebra and the size of a number. Bring this with you:

- the size of a number ignoring its sign (e.g. the "distance from zero");
- factorising and dividing simple expressions.

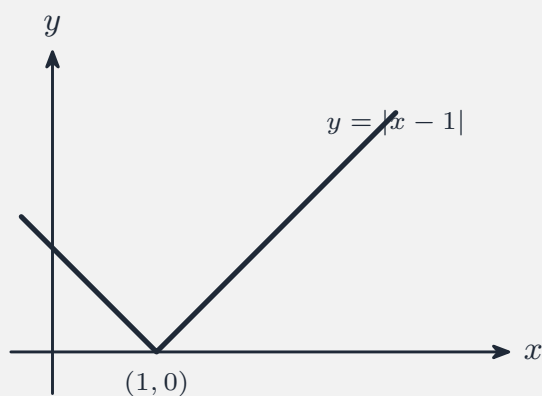
Pure 2 adds the **modulus** as a function, and a quick way to test factors of bigger polynomials.

New ideas

■ 1 The modulus

The **modulus** 绝对值 $|x|$ is the size of a number with its sign removed, so $|x| \geq 0$ always—for example $|-5| = 5$ and $|5| = 5$.

The graph of $y = |ax + b|$ is a "V" shape that bounces off the x -axis.



Micro-check. Find the value of $|3 - 7|$.

[1]

■ 2 The factor and remainder theorems

A **polynomial** 多项式 is a sum of powers of x , such as $2x^3 + x - 5$; its **degree** 次数 is the highest power.

- **remainder theorem** 余数定理: the **remainder** 余数 when $p(x)$ is divided by $(x - a)$ is $p(a)$;
- **factor theorem** 因式定理: $(x - a)$ is a factor of $p(x)$ exactly when $p(a) = 0$.



Worked example. For $p(x) = x^3 - 2x^2 - 5x + 6$: $p(1) = 1 - 2 - 5 + 6 = 0$, so $(x - 1)$ is a factor.

Micro-check. For $p(x) = x^2 - 9$, is $(x - 3)$ a factor? Check $p(3)$.

[1]

Watch out: the modulus $|x|$ is always ≥ 0 , and $|x| = k$ has *two* solutions ($x = k$ and $x = -k$). Factor theorem: $(x - a)$ is a factor when $p(a) = 0$; remainder theorem: the remainder on dividing by $(x - a)$ is $p(a)$.

Practice

2.1 Find (a) $|-8|$ and (b) $|2 - 11|$.

[2]

2.2 Solve $|x| = 4$.

[1]

2.3 The polynomial $p(x) = x^3 + 2x^2 - x - 2$. Find $p(1)$, and state whether $(x - 1)$ is a factor. [2]

2.4 Use the remainder theorem to find the remainder when $p(x) = x^2 + 3x + 5$ is divided by $(x - 2)$. [2]

2.5 State the degree of the polynomial $4x^3 - x^5 + 7$.

[1]

2.6 Challenge. Show that $(x + 2)$ is a factor of $p(x) = x^3 + 3x^2 - 4x - 12$, and hence state one value of x for which $p(x) = 0$. [3]