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Edexcel A Level Maths: Pure



1.2 Proof by Contradiction

Contents

* 1.2.1 Proof by Contradiction



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1.2.1 Proof by Contradiction

Your notes

Proof by Contradiction

What is proof by contradiction?

- A proof by contradiction assumes the **opposite** result is true
- Then, through a series of logical steps, shows that this cannot be so

How do I do proof by contradiction?

- This type of proof often involves explanation in words alongside mathematical statements
- Start with a statement assuming the opposite is true
 - e.g. 'Assume...'

"SET PIECES"

- PROVING A NUMBER
 IS IRRATIONAL
- PROVING THERE
 IS AN INFINITE
 NUMBER OF PRIMES

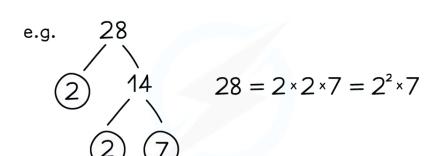
TECHNIQUES

- A RATIONAL NUMBER CAN BE WRITTEN IN THE FORM €
- COMPOSITE NUMBERS
 CAN BE WRITTEN AS
 A PRODUCT OF PRIMES
 e.g. 18 = 2 * 3 * 3

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• Use **prime factorisation** to write a composite number as a product of primes



Your notes

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✓ Worked example	i
	i
	i





Prove that $\sqrt{5}$ is irrational.



ASSUME √5 IS RATIONAL

START WITH THE OPPOSITE

SO $\sqrt{5} = \frac{d}{b}$ WHERE d AND d ARE INTEGERS WITH NO COMMON FACTORS AND $d \neq 0$

SQUARING BOTH SIDES: $5 = \frac{a^2}{b^2}$ $\Leftrightarrow 5b^2 = a^2$

THEREFORE a² IS A MULTIPLE OF 5 SO a IS A MULTIPLE OF 5

SINCE a IS AN INTEGER

WRITING a = 5k FOR SOME INTEGER k,

$$a^2 = (5k)^2 = 25k^2$$

SO
$$5b^2 = 25k^2$$

$$\Leftrightarrow$$
 $b^2 = 5k^2$

THEREFORE 13 IS A MULTIPLE OF 5 AND

SO b IS A MULTIPLE OF 5 7

SINCE b IS AN INTEGER

IT HAS BEEN SHOWN THAT & AND & ARE MULTIPLES

OF 5 SO THEY SHARE FACTOR OF 5

MAKE IT CLEAR
WHERE THE
CONTRADICTION IS

THIS IS A CONTRADICTION OF THE ASSUMPTION $\sqrt{5}$ IS RATIONAL, IT CANNOT BE WRITTEN AS $\frac{d}{b}$, SO, $\sqrt{5}$ IS IRRATIONAL

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