

# PROOF

## AS Unit 1: Pure Mathematics A

### Past paper questions and sample questions: 2017/8

Total marks available 33 (approximately 40 minutes)

1. “If I add 3 to a number and square the sum, the result is greater than the square of the original number.”

State, giving a reason, if the above statement is always true, sometimes true or never true. (2)

(Edexcel 2018)

2.  $N$  is an integer that is not divisible by 3. Prove that  $N^2$  is of the form  $3p + 1$ , where  $p$  is an integer. [5]

(OCR 2018)

3. (a) Prove that for all positive values of  $x$  and  $y$

$$\sqrt{xy} \leq \frac{x + y}{2} \quad (2)$$

- (b) Prove by counter example that this is not true when  $x$  and  $y$  are both negative. (1)

(Edexcel Sample )

4. Prove that

$n$  is a prime number greater than 5  $\Rightarrow n^4$  has final digit 1 [5 marks]

(AQA 2018)

5. (a) Given that  $n$  is an even number, prove that  $9n^2 + 6n$  has a factor of 12

**[3 marks]**

- (b) Determine if  $9n^2 + 6n$  has a factor of 12 for any integer  $n$ .

**[1 mark]**

(AQA Sample )

6. Prove the identity

$$\cos^4 x - \sin^4 x \equiv 1 - 2 \sin^2 x \qquad [6]$$

(CCEA Sample )

7. In each of the two statements below,  $c$  and  $d$  are real numbers. One of the statements is true while the other is false.

- A Given that  $(2c + 1)^2 = (2d + 1)^2$ , then  $c = d$ .  
 B Given that  $(2c + 1)^3 = (2d + 1)^3$ , then  $c = d$ .

- (a) Identify the statement which is false. Find a counter example to show that this statement is in fact false.  
 (b) Identify the statement which is true. Give a proof to show that this statement is in fact true. **[5]**

(WJEC Sample )

8. Prove that

$$\frac{\sin^3 \theta + \sin \theta \cos^2 \theta}{\cos \theta} \equiv \tan \theta. \qquad [3]$$

(WJEC 2018 )