Additional Assessment Materials
Summer 2021

Pearson Edexcel GCEin Mathematics
9MA0 (Public release version)

Resource Set 1: Topic 1
Proof

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Additional Assessment Materials, Summer 2021

## General guidance to Additional Assessment Materials for use in 2021

### Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an optional part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

### Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

**1.** Complete the table below. The first one has been done for you.

For each statement below you must state if it is always true, sometimes true or never true, giving a reason in each case.

| Statement | Always True | Sometimes True | Never True | Reason |
|---|---|---|---|---|
| The quadratic equation $ax^2 + bx + c = 0$ $(a \neq 0)$ has 2 real roots. | | ✓ | | It only has 2 real roots when $b^2 - 4ac > 0$<br>When $b^2 - 4ac = 0$ it has 1 real root and when $b^2 - 4ac < 0$ it has 0 real roots. |
| (i)<br>When a real value of $x$ is substituted into $x^2 - 6x + 10$ the result is positive.<br>**(2)** | | | | |
| (ii)<br>If $ax > b$ then $x > \frac{b}{a}$<br>**(2)** | | | | |
| (iii)<br>The difference between consecutive square numbers is odd.<br>**(2)** | | | | |

**(Total for Question 1 is 6 marks)**

**2.** "If $m$ and $n$ are irrational numbers, where $m \neq n$, then $mn$ is also irrational."
**Disprove** this statement by means of a counter example.

**(2)**
**(Total for Question 2 is 2 marks)**

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**3.** Elsa claims that

'for $n \in \mathbb{Z}^+$, if $n^2$ is even, then $n$ must be even'

Use proof by contradiction to show that Elsa's claim is true.

**(2)**
**(Total for Question 3 is 2 marks)**

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**4.** Bobby claims that

$$e^{3x} \geq e^{2x}, \quad x \in \mathbb{R}.$$

Determine whether Bobby's claim is always true, sometimes true or never true, justifying your answer.

**(2)**
**(Total for Question 4 is 2 marks)**

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**5.** (i) Prove that for all $n \in \mathbb{N}$, $n^2 + 2$ is not divisible by 4

**(4)**
**(Total for Question 5 is 4 marks)**

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**6.** **In this question you must show all stages of your working.**

A geometric series has common ratio $r$ and first term $a$.

Given $r \neq 1$ and $a \neq 0$

prove that

$$S_n = \frac{a\left(1-r^n\right)}{1-r}$$

**(4)**
**(Total for Question 6 is 4 marks)**

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**7.** Prove by contradiction that there are no positive integers $a$ and $b$, with $a$ odd, such that

$$a + 2b = \sqrt{8ab}\,.$$

**(Total for Question 7 is 4 marks)**

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**8.** Prove by contradiction that there are no positive integers $p$ and $q$ such that

$$4p^2 - q^2 = 2^5$$

**(4)**

**(Total for Question 8 is 4 marks)**

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**9.** Use algebra to prove that the square of any natural number is **either** a multiple of 3 **or** one more than a multiple of 3

**(4)**

**(Total for Question 9 is 4 marks)**

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