AQA Qualifications

# AQA Level 2 Certificate

# FURTHER MATHEMATICS

Level 2 (8360)

## Mark Scheme

## Worksheet 3

## Algebraic Proof

Version 2.0

Our specification is published on our website (www.aqa.org.uk). We will let centres know in writing about any changes to the specification. We will also publish changes on our website. The definitive version of our specification will always be the one on our website, this may differ from printed versions.

You can get further copies of this Teacher Resource from:
The GCSE Mathematics Department
AQA
Devas Street
Manchester
M16 6EX

Or, you can download a copy from our All About Maths website (http://allaboutmaths.aqa.org.uk/).

Copyright © 2012 AQA and its licensors. All rights reserved.

AQA retains the copyright on all its publications, including the specifications. However, registered centres for AQA are permitted to copy material from this specification booklet for their own internal use.

AQA Education (AQA) is a registered charity (number 1073334) and a company limited by guarantee registered in England and Wales (number 3644723). Our registered address is AQA, Devas Street, Manchester M15 6EX.

# Glossary for Mark Schemes

These examinations are marked in such a way as to award positive achievement wherever possible. Thus, for these papers, marks are awarded under various categories.

| | |
|---|---|
| **M** | Method marks are awarded for a correct method which could lead to a correct answer. |
| **A** | Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied. |
| **B** | Marks awarded independent of method. |
| **M Dep** | A method mark dependent on a previous method mark being awarded. |
| **B Dep** | A mark that can only be awarded if a previous independent mark has been awarded. |
| **ft** | Follow through marks. Marks awarded following a mistake in an earlier step. |
| **SC** | Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth. |
| **oe** | Or equivalent. Accept answers that are equivalent.<br>eg, accept 0.5 as well as $\frac{1}{2}$ |

# 3 Algebraic Proof

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **1** | $4p - 12 - 4p + 2$<br><br>$-10$ | M1<br><br>A1 | 4 terms with 3 correct |
| **2** | $8y + 24 + 6 - 3y$ or $5y + 30$<br><br>$5y + 30$ and $5(y + 6)$ | M2<br><br>A1 | M1 4 terms with 3 correct<br><br>oe eg, $5y + 30$ and states both terms divisible by 5 |
| **3** | $8a^3 + 4a^2 - 4a^2$ or $8a^3$<br><br>$8a^3$ and $(2a)^3$ | M2<br><br>A1 | M1 3 terms with 2 correct<br><br>oe eg, $8a^3$ and states that 8 is a cube number |
| **4** | $a(x + 3)$ or $b(x + 3)$<br><br>$\frac{a(x+3)}{b(x+3)}$ and cancelling seen<br><br>$\frac{a}{b}$ and explains that as numerator is smaller than denominator value will be < 1 | M1<br><br>A1<br><br>A1 | <br><br><br><br>oe |
| **5(a)** | $a = 3$<br><br>$b = 2$ | B1<br><br>B1 ft | <br><br>ft 11 – their $a^2$ |
| **5(b)** | $(x + 3)^2 \geq 0$<br><br>Adding 2 means always positive | M1<br><br>A1 | oe Allow their $a$<br><br>Must have $a = 3$ and $b = 2$ |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **6** | $(x + 1)^2$ | B1 | |
| | $(x + 1)^2 + 5$ | B1 ft | ft Their $(x + 1)^2$ |
| | $(x + 1)^2 \geq 0$ | M1 | oe Allow their 1 |
| | Adding 5 means always positive | A1 | Must have $(x + 1)^2 + 5$ |
| **7** | $4x^2 + 6x + 6x + 9 + 8x + 16$ or $4x^2 + 20x + 25$ | M2 | M1 Allow one error in expansions |
| | $4x^2 + 20x + 25$ and $(2x + 5)^2$ | A1 | oe<br>eg, $4x^2 + 20x + 25$ and $(2x + 5)(2x + 5)$ |
| | Explains that only solution is $(x =) -2.5$ | A1 | oe<br>eg, explains that because the brackets are the same there is exactly one solution |
| **8(a)** | $\frac{1}{2}(n - 1)(n - 1 + 1)$ | M1 | |
| | $\frac{1}{2}n(n - 1)$ | A1 | oe eg, $\frac{1}{2}n^2 - \frac{1}{2}n$ |
| **8(b)** | $\frac{1}{2}n(n + 1) + \frac{1}{2}n(n - 1)$ | M1 | $\frac{1}{2}n(n + 1)$ + their (a) |
| | $\frac{1}{2}n^2 + \frac{1}{2}n + \frac{1}{2}n^2 - \frac{1}{2}n$ | M1 | Expands brackets<br>ft Their (a) |
| | $n^2$ | A1 | |
| **Alt 8(b)** | $\frac{1}{2}n(n + 1) + \frac{1}{2}(n + 1)(n + 1 + 1)$ | M1 | oe |
| | $\frac{1}{2}n^2 + \frac{1}{2}n + \frac{1}{2}n^2 + n + \frac{1}{2}n + 1$ | M1 | Expands brackets<br>oe eg, $n^2 + 2n + 1$<br>ft Their $\frac{1}{2}(n + 1)(n + 1 + 1)$ |
| | $(n + 1)^2$ | A1 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **9** | $\frac{(x+2)(x-2)}{5(x-2)}$ | M2 | M1 For either numerator or denominator factorised correctly |
| | At least one correct cancellation in the product | M1 | |
| | $2x^2$ | A1 | oe eg, $\frac{10x^2}{5}$ |
| | Explains that 2 > 0 and $x^2 \geq 0$ so $2x^2$ always positive | A1 | oe eg, Explains that 10 > 0 and 5 > 0 and $x^2 \geq 0$ so $\frac{10x^2}{5}$ always positive |
| **10** | $(3n)^2 - 3n + \{(n+1)^2 - (n+1)\}$ | M1 | oe $9n^2 - 3n$ or $n^2 + n + n + 1 - n - 1$ |
| | $9n^2 - 3n + n^2 + n + n + 1 - n - 1$ | A1 | oe eg, $10n^2 - 2n$ |
| | $10n^2 - 2n$ and $2n(5n - 1)$ | A1 | oe eg $10n^2 - 2n$ and $k = 2$ |