# Mark scheme

## The quadratic formula

Mathematics 0580 · Questions from Paper 2 and Paper 4

Total marks

**45**

**MARKS FOR EACH QUESTION**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 6 | 7 | **45** |

### Question 1 [4]

| | | | |
|---|---|---|---|
| **1** | $x = 0.84$ or $7.16$ | 4 | **B1** $\frac{8 \pm k}{2}$ **B1** $\sqrt{(8^2 - 4 \times 1 \times 6)}$ or better<br>**A1 A1** |

### Question 2 [4]

| | | | |
|---|---|---|---|
| **2** | $\frac{-5 \pm \sqrt{5^2 - 4 \times 1 \times -7}}{2 \times 1}$ | **B2** | **B1** for $\sqrt{5^2 - 4 \times 1 \times -7}$<br>and if in form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$<br>**B1** for $p = -5$ and $r = 2 \times 1$ |
| | −6.14 and 1.14 cao | **B2** | **B1** for 1 correct answer for −6.1 and 1.1 or −6.140... and 1.140... or 6.14 and −1.14 or correct answers seen in working |

### Question 3 [4]

| | | | |
|---|---|---|---|
| **3** | –2.64, 1.14 cao with working | **4** | **B1** for $\sqrt{3^2 - 4(2)(-6)}$ or better seen anywhere<br>**B1** for $p = -3$ **and** $r = 2 \times 2$ or better as long as in the form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$<br>After **B0B0, SC1** for –2.6 or –2.637(45…) and 1.1 or 1.137(45…) |

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**Question 4** **[4]**

| | | | |
|---|---|---|---|
| **4** | $\sqrt{1^2-4(2)(-2)}$ | **B1** | If completing the square **B1** for $\left(x+\frac{1}{4}\right)^2$ oe |
| | If in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$<br>$p=-1,\ r=2(2)$ or 4 | **B1** | **B1** for $x=-\frac{1}{4}+\sqrt{1+\left(\frac{1}{4}\right)^2}$<br>or $x=-\frac{1}{4}-\sqrt{1+\left(\frac{1}{4}\right)^2}$ |
| | $-1.28$<br>0.78 | **B1**<br>**B1** | If **0** scored for the last two **B** marks then<br>**SC1** for $-1.3$ **and** 0.8<br>or $-1.281$ to $-1.280$ **and** 0.781 or 0.7807 to 0.7808<br>or 1.28 **and** $-0.78$<br>or $-1.28$ **and** 0.78 seen in the working |

**Question 5** **[4]**

| | | | |
|---|---|---|---|
| **5** | $\frac{-(-11)\pm\sqrt{(-11)^2-4(3)(4)}}{2\times3}$ | **2** | **B1** for $\sqrt{(-11)^2-4(3)(4)}$ or better<br>and, if in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$,<br>**B1** for $p=-(-11)$ and $r=2(3)$ |
| | 0.41 and 3.26 final ans cao | **B1B1** | **SC1** for 0.4 and 3.3<br>or 0.409... and 3.257...<br>or $-0.41$ and $-3.26$<br>or 0.41 and 3.26 seen in working |

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## Question 6 [4]

| | | | |
|---|---|---|---|
| **6** | $\sqrt{10^2-4\times5\times2}$ oe or better | **B1** | If completing the square:<br>**B1** for $(x+1)^2$ oe<br>**B1** for $-1+\sqrt{1-\frac{2}{5}}$ or $-1-\sqrt{1-\frac{2}{5}}$ oe |
| | $\frac{-10+\sqrt{q}}{2(5)}$ or $\frac{-10-\sqrt{q}}{2(5)}$ oe | **B1** | |
| | – 0.23, –1.77 final ans cao | **B1B1** | **SC1** for<br>– 0.2 or – 0.225... **and** –1.8 or –1.774... or –1.775<br>or 0.23 and 1.77 as answer<br>or – 0.23 and –1.77 seen in working<br>Maximum score without working is 2 |

## Question 7 [4]

| | | | |
|---|---|---|---|
| **7** | $\frac{-7\pm\sqrt{(7)^2-4(3)(-11)}}{2\times3}$ | **B2** | **B1** for $\sqrt{(7)^2-4(3(-11))}$ or better<br>and **B1** for $\frac{-7+\sqrt{q}}{2(3)}$ or $\frac{-7-\sqrt{q}}{2(3)}$ |
| | –3.41 and 1.08 cao | **B2** | **B1** for each<br>If **B0**, **SC1** for –3.4 and 1.1<br>or –3.409 and 1.076<br>or –3.4089... and 1.0756....<br>or 3.41 and –1.08<br>or –3.41 and 1.08 seen in working |

## Question 8 [4]

| | | | |
|---|---|---|---|
| **8** | $\frac{-(-2)\pm\sqrt{(-2)^2-4(3)(-2)}}{2(3)}$ oe | **B2** | **B1** for $\sqrt{(-2)^2-4(3)(-2)}$ or better<br>or<br>**B1** for $\frac{-(-2)+\sqrt{q}}{2(3)}$ or $\frac{-(-2)-\sqrt{q}}{2(3)}$ |
| | –0.55, 1.22 | **B2** | **B1** for each<br>If zero scored,<br>**SC1** for – 0.6 and 1.2<br>or –0.549 or –0.548… and 1.215…<br>or 0.55 and −1.22<br>or –0.55 and 1.22 seen in working |

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**Question 9** **[6]**

| | | | |
|---|---|---|---|
| **9** | $2x^2 - 5x - 15$ [= 0]<br>or<br>$y^2 - 34y + 144$ [= 0] oe | **M2** | **M1** for $4x + 12 = 2x^2 - x - 3$ or better<br>or<br>$y = 2\left(\frac{y-12}{4}\right)^2 - \left(\frac{y-12}{4}\right) - 3$ or better |
| | $\frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(-15)}}{2(2)}$ oe<br><br>or for $\frac{5}{4} \pm \sqrt{\frac{15}{2} + \left(\frac{5}{4}\right)^2}$ oe | **M2** | **FT** *their* 3-term quadratic in $x$ or $y$<br>or **M1** for $\sqrt{(-5)^2 - 4(2)(-15)}$ or better<br>or for $\frac{-(-5) + \sqrt{q}}{2 \times 2}$ oe or $\frac{-(-5) - \sqrt{q}}{2 \times 2}$ oe<br>or for $\left(x - \frac{5}{4}\right)^2$ |
| | (4.26, 29.04)<br>and<br>(– 1.76, 4.96) | **B2** | **B1** for one correct pair or both $x$-values correct or both $y$ – values correct |

**Question 10** **[7]**

| | | | |
|---|---|---|---|
| **10** | $x + 1 - 2x = 3x(x + 1)$ | **M2** | **M1** for a common denominator of $x(x + 1)$ seen<br>or attempt to multiply through by denominators<br>or for $\frac{x+1-2x}{x(x+1)} = 3$ |
| | $3x^2 + 4x - 1$[= 0] oe nfww | **A1** | |
| | $[x =] \frac{-4 \pm \sqrt{4^2 - 4 \times 3 \times (-1)}}{2 \times 3}$ | **B2** | **B1FT** for $\sqrt{4^2 - 4 \times 3 \times (-1)}$ or better<br>or for $\left(x + \frac{2}{3}\right)^2$<br>**B1FT** for $\frac{-4 + \sqrt{q}}{2 \times 3}$ or $\frac{-4 - \sqrt{q}}{2 \times 3}$<br>or for $-\frac{2}{3} \pm \sqrt{\frac{1}{3} + \left(\frac{2}{3}\right)^2}$ |
| | –1.55 and 0.22 final answers | **B2** | **B1** for each<br>or<br>**B1** for –1.548 to –1.549 **and** 0.215…<br>or for –1.55 **and** 0.22 seen in working<br>or for –0.22 **and** 1.55 as final answer<br>or for –1.5 or –1.54 **and** 0.2 or 0.21 as final answer |

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