Quadratic Equations Mark Scheme

1. 1.193, –4.193 3

$\frac{-3\pm\sqrt{\left(3^2-4\times1\times(-5)\right)}}{2\times1}$

$\frac{-3\pm\sqrt{29}}{2}$

M1 for correct sub. into quadratic formula, condone wrong sign of a, b or c

A1 for $\frac{-3\pm\sqrt{29}}{2}$ $\left(=\frac{-3\pm5.3(85....)}{2}\right)$

A1 for 1.193 ***and*** *–4.193*

Alternative method:

M1 sight of $(x+1.5)^2$

A1 for $-1.5\pm\sqrt{7.25}$

A1 cao for both answers

[3]

2. $x^2=\frac{108}{3}$

6 2

M1 $(x^2=)$ $\frac{108}{3}$ *(=36) or 36 seen*

A1 cao 6 or – 6 or both. Also accept $\sqrt{36}$

[2]

3. 6, – 3 3

$(x-6)(x+3)$

M2 for (x – 6)(x + 3)

(M1 for $(x\pm6)(x\pm3)$*)*

A1 cao for 6 and –3

[3]

4. (a) $(x-5)(x+3)$ 2

B1 $(x\pm5)(x\pm3)$

B1 cao

(b) 5 or –3 1

B1 cao

[3]

5. (a) As given 2

$\frac{2x(x+20)}{2} = 400$

M1 $\frac{2x(x+20)}{2}$ *or* $\frac{2x \times x + 20}{2}$ *or 2x(x + 20) = 800*

A1 cao following correct working, no need for = 400

SC B1 $2x \times x + \frac{1}{2} \times 2x(10 - \frac{x}{2}) \times 2$

(b) 12.361 3

$\frac{-20 \pm \sqrt{20^2 - 4 \times 1 \times (-400)}}{2}$

$= \frac{-20 \pm 44.721}{2}$

M1 for correct sub, up to signs, in the quad formula

A1 for 44.7 or $\sqrt{2000}$

A1 for 12.3606 – 12.361, ignore negative solution

T.I B3 for 12.361

OR

Completing the square

M1 for $(x + 10)^2$ *seen*

A1 for $-10 \pm \sqrt{500}$

A1 for 12.3606 – 12.361 ignore negative solution

[5]

6. (a) $6x^2 + 11x - 10 + 6x - 4 = 25$

$6x^2 + 17x - 39 = 0$ 3

M1 for an expression for the area involving either

(3x – 2)(2x + 5) +2(3x – 2)

or 3x(3x – 2) + (3x – 2)(7 – x)

or 3x(2x + 5) – 2(7 – x)

or $(3x – 2)^2 + 2(3x – 2) + (3x – 2)(7 – x)$

where in each case at least one of 2 or 3 product terms must be correct

M1 (indep) for one correct expansion involving x^2

A1 for simplification to final answer

(b) (i) 1.5, $-\frac{13}{3}$ 4

$x = \frac{-17 \pm \sqrt{17^2 - 4 \times 6 \times (-39)}}{2 \times 6}$

$= \frac{-17 \pm \sqrt{289 + 936}}{12}$

$x = +\frac{18}{12}$ or – 4.33

$x^2 + \frac{17}{6}x - \frac{39}{6} = 0$

$\left(x + \frac{17}{12}\right)^2 - \left(\frac{17}{12}\right)^2 - \frac{39}{6} = 0$

$\left(x + \frac{17}{12}\right)^2 = \left(\frac{17}{12}\right)^2 + \frac{39}{6}$

M1 for $x = \frac{-17 \pm \sqrt{17^2 - 4 \times 6 \times (-39)}}{2 \times 6}$ *up to signs in b & c*

M1 for $x = \frac{-17 \pm \sqrt{1225}}{12}$

A1 x= 1.5 or – 4.33, or better

OR

M2 for (3x + 13)(2x – 3)

(M1 for (3x ± a)(2x ± b) with ab = ±39

A1 x = 1.5 or – 4.33, or better

OR

M1 for $\left(x + \frac{17}{12}\right)^2$ *seen*

M1 $\left(x + \frac{17}{12}\right)^2 = \left(\frac{17}{12}\right)^2 + \frac{39}{6}$

A1 x = 1.5 or – 4.33, or better

SC:M1 for answer "1.5" with no working or T & I

(ii) 8

B1 cao length = 8

[7]

7. (a) Printed 4

$\left(\frac{x + 2 + x + 6}{2}\right)(x - 5)$

$(x + 4)(x - 5)$

$x^2 - 5x + 4x - 20$

$x^2 - x - 20 = 36$

B1 for $\left(\frac{x + 2 + x + 6}{2}\right)(x - 5)$ *or any correct unsimplified form for the area*

M1 for at least 3 terms correct in expansion of form (x + a) (x + b) or (2x + a)(x + b)

A1 for area = $x^2 - 5x + 4x - 20$ or better

A1 for $x^2 - x - 56 (= 0)$ obtained convincingly

(b) (i) 8, –7 4

$(x - 8)(x + 7) = 0$

M1 for (x ± 8)(x ± 7) or correct subst. into quadratic formula (condone sign errors)

A2 cao (B1 for either x = –7 or x = 8)

(ii) 3

B1 cao (the only value) *[8]*