AS and A-level MATHS

Algebraic manipulation, quadratic equations

Mark sch eme

Specification content coverage: B1, B2, B3

Question	Solutions	Mark
1 (a)	$x^{\frac{4}{3}}$ circled	1
1 (b)	$p = 0$	1
	$q = -4$	1
2 (a)	$25 - 10\sqrt{2} + 5\sqrt{2} - 2\sqrt{2}\sqrt{2}$	1
	$25 - 5\sqrt{2} - 4$	
	$21 - 5\sqrt{2}$	1
2 (b)	$\dfrac{4}{\sqrt{5}-3} \times \dfrac{\sqrt{5}+3}{\sqrt{5}+3}$	1
	$= \dfrac{4\sqrt{5}+12}{5-9}$	
	$= \dfrac{4\sqrt{5}+12}{-4}$	1
	$= -\sqrt{5} - 3$	1
3 (a)	$\left(x - \sqrt{2}\right)\left(x + \sqrt{2}\right)$	1
3 (b)	$\left(2x + a\right)\left(3x + b\right)$	1
	$\left(2x + 3\right)\left(3x - 7\right)$	1
4 (a)	Parabola sketched as ∪ shape	1
	y-axis intercept $y = -4$	1
	x-axis intercepts $x = \dfrac{1}{2} \pm \dfrac{\sqrt{17}}{2}$	2

4 (b)	$y = \left(x - \dfrac{1}{2}\right)^2 - \dfrac{1}{4} - 4$ $y = \left(x - \dfrac{1}{2}\right)^2 - \dfrac{17}{4}$	1 method 1
4 (c)	Minimum at $\left(\dfrac{1}{2}, \dfrac{-17}{4}\right)$ Line of symmetry at $x = \dfrac{1}{2}$	1 1
5	Area of parallelogram = base × perpendicular height Perpendicular height $= \dfrac{\left(10 + 3\sqrt{2}\right)}{\left(3 + 5\sqrt{2}\right)}$ $= \dfrac{\left(10 + 3\sqrt{2}\right)}{\left(3 + 5\sqrt{2}\right)} \times \dfrac{\left(3 - 5\sqrt{2}\right)}{\left(3 - 5\sqrt{2}\right)}$ $= \dfrac{30 - 50\sqrt{2} + 9\sqrt{2} - 15\sqrt{2}\sqrt{2}}{9 - 25\sqrt{2}\sqrt{2}}$ $= \dfrac{-41\sqrt{2}}{-41}$ $= \sqrt{2}$ cm	 1 1 1 1
6	$\dfrac{5(x-1)}{(x-1)(x+3)} + \dfrac{1(x+3)}{(x-1)(x+3)} = 2$ $(5x - 5) + (x + 3) = 2(x-1)(x+3)$ $6x - 2 = 2x^2 + 4x - 6$ $2x^2 - 2x - 4 = 0$ $x^2 - x - 2 = 0$ $(x+1)(x-2) = 0$ Therefore $x = -1$, $x = 2$	1 1 1 1

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7	$\left(x^{\frac{1}{3}}\right)^2 - 17x^{\frac{1}{3}} + 16 = 0$	1
	Let $Y = x^{\frac{1}{3}}$ so that $Y^2 - 17Y + 16 = 0$	1
	$(Y - 16)(Y - 1) = 0$	
	$Y = 16, Y = 1$	1
	$x^{\frac{1}{3}} = 16$ or $x^{\frac{1}{3}} = 1$	1
	Therefore $x = 4096, x = 1$	1

Rationale

It is assumed that students are proficient at using calculators to solve quadratics equations.
Weighted to basic skills as first topic test so less skills to draw on for problem-solving.

19 marks scaffolded, with basic skills assessed.
13 marks applying, including some problem-solving.

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