1.2 Rationalising Denominators and Surd Equations: 30-minute Pack

AQA 8365 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Show that each statement is true. You must show all your working.

(a) Show that $\sqrt{3} + \sqrt{12} = 3\sqrt{3}$. **(2)**

(b) Show that $(5 + \sqrt{2})^2 = 27 + 10\sqrt{2}$. **(4)**

(Total for Question 1 is 6 marks)

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2 Simplify each expression fully.

(a) $(\sqrt{18} + \sqrt{2}) / \sqrt{2}$ **(3)**

(b) Rationalise and simplify $(\sqrt{3} + 1) / (\sqrt{3} - 1)$. **(3)**

(Total for Question 2 is 6 marks)

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3 Solve $\sqrt{3x + 10} = x$, showing why any extraneous solution must be rejected.

(Total for Question 3 is 5 marks)

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4 A is the point (0, 0) and B is the point $(2, 2\sqrt{5})$.

(a) Find the length AB, giving your answer in the form $k\sqrt{6}$. **(3)**

(b) Find the exact y-coordinate of the midpoint M of AB. **(2)**

(c) Explain why AB^2 is a rational number even though the y-coordinate of B is irrational. **(2)**

(Total for Question 4 is 7 marks)

5 Solve each equation.

(a) $\sqrt{3x - 2} = \sqrt{x + 8}$ **(2)**

(b) $\sqrt{5x + 1} = 2\sqrt{x + 1}$ **(3)**

(Total for Question 5 is 5 marks)

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Mark scheme · 1.2 Rationalising Denominators and Surd Equations: 30-minute Pack

Question 1

(a) identifies $\sqrt{12} = 2\sqrt{3}$ **M1**

(a) $\sqrt{3} + 2\sqrt{3} = 3\sqrt{3}$ cso **A1**

(a) Answer: $3\sqrt{3}$ (shown)

(b) attempts full expansion $(5+\sqrt{2})(5+\sqrt{2})$ **M1**

(b) obtains $25 + 5\sqrt{2} + 5\sqrt{2} + 2$ oe (unsimplified) **M1**

(b) collects rational terms $25 + 2 = 27$ and surd terms $5\sqrt{2}+5\sqrt{2} = 10\sqrt{2}$ **A1**

(b) $27 + 10\sqrt{2}$ cso, no errors seen **A1**

(b) Answer: $27 + 10\sqrt{2}$ (shown)

Question 2

(a) $\sqrt{18} = 3\sqrt{2}$ **M1**

(a) combines numerator to $4\sqrt{2}$ **M1**

(a) 4 cao **A1**

(a) Answer: 4

(b) multiplies numerator and denominator by $(\sqrt{3}+1)$ **M1**

(b) denominator = 2 and numerator = $4 + 2\sqrt{3}$ obtained **M1**

(b) $2 + \sqrt{3}$ cao **A1**

(b) Answer: $2 + \sqrt{3}$

Question 3

squares both sides: $3x + 10 = x^2$ **M1**

rearranges to $x^2 - 3x - 10 = 0$ **M1**

factorises correctly: $(x-5)(x+2) = 0$, or uses the quadratic formula correctly **M1**

$x = 5$ and $x = -2$ both found **A1**

rejects $x = -2$ with valid reason (sqrt gives a non-negative value, but $x = -2$ is negative, so it cannot satisfy the original equation); final answer $x = 5$ **A1**

Answer: x = 5 (x = -2 rejected)

Question 4

(a) correct distance formula set up: $\sqrt{(2-0)^2 + (2\sqrt{5}-0)^2}$ **M1**

(a) simplifies to $\sqrt{4 + 20} = \sqrt{24}$ **M1**

(a) $2\sqrt{6}$ cao **A1**

(a) Answer: $2\sqrt{6}$

(b) uses midpoint formula $(0 + 2\sqrt{5})/2$ **M1**

(b) $\sqrt{5}$ cao **A1**

(b) Answer: $\sqrt{5}$

(c) $(2\sqrt{5})^2 = 4 \times 5 = 20$, a rational number **B1**

(c) correct conclusion: $AB^2 = 2^2 + (2\sqrt{5})^2 = 4 + 20 = 24$, the sum of two rational numbers, so AB^2 is rational **B1**

(c) Answer: $AB^2 = 24$, which is rational

Question 5

(a) squares both sides to $3x - 2 = x + 8$ **M1**

(a) $x = 5$ cao **A1**

(a) Answer: x = 5

(b) squares both sides correctly, including squaring the 2, to give $5x + 1 = 4(x+1)$ **M1**

(b) expands and rearranges: $5x + 1 = 4x + 4$ **M1**

(b) $x = 3$ cao **A1**

(b) Answer: x = 3

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