HIGHER

7.1 Surds: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

Surds: Fluency and Exam Drill

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This is a non-calculator practice set on surds. Work through the fluency questions first to secure the core skills of simplifying, combining and rationalising surds, then attempt the exam-style questions, finishing with two grade 9 stretch questions. Show all your working clearly, since method marks are available even when a final answer is not fully correct. Give all answers in their simplest surd form unless told otherwise.

1 Simplify $\sqrt{18}$ fully.

(Total for Question 1 is 1 mark)

2 Simplify $\sqrt{80}$ fully.

(Total for Question 2 is 1 mark)

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3 Work out the value of each of the following.

(a) $\sqrt{16}$ **(1)**

(b) $\sqrt{3} \times \sqrt{3}$ **(1)**

(c) $\sqrt{2} \times \sqrt{8}$ **(1)**

(Total for Question 3 is 3 marks)

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4 Rationalise the denominator of $6/\sqrt{3}$ fully.

(Total for Question 4 is 2 marks)

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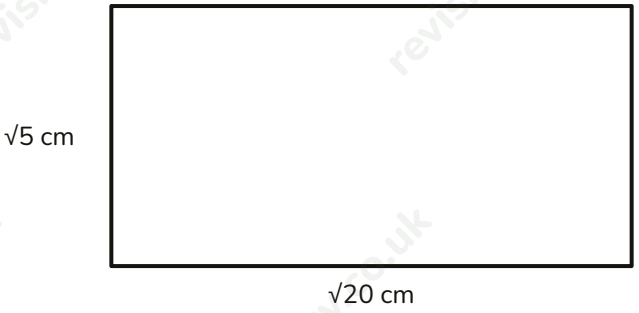
5 Solve algebraically $2x^2 = 24$, giving your solutions in the form $\pm k\sqrt{n}$, where k and n are integers.

(Total for Question 5 is 3 marks)

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6 A rectangle has length $\sqrt{20}$ cm and width $\sqrt{5}$ cm. Find the perimeter of the rectangle, giving your answer in the form $k\sqrt{n}$ cm.

Diagram NOT accurately drawn



(Total for Question 6 is 3 marks)

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7 Show that $44/(4 + \sqrt{5})$ can be written in the form $p - q\sqrt{5}$, where p and q are integers, and find p and q.

(Total for Question 7 is 3 marks)

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8 Rationalise the denominator of $30/\sqrt{6}$. Give your answer in its simplest form.

(Total for Question 8 is 2 marks)

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9 Expand and simplify $(-5 + 3\sqrt{2})(-1 - 2\sqrt{2})$. Give your answer in the form $p + q\sqrt{2}$.

(Total for Question 9 is 3 marks)

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10 Write $\sqrt{396}$ in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible.

(Total for Question 10 is 2 marks)

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11 Expand and simplify $(-3 + \sqrt{7})(5 - \sqrt{7})$. Give your answer in the form $p + q\sqrt{7}$.

(Total for Question 11 is 3 marks)

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12 Expand and simplify $(2 + \sqrt{3})(4 - \sqrt{3})$

(Total for Question 12 is 4 marks)

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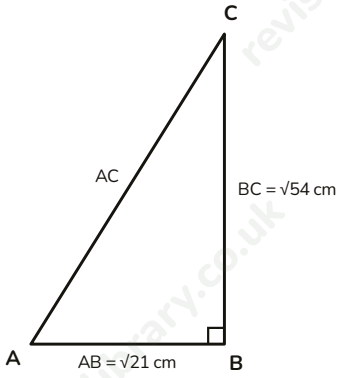
13 Rationalise the denominator and simplify fully: $12/\sqrt{8}$

(Total for Question 13 is 3 marks)

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14 In triangle ABC, the angle at B is 90 degrees. AB = $\sqrt{21}$ cm and BC = $\sqrt{54}$ cm. Work out the length of AC, giving your answer in the form $k\sqrt{n}$ cm, where k and n are integers.

Diagram NOT accurately drawn



(Total for Question 14 is 4 marks)

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15 Simplify $(5 + \sqrt{3})/(\sqrt{3} - 1)$ fully, writing your answer in the form $a + b\sqrt{3}$, where a and b are integers.

(Total for Question 15 is 4 marks)

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16 Show that $\sqrt{7 + 2\sqrt{10}} = \sqrt{5} + \sqrt{2}$.

(Total for Question 16 is 3 marks)

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Mark scheme · 7.1 Surds: Test Pack

A correct answer earns full marks unless the question asks for working, a method, proof or explanation.

Question 1

$3\sqrt{2}$ oe cao **B1**

Answer: $3\sqrt{2}$

Question 2

$4\sqrt{5}$ oe cao **B1**

Answer: $4\sqrt{5}$

Question 3

(a) 4 cao **B1**

(a) Answer: 4

(b) 3 cao **B1**

(b) Answer: 3

(c) 4 cao **B1**

(c) Answer: 4

Question 4

multiplies numerator and denominator by $\sqrt{3}$, giving $6\sqrt{3}/3$ **M1**

$2\sqrt{3}$ cao **A1**

Answer: $2\sqrt{3}$

Question 5

$x^2 = 12$ **M1**

$x = \sqrt{12}$ (or $-\sqrt{12}$) seen **M1**

$x = \pm 2\sqrt{3}$ cao (both values) **A1**

Answer: $x = 2\sqrt{3}$ or $x = -2\sqrt{3}$

Question 6

$\sqrt{20} = 2\sqrt{5}$ **M1**

perimeter $= 2(2\sqrt{5} + \sqrt{5})$ oe **M1**

$6\sqrt{5}$ cm cao **A1**

Answer: $6\sqrt{5}$ cm

Question 7

multiply numerator and denominator by $(4 - \sqrt{5})$ **M1**

denominator = 11 **M1**

$16 - 4\sqrt{5}$ **A1**

Answer: $16 - 4\sqrt{5}$

Question 8

multiply numerator and denominator by $\sqrt{6}$ **M1**

$5\sqrt{6}$ cao **A1**

Answer: $5\sqrt{6}$

Question 9

at least 3 of the 4 products correct **M1**

$\sqrt{2} \times \sqrt{2} = 2$ used **M1**

$-7 + 7\sqrt{2}$ cao **A1**

Answer: $-7 + 7\sqrt{2}$

Question 10

$396 = 36 \times 11$ or $\sqrt{36} = 6$ seen **M1**

$6\sqrt{11}$ cao **A1**

Answer: $6\sqrt{11}$

Question 11

at least 3 of the 4 products correct **M1**

$\sqrt{7} \times \sqrt{7} = 7$ used **M1**

$-22 + 8\sqrt{7}$ cao **A1**

Answer: $-22 + 8\sqrt{7}$

Question 12

correct expansion: $8 - 2\sqrt{3} + 4\sqrt{3} - 3$ (or equivalent four terms) **M1**

surd terms combined: $-2\sqrt{3} + 4\sqrt{3} = 2\sqrt{3}$ **M1**

constant terms combined: $8 - 3 = 5$ **A1**

$5 + 2\sqrt{3}$ oe cao **A1**

Answer: $5 + 2\sqrt{3}$

Question 13

$\sqrt{8}$ simplified to $2\sqrt{2}$ (or $12/\sqrt{8} \times \sqrt{8}/\sqrt{8} = 12\sqrt{8}/8$) **M1**

further simplification (e.g. $6/\sqrt{2}$ or $24\sqrt{2}/8$) **M1**

$3\sqrt{2}$ cao **A1**

Answer: $3\sqrt{2}$

Question 14

uses Pythagoras: $AC^2 = AB^2 + BC^2$ **M1**

$AC^2 = 21 + 54$ (= 75) **M1**

$AC = \sqrt{75}$ oe **M1**

$AC = 5\sqrt{3}$ cm cao **A1**

Answer: AC = $5\sqrt{3}$ cm

Question 15

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

denominator simplifies to $3 - 1 = 2$ **M1**

numerator simplifies to $8 + 6\sqrt{3}$ **A1**

$4 + 3\sqrt{3}$ cao ($a = 4$, $b = 3$) **A1**

Answer: $4 + 3\sqrt{3}$ ($a = 4$, $b = 3$)

Question 16

squares the right-hand side: $(\sqrt{5} + \sqrt{2})^2 = 5 + 2\sqrt{5}\sqrt{2} + 2$ **M1**

simplifies to $7 + 2\sqrt{10}$, matching the expression under the root **A1**

cso - since both sides are positive and $(\sqrt{5}+\sqrt{2})^2 = 7+2\sqrt{10}$, concludes $\sqrt{7+2\sqrt{10}} = \sqrt{5}+\sqrt{2}$ **A1**

Answer: $\sqrt{5} + \sqrt{2}$ (given)

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