

9.2 Answers

A-Level Pure Mathematics : Year 1
GCSE (Grades 8 and 9)
Algebra of Surds and Indices I

The test has 71 marks available

Answer 1

(a) e^{15} (b) $4g^8$ (c) 1 (d) $9x^4$

[1, 2, 1, 2 marks]

Answer 2

63

[1 mark]

Answer 3

(Question states "Showing non-calculator method used")

$$\begin{aligned}(\sqrt{7} + 2)(\sqrt{7} - 2) &= 7 + 2\sqrt{7} - 2\sqrt{7} - 4 \\ &= 3\end{aligned}$$

[2 marks]

Answer 4

(Question states "Demonstrate how to simplify without using a calculator")

$$\begin{aligned}(3 + \sqrt{5})(3 + \sqrt{5}) &= 9 + 3\sqrt{5} + 3\sqrt{5} + 5 \\ &= 4\end{aligned}$$

[2 marks]

Answer 5

(a) Must expand, then simplify,

$$\begin{aligned}(7 + \sqrt{5})(3 - \sqrt{5}) &= 21 + 3\sqrt{5} - 7\sqrt{5} - 5 \\ &= 16 - 4\sqrt{5}\end{aligned}$$

[3 marks]

(b) Must make non-calculator method clear,

$$\begin{aligned}\frac{7 + \sqrt{5}}{3 + \sqrt{5}} \times \frac{3 - \sqrt{5}}{3 - \sqrt{5}} &= \frac{16 - 4\sqrt{5}}{9 + 3\sqrt{5} - 3\sqrt{5} - 5} \\ &= \frac{4(4 - \sqrt{5})}{4} \\ &= 4 - \sqrt{5}\end{aligned}$$

$$\therefore a = 4 \quad b = -1$$

[3 marks]

Answer 6

Must demonstrate a non-calculator method

$$\begin{aligned}
 \text{(i)} \quad 3\sqrt{15} \times 7\sqrt{10} &= 3 \times \sqrt{3} \times \sqrt{5} \times 7 \times \sqrt{2} \times \sqrt{5} \\
 &= 3 \times 5 \times 7 \times \sqrt{2} \times \sqrt{3} \\
 &= 105\sqrt{6}
 \end{aligned}$$

[2 marks]

$$\begin{aligned}
 \text{(ii)} \quad 3\sqrt{5^2 \times 7} \times 2\sqrt{5 \times 7^2} &= 3 \times 5 \times \sqrt{7} \times 2 \times \sqrt{5} \times 7 \\
 &= 210\sqrt{35}
 \end{aligned}$$

[2 marks]

Answer 7

$$\text{(i)} \quad 980 = 2^2 \times 5 \times 7^2$$

[1 mark]

$$\begin{aligned}
 \text{(ii)} \quad \sqrt{980} &= \sqrt{2^2 \times 5 \times 7^2} \\
 &= 2 \times \sqrt{5} \times 7 \\
 &= 14\sqrt{5} \\
 \therefore m &= 14
 \end{aligned}$$

[1 mark]

Answer 8

$$\text{(i)} \quad 1125 = 3^2 \times 5^3$$

[1 mark]

$$\begin{aligned}
 \text{(ii)} \quad \sqrt{1125} &= \sqrt{3^2 \times 5^3} \\
 &= \sqrt{3^2 \times 5^2 \times 5} \\
 &= 3 \times 5 \times \sqrt{5} \\
 &= 15\sqrt{5} \\
 \therefore n &= 15
 \end{aligned}$$

[1 mark]

Answer 9

$$\begin{aligned}
 \sqrt{980} + \sqrt{1125} &= 14\sqrt{5} + 15\sqrt{5} \\
 &= 29\sqrt{5}
 \end{aligned}$$

[1 mark]

Answer 10

$$\text{(a)} \quad 2 \qquad \text{(b)} \quad 8x^9$$

[1, 2 marks]

Answer 11

$$\begin{aligned}
\frac{7 + \sqrt{5}}{\sqrt{5} - 1} \times \frac{\sqrt{5} + 1}{\sqrt{5} + 1} &= \frac{7\sqrt{5} + 5 + 7 + \sqrt{5}}{5 - \sqrt{5} + \sqrt{5} - 1} \\
&= \frac{12 + 8\sqrt{5}}{4} \\
&= \frac{4(3 + 2\sqrt{5})}{4} \\
&= 3 + 2\sqrt{5}
\end{aligned}$$

[4 marks]**Answer 12**

Must make non-calculator method clear...

$$\begin{aligned}
\text{(i)} \quad \frac{12}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} &= \frac{12\sqrt{6}}{6} \\
&= 2\sqrt{6}
\end{aligned}$$

[2 marks]

$$\begin{aligned}
\text{(ii)} \quad \frac{14\sqrt{3}}{5\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} &= \frac{14\sqrt{21}}{5 \times 7} \\
&= \frac{2\sqrt{21}}{35}
\end{aligned}$$

[2 marks]**Answer 13**

$$\begin{aligned}
64\sqrt{2} &= 2^a \\
2^6 \times 2^{\frac{1}{2}} &= 2^a \\
2^{6.5} &= 2^a \\
a &= 6.5
\end{aligned}$$

[3 marks]**Answer 14**

Must make non-calculator method clear...

$$\begin{aligned}
\sqrt{2^7 \times 3^3 \times 5^2} &= \sqrt{2^6 \times 2 \times 3^2 \times 3 \times 5^2} \\
&= 2^3 \times \sqrt{2} \times 3 \times \sqrt{3} \times 5 \\
&= 120\sqrt{6}
\end{aligned}$$

[3 marks]**Answer 15**

$$\begin{aligned}
\sqrt{75} - \sqrt{27} &= \sqrt{25 \times 3} - \sqrt{9 \times 3} \\
&= 5\sqrt{3} - 3\sqrt{3} \\
&= 2\sqrt{3}
\end{aligned}$$

[2 marks]

Answer 16

$$\begin{aligned}
\frac{2}{\sqrt{12} - \sqrt{8}} &= \frac{2}{\sqrt{4 \times 3} - \sqrt{4 \times 2}} \\
&= \frac{2}{2\sqrt{3} - 2\sqrt{2}} \\
&= \frac{1}{\sqrt{3} - \sqrt{2}} \times \frac{\sqrt{3} + \sqrt{2}}{\sqrt{3} + \sqrt{2}} \\
&= \frac{\sqrt{3} + \sqrt{2}}{3 - \sqrt{3}\sqrt{2} + \sqrt{3}\sqrt{2} - 2} \\
&= \sqrt{3} + \sqrt{2}
\end{aligned}$$

[5 marks]**Answer 17**

$$\begin{aligned}
\text{(a)} \quad \sqrt{50} + \sqrt{128} - \sqrt{200} &= \sqrt{25 \times 2} + \sqrt{64 \times 2} - \sqrt{100 \times 2} \\
&= 5\sqrt{2} + 8\sqrt{2} - 10\sqrt{2} \\
&= 3\sqrt{2}
\end{aligned}$$

[2 marks]

$$\begin{aligned}
\text{(b)} \quad \frac{5\sqrt{a} + a}{10\sqrt{a}} \times \frac{\sqrt{a}}{\sqrt{a}} &= \frac{5a + a\sqrt{a}}{10a} \\
&= \frac{a(5 + \sqrt{a})}{10a} \\
&= \frac{5 + \sqrt{a}}{10} \\
&= \frac{1}{2} + \frac{1}{10}\sqrt{a}
\end{aligned}$$

$$\therefore x = 0.5 \text{ and } y = 0.1$$

[2 marks]**Answer 18**

$$\text{(a)} \quad 32 \qquad \text{(b)} \quad 2x^{-0.5}$$

[2, 3 marks]**Answer 19**

$$\begin{aligned}
\text{(a)} \quad \sqrt{80} &= \sqrt{16 \times 5} \\
&= 4\sqrt{5} \\
\therefore c &= 4
\end{aligned}$$

[1 mark]

(b)

$$\text{Area } R = l \times w$$

$$\sqrt{80} = (1 + \sqrt{5}) \times w$$

$$w = \frac{\sqrt{80}}{(1 + \sqrt{5})} \times \frac{(1 - \sqrt{5})}{(1 - \sqrt{5})}$$

$$= \frac{4\sqrt{5}(1 - \sqrt{5})}{1 - \sqrt{5} + \sqrt{5} - 5}$$

$$= \frac{4\sqrt{5} - 20}{-4}$$

$$= \frac{-4(5 - \sqrt{5})}{-4}$$

$$= 5 - \sqrt{5}$$

[4 marks]

Answer 20

(a)

$$\sqrt{50} - \sqrt{18} = \sqrt{25 \times 2} - \sqrt{9 \times 2}$$

$$= 5\sqrt{2} - 3\sqrt{2}$$

$$= 2\sqrt{2}$$

$$\therefore a = 2$$

[2 marks]

(b)

$$\frac{12\sqrt{3}}{\sqrt{50} - \sqrt{18}} = \frac{12\sqrt{3}}{2\sqrt{2}}$$

$$= \frac{12\sqrt{3}}{2\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$$

$$= \frac{12\sqrt{6}}{4}$$

$$= 3\sqrt{6}$$

[3 marks]

Answer 21

$$9^{3x+1} = 3^y$$

$$(3^2)^{3x+1} = 3^y$$

$$3^{6x+2} = 3^y$$

$$\therefore y = 6x + 2$$

[2 marks]

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