N62 Surds Rationalise the Denominator

OCR

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15 **(a)** Simplify fully.

(i) $\sqrt{50}+\sqrt{2}$

(a)(i) .... **[2]**

(ii) $\dfrac{10}{\sqrt{6}}$

(ii) .... **[2]**

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15 **(a)** Simplify fully.

N59/60 **(i)** $\sqrt{50} + \sqrt{2}$

$5\sqrt{2} + \sqrt{2}$

$\sqrt{50}$

$\sqrt{25}\sqrt{2}$

$5\sqrt{2}$

(a)(i) $6\sqrt{2}$ .... **[2]**

(ii) $\dfrac{10}{\sqrt{6}}$

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$\dfrac{10}{\sqrt{6}} \times \dfrac{\sqrt{6}}{\sqrt{6}} = \dfrac{\overset{5}{\cancel{10}}\sqrt{6}}{\underset{3}{\cancel{6}}} =$

(ii) $\dfrac{5\sqrt{6}}{3}$ ✓ .... **[2]**

15 Show that $\dfrac{(4+2\sqrt{5})}{\sqrt{5}-1}$ can be simplified to $\dfrac{3\sqrt{5}+7}{2}$.

N62

[4]

15 Show that $\frac{(4 + 2\sqrt{5})}{\sqrt{5} - 1}$ can be simplified to $\frac{3\sqrt{5} + 7}{2}$.

N62

$$\frac{4 + 2\sqrt{5}}{\sqrt{5} - 1} \times \frac{\sqrt{5} + 1}{\sqrt{5} + 1}$$

$(4 + 2\sqrt{5})(\sqrt{5} + 1)$

$4\sqrt{5} + 4 + 2(5) + 2\sqrt{5}$

$= 4\sqrt{5} + 4 + 10 + 2\sqrt{5}$

$= 6\sqrt{5} + 14$ ✓

$(\sqrt{5} - 1)(\sqrt{5} + 1)$

$(5 + \sqrt{5} - \sqrt{5} - 1)$

$= 4$

$$\frac{{}^{3}\cancel{6}\sqrt{5} + \cancel{14}^{7}}{\cancel{4}_{2}} = \frac{3\sqrt{5} + 7}{2}$$

[4]

20 In the following equation, n is an integer greater than 1.

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$$(\sqrt{2})^n = k\sqrt{2}$$

(a) **(i)** Find k when $n = 7$.

(a)(i) $k =$ .... **[2]**

(ii) Find n when $k = 64$.

(ii) $n =$ .... **[2]**

20 In the following equation, n is an integer greater than 1.

N54H

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$$(\sqrt{2})^n = k\sqrt{2}$$

$\sqrt[2]{2^1} = 2^{1/2}$

(a) **(i)** Find k when $n = 7$.

$(2^{1/2})^7 = K(2^{1/2})$

$2^{7/2} = K(2^{1/2})$

$\dfrac{2^{7/2}}{2^{1/2}} = K$

$K = 2^3$

$K = 8$

$7/2 = 3\tfrac{1}{2}$

$3\tfrac{1}{2} - \tfrac{1}{2} = 3$

(a)(i) $k =$ ....8.................... **[2]**

(ii) Find n when $k = 64$.

$K\sqrt{2}$

$64 \times 2^{1/2}$

$2^6 \times 2^{1/2}$

$= 2^{6\frac{1}{2}}$

$\sqrt{2} = (2^{1/2})^n = 2^{6\frac{1}{2}}$

$2^{\frac{1}{2}n} = 2^{6\frac{1}{2}}$

$\tfrac{1}{2}n = 6.5$

$n = 13$

(ii) $n =$ ....13.................... **[2]**

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(b) Show that $\dfrac{14}{3-\sqrt{2}}$ can be written in the form $a+b\sqrt{2}$. **[5]**

N62H

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(b) Show that $\dfrac{14}{3-\sqrt{2}}$ can be written in the form $a+b\sqrt{2}$. **[5]**

N62H

$$\frac{14}{3-\sqrt{2}} \times \frac{3+\sqrt{2}}{3+\sqrt{2}} = \frac{14(3+\sqrt{2})}{(3-\sqrt{2})(3+\sqrt{2})} = \frac{42+14\sqrt{2}}{7}$$

$$= 6+2\sqrt{2}$$

$$(3-\sqrt{2})(3+\sqrt{2})$$

$$9+3\sqrt{2}-3\sqrt{2}-2$$

$$9-2$$

$$=7$$

Edexcel

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19 $\dfrac{1+\sqrt{2}}{(3-\sqrt{2})^2}$ can be written in the form $a + b\sqrt{2}$

Find the value of a and the value of b.

$a =$ ....

$b =$ ....

(Total for Question 19 is 5 marks)

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19 $\dfrac{1+\sqrt{2}}{(3-\sqrt{2})^2}$ can be written in the form $a + b\sqrt{2}$

Find the value of a and the value of b.

$(3-\sqrt{2})(3-\sqrt{2})$

$9 - 3\sqrt{2} - 3\sqrt{2} + 2$

$11 - 6\sqrt{2}$

$(1+\sqrt{2})(11+6\sqrt{2})$

$11 + 6\sqrt{2} + 11\sqrt{2} + 6(2)$

$23 + 17\sqrt{2}$

$\dfrac{1+\sqrt{2}}{11-6\sqrt{2}} \times \dfrac{11+6\sqrt{2}}{11+6\sqrt{2}}$

$\dfrac{23+17\sqrt{2}}{49}$

$(11-6\sqrt{2})(11+6\sqrt{2})$

$121 \cancel{+66\sqrt{2}} \cancel{-66\sqrt{2}}$

$-36(2)$

$121 - 72$

$= 49$

$a = 23/49$

$b = 17/49$

(Total for Question 19 is 5 marks)

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20 Show that $\dfrac{12 + \sqrt{128}}{1 - \sqrt{2}}$ can be written in the form $a + b\sqrt{2}$ where a and b are integers.

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(Total for Question 20 is 4 marks)

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20 Show that $\dfrac{12 + \sqrt{128}}{1 - \sqrt{2}}$ can be written in the form $a + b\sqrt{2}$ where a and b are integers.

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$\sqrt{128}$

$\sqrt{64}\sqrt{2}$

$8\sqrt{2}$

$$\frac{12 + \sqrt{128}}{1 - \sqrt{2}} \times \frac{1 + \sqrt{2}}{1 + \sqrt{2}}$$

$(12 + \sqrt{128})(1 + \sqrt{2})$

$= 12 + 12\sqrt{2} + \sqrt{128} + \sqrt{256}$

$= 12 + 12\sqrt{2} + 8\sqrt{2} + 16$

$= 28 + 20\sqrt{2}$

$(1 - \sqrt{2})(1 + \sqrt{2})$

$1 + \sqrt{2} - \sqrt{2} - 2$

$1 - 2 = -1$

$$\text{Ans} = \frac{28 + 20\sqrt{2}}{-1}$$

$= -28 - 20\sqrt{2}$

(Total for Question 20 is 4 marks)

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21 Show that $\dfrac{6-\sqrt{8}}{\sqrt{2}-1}$ can be written in the form $a+b\sqrt{2}$ where a and b are integers.

(Total for Question 21 is 3 marks)

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21 Show that $\frac{6-\sqrt{8}}{\sqrt{2}-1}$ can be written in the form $a + b\sqrt{2}$ where a and b are integers.

$$\frac{6-\sqrt{8}}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1}$$

$$(6-\sqrt{8})(\sqrt{2}+1)$$

$$6\sqrt{2}+6-\sqrt{16}-\sqrt{8}$$

$$6\sqrt{2}+6-4-2\sqrt{2}$$

$$=4\sqrt{2}+2$$

$$\sqrt{8}=\sqrt{4}\sqrt{2}=2\sqrt{2}$$

$$(\sqrt{2}-1)(\sqrt{2}+1)$$

$$2+\sqrt{2}-\sqrt{2}-1$$

$$2-1=1$$

ans

$$\frac{4\sqrt{2}+2}{1}$$

$$=4\sqrt{2}+2$$

$$=2+4\sqrt{2}$$ ✓

(Total for Question 21 is 3 marks)

20 Martin did this question.

Rationalise the denominator of $\dfrac{14}{2+\sqrt{3}}$

Here is how he answered the question.

$$\frac{14}{2+\sqrt{3}} = \frac{14 \times (2-\sqrt{3})}{(2+\sqrt{3})(2-\sqrt{3})}$$

$$= \frac{28 - 14\sqrt{3}}{4 + 2\sqrt{3} - 2\sqrt{3} + 3}$$

$$= \frac{28 - 14\sqrt{3}}{7}$$

$$= 4 - 2\sqrt{3}$$

Martin's answer is wrong.

(a) Find Martin's mistake.

N62

....

....

(1)

20 Martin did this question.

Rationalise the denominator of $\dfrac{14}{2+\sqrt{3}}$

Here is how he answered the question.

$$\frac{14}{2+\sqrt{3}} = \frac{14 \times (2-\sqrt{3})}{(2+\sqrt{3})(2-\sqrt{3})} \checkmark$$

$$= \frac{28 - 14\sqrt{3}}{4 + 2\sqrt{3} - 2\sqrt{3} + 3} \checkmark$$

$$= \frac{28 - 14\sqrt{3}}{7}$$

$$= 4 - 2\sqrt{3}$$

$$14(2-\sqrt{3}) = 28 - 14\sqrt{3}$$

$$(2+\sqrt{3})(2-\sqrt{3})$$

$$4 - 2\sqrt{3} + 2\sqrt{3} - 3$$

$$4 - 3$$

Martin's answer is wrong.

(a) Find Martin's mistake.

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$+\sqrt{3} \times -\sqrt{3}$ and called it $+3$

needs to be -3

(1)

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20 Show that $\dfrac{(\sqrt{18}+\sqrt{2})^2}{\sqrt{8}-2}$ can be written in the form $a(b+\sqrt{2})$ where a and b are integers.

N62

(Total for Question 20 is 3 marks)

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20 Show that $\dfrac{(\sqrt{18}+\sqrt{2})^2}{\sqrt{8}-2}$ can be written in the form $a(b+\sqrt{2})$ where a and b are integers.

N62

$(\sqrt{18}+\sqrt{2})(\sqrt{18}+\sqrt{2})$

$18+\sqrt{36}+\sqrt{36}+2$

$18+6+6+2$

$=32$

$(\sqrt{8}-2)(\sqrt{8}+2)$

$8+2\sqrt{8}-2\sqrt{8}-4$

$8-4=4$

$\dfrac{32}{\sqrt{8}-2}\times\dfrac{\sqrt{8}+2}{\sqrt{8}+2}=\dfrac{32(\sqrt{8}+2)}{4}$

$\sqrt{8} \ldots \sqrt{4}\sqrt{2}$

$2\sqrt{2}$

$32\times 2\sqrt{2}$

$64\sqrt{2}$

$\dfrac{32\sqrt{8}+64}{4}$

$\dfrac{64+64\sqrt{2}}{4}$

$\dfrac{\overset{16}{\cancel{64}}(1+\sqrt{2})}{\cancel{4}_1}$

$16(1+\sqrt{2})$

(Total for Question 20 is 3 marks)

AQA

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29 Simplify $\dfrac{2\sin 45^\circ - \tan 45^\circ}{4\tan 60^\circ}$

G48
N62

Give your answer in the form $\dfrac{\sqrt{a}-\sqrt{b}}{c}$ where a, b and c are integers.

[4 marks]

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29 Simplify $\dfrac{2\sin 45^\circ - \tan 45^\circ}{4\tan 60^\circ}$

G48
N62

Give your answer in the form $\dfrac{\sqrt{a}-\sqrt{b}}{c}$ where a, b and c are integers.

[4 marks]

$\sin 45 = \dfrac{\sqrt{2}}{2} \times 2 = \dfrac{2\sqrt{2}}{2} = \sqrt{2}$

$\tan 45 = 1$

$\tan 60 = \sqrt{3} \times 4 = 4\sqrt{3}$

$$\frac{\sqrt{2}-1}{4\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$\sqrt{3}(\sqrt{2}-1)$

$\sqrt{6}-\sqrt{3}$

$4\sqrt{3} \times \sqrt{3}$

$= 4(3)$

$= 12$

$$= \frac{\sqrt{6}-\sqrt{3}}{12}$$

24 Show that $\frac{2\sqrt{6}}{\sqrt{5}} - \frac{\sqrt{3}}{\sqrt{10}}$ can be written in the form $\frac{c\sqrt{d}}{10}$

N59
N60
N62

where c and d are integers.

[3 marks]

24 Show that $\dfrac{2\sqrt{6}}{\sqrt{5}} - \dfrac{\sqrt{3}}{\sqrt{10}}$ can be written in the form $\dfrac{c\sqrt{d}}{10}$

N59
N60
N62

where c and d are integers.

[3 marks]

$$\frac{2\sqrt{6}\sqrt{2}}{\sqrt{5}\sqrt{2}}$$

$$= \frac{2\sqrt{12}}{\sqrt{10}}$$

$$\frac{2\sqrt{4}\sqrt{3}}{\sqrt{10}} \quad \frac{2(2)\sqrt{3}}{\sqrt{10}} \quad \frac{4\sqrt{3}}{\sqrt{10}}$$

$$\frac{2\sqrt{12}}{\sqrt{10}} - \frac{\sqrt{3}}{\sqrt{10}}$$

$$= \frac{4\sqrt{3}}{\sqrt{10}} - \frac{\sqrt{3}}{\sqrt{10}}$$

$$= \frac{3\sqrt{3}}{\sqrt{10}} \times \frac{\sqrt{10}}{\sqrt{10}} = \frac{3\sqrt{30}}{10}$$

$$= \frac{3\sqrt{30}}{10}$$