



Rationalising surds (2)

Getting ready for A-Level Maths...

*"The most important investment you can make is in **yourself.**"*

Rationalising surds (2)

Difference of two squares

$$(a + b)(a - b) = a^2 - b^2$$

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

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

Rationalising surds (2)

My turn

Rationalise the following giving your answer in the form $a + b\sqrt{3}$. State a and b .

$$\frac{4}{1+\sqrt{3}}$$

$$\frac{4}{1+\sqrt{3}} = \frac{4}{1+\sqrt{3}} \times \frac{(1-\sqrt{3})}{(1-\sqrt{3})}$$

$$= \frac{4(1-\sqrt{3})}{1^2 - (\sqrt{3})^2}$$

$$= \frac{4(1-\sqrt{3})}{-2}$$

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

$$= \underline{\underline{-2+2\sqrt{3}}}$$

$$\begin{array}{l} a = -2 \\ b = 2 \end{array}$$

Your turn

Rationalise the following giving your answer in the form $a + b\sqrt{7}$. State a and b .

$$\frac{18}{1+\sqrt{7}}$$

$$\frac{18}{1+\sqrt{7}} = \frac{18}{(1+\sqrt{7})} \times \frac{(1-\sqrt{7})}{(1-\sqrt{7})}$$

$$= \frac{18(1-\sqrt{7})}{1^2 - (\sqrt{7})^2}$$

$$= \frac{18(1-\sqrt{7})}{-6}$$

$$= -3(1-\sqrt{7})$$

$$= \underline{\underline{-3+3\sqrt{7}}}$$

$$\begin{array}{l} a = -3 \\ b = 3 \end{array}$$

Rationalising surds (2)

My turn

Rationalise the following giving your answer in the form $a + b\sqrt{2}$. State a and b .

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

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

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

$$= \frac{2(3+\sqrt{2})}{7}$$

$$= \frac{6+2\sqrt{2}}{7}$$

$$= \underline{\underline{\frac{6}{7} + \frac{2}{7}\sqrt{2}}}}$$

$$a = \frac{6}{7} \quad b = \frac{2}{7}$$

Your turn

Rationalise the following giving your answer in the form $a + b\sqrt{5}$. State a and b .

$$\frac{2}{4-\sqrt{5}}$$

$$\frac{2}{4-\sqrt{5}} = \frac{2}{4-\sqrt{5}} \times \frac{(4+\sqrt{5})}{(4+\sqrt{5})}$$

$$= \frac{2(4+\sqrt{5})}{4^2-(\sqrt{5})^2}$$

$$= \frac{2(4+\sqrt{5})}{11}$$

$$= \frac{8+2\sqrt{5}}{11}$$

$$= \underline{\underline{\frac{8}{11} + \frac{2}{11}\sqrt{5}}}}$$

$$a = \frac{8}{11} \quad b = \frac{2}{11}$$

Rationalising surds (2)

My turn

Rationalise the following giving your answer in the form $a + b\sqrt{5}$. State a and b .

$$\frac{12}{-1+\sqrt{5}} \quad -1+\sqrt{5} = \sqrt{5}-1$$

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

$$\begin{aligned}a &= 3 \\ b &= 3\end{aligned}$$

Your turn

Rationalise the following giving your answer in the form $a + b\sqrt{11}$. State a and b .

$$\frac{20}{-3+\sqrt{11}} \quad -3+\sqrt{11} = \sqrt{11}-3$$

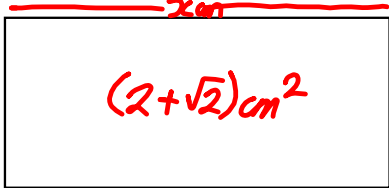
$$\begin{aligned}\frac{20}{\sqrt{11}-3} &= \frac{20}{\sqrt{11}-3} \times \frac{(\sqrt{11}+3)}{(\sqrt{11}+3)} \\ &= \frac{20(\sqrt{11}+3)}{(\sqrt{11})^2-3^2} \\ &= \frac{20\sqrt{11}+60}{11-9} \\ &= \frac{20\sqrt{11}+60}{2} \\ &= 10\sqrt{11}+30 \\ &= 30 + 10\sqrt{11}\end{aligned}$$

$$\begin{aligned}a &= 30 \\ b &= 10\end{aligned}$$

Rationalising surds (2)

My turn

A rectangle has an area $(2 + \sqrt{2})\text{cm}^2$ and a width of $(3\sqrt{2} - 4)\text{cm}$. Find the length and state your answer in the form $a + b\sqrt{2}$ where a and b are integers.

$$(3\sqrt{2} - 4)x = (2 + \sqrt{2})$$


$$x = \frac{2 + \sqrt{2}}{(3\sqrt{2} - 4)}$$

$$= \frac{(2 + \sqrt{2})(3\sqrt{2} + 4)}{(3\sqrt{2})^2 - (4)^2}$$

$\hookrightarrow (3\sqrt{2})^2 = 3\sqrt{2} \times 3\sqrt{2} = 9 \times 2 = 18$

$$= \frac{2(3\sqrt{2} + 4) + \sqrt{2}(3\sqrt{2} + 4)}{18 - 16}$$

$$= \frac{6\sqrt{2} + 8 + 3\sqrt{2}\sqrt{2} + 4\sqrt{2}}{2}$$

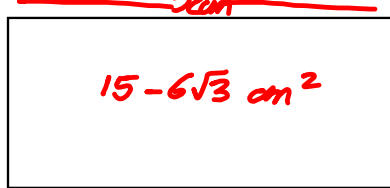
$a = 7$
 $b = 5$

$$= \frac{10\sqrt{2} + 14}{2}$$

$$= 5\sqrt{2} + 7 \quad (= 7 + 5\sqrt{2})$$

Your turn

A rectangle has an area $(15 - 6\sqrt{3})\text{cm}^2$ and a width of $(2\sqrt{3} - 3)\text{cm}$. Find the length and state your answer in the form $a + b\sqrt{3}$ where a and b are integers.

$$(2\sqrt{3} - 3)x = 15 - 6\sqrt{3}$$


$$x = \frac{15 - 6\sqrt{3}}{2\sqrt{3} - 3}$$

$$= \frac{15 - 6\sqrt{3}}{2\sqrt{3} - 3} \times \frac{2\sqrt{3} + 3}{2\sqrt{3} + 3}$$

$\hookrightarrow (2\sqrt{3})^2 = 2\sqrt{3} \times 2\sqrt{3} = 4 \times 3 = 12$

$$= \frac{(15 - 6\sqrt{3})(2\sqrt{3} + 3)}{(2\sqrt{3})^2 - 3^2}$$

$a = 3$
 $b = 4$

$$= \frac{15(2\sqrt{3} + 3) - 6\sqrt{3}(2\sqrt{3} + 3)}{12 - 9}$$

$$= \frac{30\sqrt{3} + 45 - 36 - 18\sqrt{3}}{3}$$

$$= \frac{12\sqrt{3} + 9}{3} = \underline{\underline{3 + 4\sqrt{3}}}$$

Rationalising surds (2)

Review Exercise

1. Rationalise the following giving your answer in the form $a + b\sqrt{5}$.
State a and b . $\frac{24}{1+\sqrt{5}}$
2. Rationalise the following giving your answer in the form $a + b\sqrt{6}$.
State a and b . $\frac{2}{5-\sqrt{6}}$
3. Rationalise the following giving your answer in the form $a + b\sqrt{7}$.
State a and b . $\frac{18}{-2+\sqrt{7}}$
4. A rectangle has an area $(10 + 4\sqrt{3}) \text{ cm}^2$ and a width of $(3\sqrt{3} - 5) \text{ cm}$.
Find the length and state your answer in the form $a + b\sqrt{3}$ where a and b are integers.

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Review Exercise (Answers)

1. Rationalise the following giving your answer in the form $a + b\sqrt{5}$.
State a and b . $\frac{24}{1+\sqrt{5}}$ $-6+6\sqrt{5}$
 $a=-6, b=6$
2. Rationalise the following giving your answer in the form $a + b\sqrt{6}$.
State a and b . $\frac{2}{5-\sqrt{6}}$ $\frac{10}{19} + \frac{2}{19}\sqrt{6}$
 $a = \frac{10}{19}, b = \frac{2}{19}$
3. Rationalise the following giving your answer in the form $a + b\sqrt{7}$.
State a and b . $\frac{18}{-2+\sqrt{7}}$ $12+6\sqrt{7}$
 $a=12, b=6$
4. A rectangle has an area $(10 + 4\sqrt{3}) \text{ cm}^2$ and a width of $(3\sqrt{3} - 5) \text{ cm}$.
Find the length and state your answer in the form $a + b\sqrt{3}$ where
 a and b are integers. $43+25\sqrt{3}$