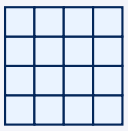
INTRODUCING SURDS

BUILDING BLOCKS

NAME _____ CLASS _____ DATE _____

KEY IDEA



side 4

A square with area 16 has side length 4.

So the square root of 16 is 4: $\sqrt{16} = 4$

Square numbers: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, ...

1 Complete the table of square numbers.

n	1	2	3	4	5	6	7	8
n^2	1	4						

2 Find each square root.

a) $\sqrt{25}$ = ☐ b) $\sqrt{36}$ = ☐ c) $\sqrt{64}$ = ☐

d) $\sqrt{100}$ = ☐ e) $\sqrt{1}$ = ☐ f) $\sqrt{49}$ = ☐

3 The blue numbers are the square numbers. Use them to answer.

Example: $9 < 10 < 16$, so $\sqrt{10}$ is between 3 and 4.



a) $\sqrt{20}$ is between ☐ and ☐ b) $\sqrt{50}$ is between ☐ and ☐

4 Collect like terms. You will use this idea with surds.

a) $3x + 6x$ = ☐ b) $4a + 3a - 2a$ = ☐

c) $6p - p$ = ☐ d) $y + y + y$ = ☐

INTRODUCING SURDS

SUPPORT

NAME _____ CLASS _____ DATE _____

KEY IDEA

$\sqrt{25} = 5$ is an integer. $\sqrt{2}, \sqrt{10}, \sqrt{30}$ are surds: roots that are irrational.

Surds behave like letters: $3\sqrt{5} + 4\sqrt{5} = 7\sqrt{5}$ (like $3x + 4x = 7x$)

$\sqrt{a} \times \sqrt{a} = a$ $\quad$ $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$

1 Circle the surds.

$\sqrt{16}$ $\quad$ $\sqrt{15}$ $\quad$ $\sqrt{49}$ $\quad$ $\sqrt{50}$ $\quad$ $\sqrt{1}$ $\quad$ $\sqrt{2}$ $\quad$ $\sqrt{81}$ $\quad$ $\sqrt{30}$

2 Collect like terms. Do the surds in the same way as the letters.

$2x + 4x =$ ☐

$7y - 3y =$ ☐

$a + a + a =$ ☐

$2\sqrt{3} + 4\sqrt{3} =$ ☐

$7\sqrt{5} - 3\sqrt{5} =$ ☐

$\sqrt{2} + \sqrt{2} + \sqrt{2} =$ ☐

3 Work out:

a) $\sqrt{5} \times \sqrt{5} =$ ☐ $\quad$ b) $\sqrt{11} \times \sqrt{11} =$ ☐ $\quad$ c) $(\sqrt{7})^2 =$ ☐

d) $\sqrt{4} \times \sqrt{25} =$ ☐ $\times$ ☐ $=$ ☐ $\quad$ $\sqrt{4 \times 25} = \sqrt{100} =$ ☐

4 Multiply. Write each answer as one square root.

a) $\sqrt{2} \times \sqrt{3} = \sqrt{\square}$ $\quad$ b) $\sqrt{5} \times \sqrt{7} = \sqrt{\square}$ $\quad$ c) $\sqrt{3} \times \sqrt{10} = \sqrt{\square}$

INTRODUCING SURDS

CORE

NAME _____ CLASS _____ DATE _____

KEY IDEA

$a\sqrt{c} + b\sqrt{c} = (a + b)\sqrt{c}$ $\quad \sqrt{a} \times \sqrt{b} = \sqrt{ab}$ $\quad \sqrt{a} \div \sqrt{b} = \sqrt{a \div b}$

Simplify using a square factor: $\sqrt{12} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$

FLUENCY

1 Simplify.

a) $4\sqrt{3} + 2\sqrt{3} =$ ☐

b) $9\sqrt{7} - 4\sqrt{7} =$ ☐

c) $3\sqrt{2} + 5\sqrt{3} - \sqrt{2} =$ ☐

d) $\sqrt{6} + \sqrt{6} =$ ☐

2 Work out. Give each answer in its simplest form.

a) $\sqrt{5} \times \sqrt{6} =$ ☐

b) $\sqrt{22} \div \sqrt{2} =$ ☐

c) $\sqrt{6} \times \sqrt{6} =$ ☐

d) $2\sqrt{5} \times 3\sqrt{2} =$ ☐

3 Write each surd in the form $a\sqrt{b}$, where b is as small as possible.

a) $\sqrt{18} =$ ☐

b) $\sqrt{20} =$ ☐

c) $\sqrt{75} =$ ☐

REASONING

4 Explain your thinking.

a) Tom says $\sqrt{18} = 9$ because $18 \div 2 = 9$. Explain why Tom is wrong.

.....

b) Explain why $2\sqrt{7} + 7\sqrt{2}$ cannot be simplified to one surd.

.....

INTRODUCING SURDS

GREATER DEPTH

NAME _____ CLASS _____ DATE _____

REASONING

1 Is each statement always, sometimes or never true? Circle your answer.

If it is sometimes true, give an example of when it is true and when it is not.

a) $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$ ALWAYS SOMETIMES NEVER

b) $\sqrt{a} + \sqrt{b} = \sqrt{a + b}$ ALWAYS SOMETIMES NEVER

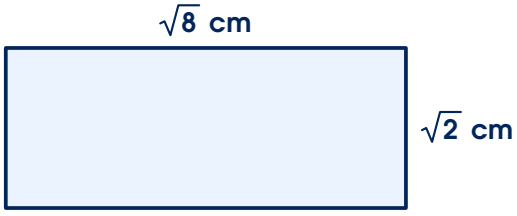
c) The product of two surds is a surd. ALWAYS SOMETIMES NEVER

d) The square of a surd is an integer. ALWAYS SOMETIMES NEVER

(a and b are positive whole numbers)

PROBLEM SOLVING

2 Here is a rectangle.



a) Area = ☐ cm^2

b) Perimeter = ☐ cm

Give the perimeter in its simplest form.

3 Find the missing numbers.

a) $\sqrt{\square} \times \sqrt{3} = 6$ **b)** $\sqrt{72} = \square\sqrt{2}$ **c)** $(\sqrt{5} + \sqrt{5})^2 = \square$

★ CHALLENGE FOR ALL

4 a) Write these numbers in order of size, smallest first.

$2\sqrt{5}$ $3\sqrt{2}$ $\sqrt{19}$ 4

Smallest ☐ ☐ ☐ ☐ Largest

b) Find the whole number n so that $n\sqrt{2}$ is between 11 and 12. ☐

INTRODUCING SURDS

ANSWERS

BUILDING BLOCKS

1 9, 16, 25, 36, 49, 64

2 a) 5 · b) 6 · c) 8 · d) 10 · e) 1 · f) 7

3 a) 4 and 5 · b) 7 and 8

4 a) 9x · b) 5a · c) 5p · d) 3y

SUPPORT

1 $\sqrt{15}$, $\sqrt{50}$, $\sqrt{2}$, $\sqrt{30}$

2 6x, $6\sqrt{3}$ · 4y, $4\sqrt{5}$ · 3a, $3\sqrt{2}$

3 a) 5 · b) 11 · c) 7 · d) $2 \times 5 = 10$; $\sqrt{100} = 10$ (the same)

4 a) $\sqrt{6}$ · b) $\sqrt{35}$ · c) $\sqrt{30}$

CORE

1 a) $6\sqrt{3}$ · b) $5\sqrt{7}$ · c) $2\sqrt{2} + 5\sqrt{3}$ · d) $2\sqrt{6}$

2 a) $\sqrt{30}$ · b) $\sqrt{11}$ · c) 6 · d) $6\sqrt{10}$

3 a) $3\sqrt{2}$ · b) $2\sqrt{5}$ · c) $5\sqrt{3}$

4 a) Square rooting is not halving: $9 \times 9 = 81$, not 18 ($\sqrt{18} = 3\sqrt{2} \approx 4.24$) · b) $\sqrt{7}$ and $\sqrt{2}$ are different surds, so they are not like terms

GREATER DEPTH

1 a) always · b) never · c) sometimes: $\sqrt{2} \times \sqrt{3} = \sqrt{6}$, but $\sqrt{2} \times \sqrt{8} = 4$ · d) always ($(\sqrt{n})^2 = n$)

2 a) $\sqrt{16} = 4$ cm² · b) $2\sqrt{8} + 2\sqrt{2} = 4\sqrt{2} + 2\sqrt{2} = 6\sqrt{2}$ cm

3 a) 12 · b) 6 · c) $(2\sqrt{5})^2 = 20$

4 a) 4, $3\sqrt{2}$, $\sqrt{19}$, $2\sqrt{5}$ ($\sqrt{16}$, $\sqrt{18}$, $\sqrt{19}$, $\sqrt{20}$) · b) n = 8 ($8\sqrt{2} = \sqrt{128}$)