Student Name

Mathematics Stage 4

INDICES

Book 2 Examine cube roots and square roots

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CONTENTS

OVERVIEW

SYLLABUS CONTENT

MA4-INT-C-01 operates with primes and roots, positive-integer and zero indices involving numerical bases and establishes the relevant index laws

Examine cube roots and square roots

- Use the notations for square root ($\sqrt{}$) and cube root ($\sqrt[3]{}$)
- Recognise and describe the relationship between squares and square roots, and cubes and cube roots for positive numbers
- Verify, through numerical examples, that $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$
- Estimate the square root of any non-square whole number and the cube root of any non-cube whole number, then check using a calculator
- Identify and describe exact and approximate solutions in the context of square roots and cube roots
- Apply the order of operations to evaluate expressions involving square roots, cube roots, square numbers and cube numbers

SUMMARY

Square and Cube Roots

Square Rooting

Square rooting is the inverse operation of squaring.

$1^2 = 1$ $2^2 = 4$ $3^2 = 9$ $4^2 = 16$ $5^2 = 25$ $6^2 = 36$

$\sqrt{1} = 1$ $\sqrt{4} = 2$ $\sqrt{9} = 3$ $\sqrt{16} = 4$ $\sqrt{25} = 5$ $\sqrt{36} = 6$

Cube Rooting

Cube rooting is the inverse operation of cubing.

$1^3 = 1$ $2^3 = 8$ $3^3 = 27$ $4^3 = 64$ $5^3 = 125$

$\sqrt[3]{1} = 1$ $\sqrt[3]{8} = 2$ $\sqrt[3]{27} = 3$ $\sqrt[3]{64} = 4$ $\sqrt[3]{125} = 5$

Order of Operations

Write a new line for every operation you do

Operations in **B**rackets	$(\square)$
Indices/Roots	$\square^2$ $\sqrt{\square}$
Division/**M**ultiplication	$\times$ $\div$
Addition/**S**ubtraction	$-$ $+$

$3^3 - \sqrt{9}$

$= 27 - 3$

$= 24$

Estimating Roots

If a number x lies between two perfect squares a^2 and b^2, then $\sqrt{x}$ will lie between a and b.

1. Identify two perfect squares between which the given number lies.
2. The square root of the number lies between the square roots of these perfect squares.

$\sqrt{2}$

1. $\sqrt{2}$ is between $\sqrt{1}$ and $\sqrt{4}$
2. $\sqrt{2}$ is between 1 and 2

Check using a calculator: $\sqrt{2} = 1.4142\ldots$

REVIEW OF PRIOR KNOWLEDGE

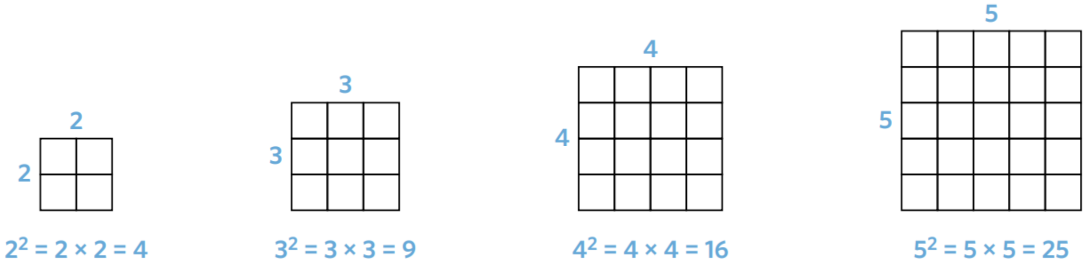
1 Complete the following using the order of operations.

a $3 \times 5 + 4 - 2$	**b** $3 \times 5 - 2 + 4$	**c** $3 - 5 + 4 \times 2$
d $3 - 5 \times 4 + 2$	**e** $(4 + 5)^2$	**f** $4 + 5^2$
g $2 + (3 \times 4^2)$	**h** $6 \times (2^3 + 8)$	**i** $4 + (6 \div (2 \times 5)^2)$

SQUARE ROOTS

SQUARING A NUMBER

- Squaring a number means to multiply the number by itself.
- This is the same as raising to the power of 2.
- By squaring a number, we make a square with that side length.
- A **perfect square** the square of a whole number.



Example Identify perfect squares.

$1^2 = 1 \times 1 =$	$9^2 =$
$2^2 =$	$10^2 =$
$3^2 =$	$11^2 =$
$4^2 =$	$12^2 =$
$5^2 =$	$13^2 =$
$6^2 =$	$14^2 =$
$7^2 =$	$15^2 =$
$8^2 =$	

Square these numbers.

a 8^2

$=$

64

b 13^2

$=$

169

c 100^2

$=$

10 000

d 0.4^2

$=$

0.16

e 1.1^2

$=$

1.21

f 15^2

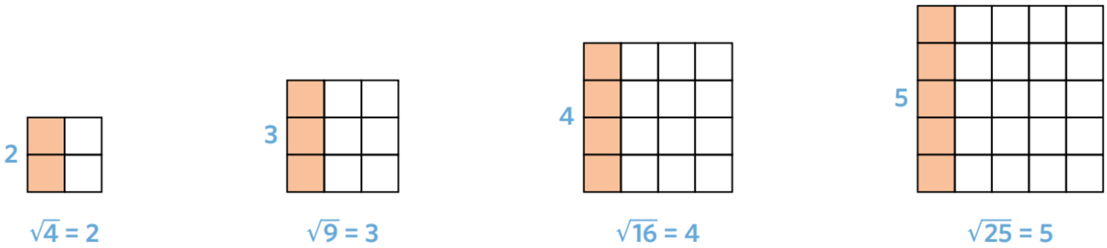
$=$

225

SQUARE ROOTS

- **Square rooting** $\sqrt{\ }$ a number is the inverse operation of squaring a number.

$$4^2 = 16$$
$$\sqrt{16} = 4$$



Square Roots: https://www.geogebra.org/m/wxvue3sb

Example Identify square roots of perfect squares.

$\sqrt{1} =$	$\sqrt{4} =$	$\sqrt{25} =$	$\sqrt{121} =$
$\sqrt{16} =$	$\sqrt{49} =$	$\sqrt{36} =$	$\sqrt{100} =$
$\sqrt{9} =$	$\sqrt{81} =$	$\sqrt{64} =$	$\sqrt{144} =$

Key ideas

1. Squaring a number means to ……………… a number by itself.
2. Square rooting is the ………………… operation of squaring. It will “undo” a square.

1 Evaluate:

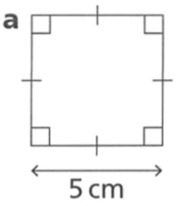
a 6^2 36	**b** 6 squared 36	**c** 6 to the power of 2 36
d 6×6 36	**e** 5^2 25	**f** 11^2 121
g 13^2 169	**h** 12^2 144	**i** 9^2 81
j 100^2 10 000	**k** 0^2 0	**l** 1^2 1

2 Evaluate:

a $\sqrt{36}$ 6	**b** Square root of 36 6	**c** $\sqrt{25}$ 5
d $\sqrt{169}$ 13	**e** $\sqrt{4}$ 2	**f** $\sqrt{0}$ 0
g $\sqrt{49}$ 7	**h** $\sqrt{100}$ 10	**i** $\sqrt{400}$ 20
j $\sqrt{1}$ 1	**k** $\sqrt{49}$ 7	**l** $\sqrt{144}$ 12
m $\sqrt{169}$ 13	**n** $\sqrt{196}$ 14	**o** $\sqrt{225}$ 15

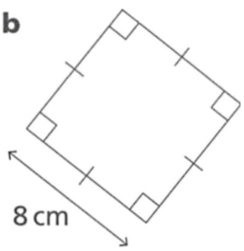
3 Calculate the area of each square.

a



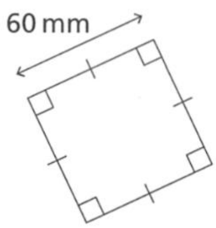
25 cm^2

b



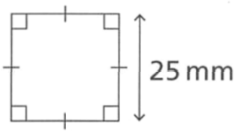
64 cm^2

c



3600 mm^2

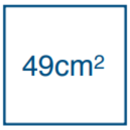
d



625 mm^2

4 Find the side lengths of these squares.

a



7 cm

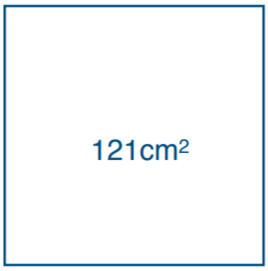
b

8 cm

c

6 cm

d



11 cm

5 Find the missing values.

a $\_\_\_^2 = 9$

3

b $\_\_\_^2 = 25$

5

c $\_\_\_^2 = 16$

4

d $\_\_\_^2 = 49$

7

6 List all the square numbers between 101 and 200. Hint: There are only four.

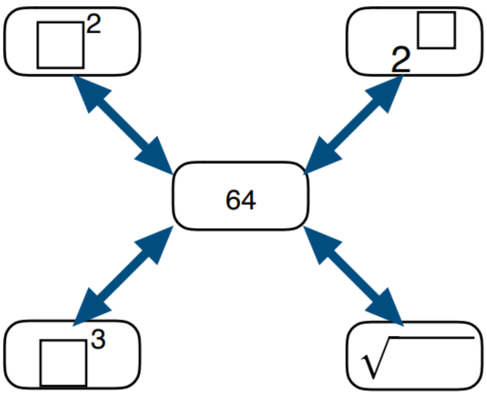
121, 144, 169, 196

7 Type $\sqrt{-1}$ into the calculator. Try this with square roots of other negative numbers. Explain.

You cannot square root a negative number, since the square of a number must be positive.

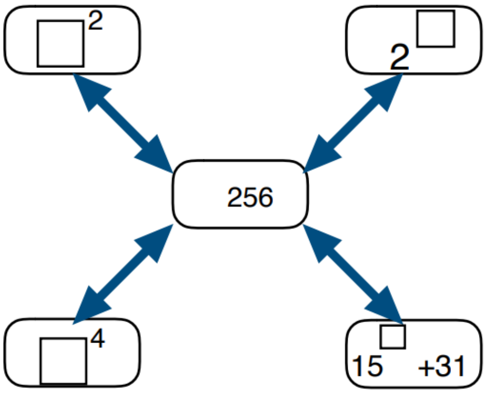
8 Fill in the missing numbers to make each box equal to each other.

a



Clockwise from top-left: $8^2, 2^6, \sqrt{4096}, 4^3$

b



Clockwise from top-left: $16^2, 2^8, 15^2 + 31, 4^4$

9 First determine the prime factorisation of the quantity, then use it to find the square root.

a $196 = 2 \times 2 \times 7 \times 7$

$= 2^2 \times 7^2$

$= 14^2$

$\sqrt{196} = \ldots\ldots\ldots$

14

b $100 = 2 \times 2 \times 5 \times 5$

$= \ldots\ldots\ldots\ldots\ldots$

$= \ldots\ldots\ldots\ldots\ldots$

$\sqrt{100} = \ldots\ldots\ldots\ldots\ldots$

10

c $225 = 3 \times 3 \times \ldots\ldots\ldots \times \ldots\ldots\ldots$

$= 3^2 \times \ldots\ldots$

$= \ldots\ldots\ldots\ldots$

$\sqrt{225} = \ldots\ldots\ldots\ldots$

15

d $900 =$

$\sqrt{900} =$

30

10 Find the square root of each of the following numbers using its prime factorisation.

a $441 = 3 \times 3 \times 7 \times 7$

21

b $5625 = 3 \times 3 \times 5 \times 5 \times 5 \times 5$

75

c $9801 = 3 \times 3 \times 3 \times 3 \times 11 \times 11$

99

d $1296 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3$

36

11

a Draw the factor tree of 784

Use the prime factorisation of 784 to find $\sqrt{784}$

28

b Draw the factor tree of 4356

Hence find $\sqrt{4356}$

66

12

a List the factors of the number 20

$1, 20 \quad 2, 10 \quad 4, 5$

b List the factors of the number 49

$1, 7, 49$

c The number of factors of a square number will always be odd. Why is this true?

Factors usually come in “pairs,” so most numbers have an even number of factors.

Square numbers have a “pair” that is a number and itself, so it only counts as 1. An even number of factors plus 1 is always odd.

13

a Evaluate 12^2

144

b Evaluate $3^2 \times 4^2$

144

c The rule $(ab)^2 = a^2b^2$ can be used to link 12^2 and $3^2 \times 4^2$. Check this rule is always true using three pairs of other numbers (you may use a calculator).

14 Use the rule above to evaluate mentally:

a $2^2 \times 4^2$	**b** $6^2 \times 2^2$	**c** $10^2 \times 5^2$
64	144	2500

15 Use a calculator to:

a Evaluate $\sqrt{36} + \sqrt{64}$

14

b Evaluate $\sqrt{36 + 64}$

10

c Is $\sqrt{36} + \sqrt{64} = \sqrt{36 + 64}$?

no

16 Use a calculator to:

a Evaluate $\sqrt{36} \times \sqrt{64}$

48

b Evaluate $\sqrt{36 \times 64}$

48

c Is $\sqrt{36} \times \sqrt{64} = \sqrt{36 \times 64}$?

yes

17 Find the smallest whole number n such that $\sqrt{2016n}$ is a whole number.

$2016n = 2^5 \times 3^2 \times 7 \times n$

For a square root to be a whole number, it must be a perfect square.

So all the powers must be multiples of 2.

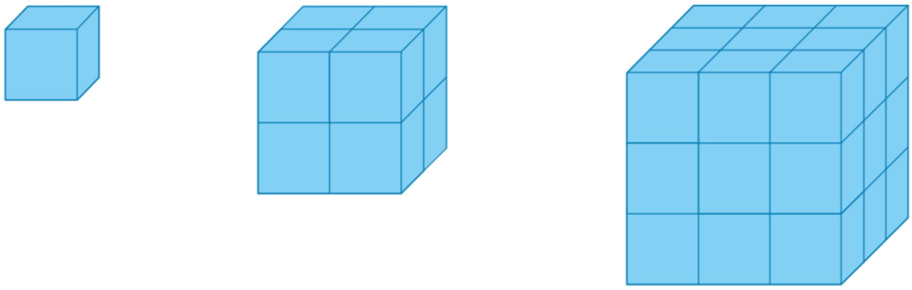
Smallest number for n is $2 \times 7 = 14$

CUBE ROOTS

CUBING A NUMBER

- **Cubing** a number means to use a number in a multiplication 3 times.
  It is shown by the index number ^{3}
- By cubing a number, we have made a cube with that side length.

$1^3 = 1 \times 1 \times 1 = 1$ $2^3 = 2 \times 2 \times 2 = 8$ $3^3 = 3 \times 3 \times 3 = 27$



CUBE ROOTS

- Cube rooting a number is the inverse operation of cubing a number.
- The cube root symbol is written as $\sqrt[3]{}$

Cube Roots: https://www.geogebra.org/m/hmmv2sud

Example Perfect cubes and cube roots

$1^3 =$	$4^3 =$	$\sqrt[3]{1} =$	$\sqrt[3]{216} =$
$2^3 =$	$5^3 =$	$\sqrt[3]{27} =$	$\sqrt[3]{64} =$
$3^3 =$	$6^3 =$	$\sqrt[3]{8} =$	$\sqrt[3]{125} =$

Evaluate the following numbers.

a 4^3

64

b 5^3

125

c 3^3

27

d $\sqrt[3]{1000}$

10

e $\sqrt[3]{64}$

4

f $\sqrt[3]{8}$

2

Key ideas

1. Cubing a number means to use a number in a multiplication ……… times.
2. Cube rooting is the ………………… operation of cubing. It will "undo" a cube.

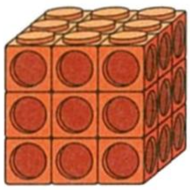
1 Evaluate the following.

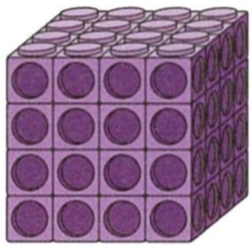
a 2^3 8	**b** 2 cubed 8	**c** 2 to the power of 3 8
d 4^3 64	**e** 3^3 27	**f** 5^3 125
g 10^3 1000	**h** $\sqrt[3]{64}$ 4	**i** $\sqrt[3]{125}$ 5
j $\sqrt[3]{1000}$ 10	**k** $\sqrt[3]{1}$ 1	**l** $\sqrt[3]{0}$ 0

2 How many small cubes are used to make each bigger cube?

a

8

b

27

c

64

3 Evaluate each expression.

a	2^4	………… 16	**f**	4^3	………… 64
b	8^2	………… 64	**g**	3^4	………… 81
c	$\sqrt[3]{27}$	………… 3	**h**	$\sqrt{9}$	………… 3
d	3^4	………… 81	**i**	2^6	………… 64
e	$\sqrt[3]{1000}$	………… 10	**j**	$\sqrt{256}$	………… 16

Therefore, match the left and right columns in the table above.

4 Using a calculator, or otherwise, evaluate the following:

a $\sqrt[3]{27}$	**b** $\sqrt[4]{16}$	**c** $\sqrt[5]{100\,000}$	**d** $\sqrt[3]{125}$	**e** $\sqrt[3]{343}$
3	2	10	5	7

5

a Use the fact that $5^7 = 78\,125$ to work out $\sqrt[7]{78\,125}$

5

b Use the fact that $\sqrt[4]{1296} = 6$ to evaluate 6^4

1296

c Given that $2^{10} = 1024$, work out $\left(\sqrt[10]{1024}\right)^2$

4

6

a Evaluate 3^3

27

b Evaluate $(-3)^3$

-27

c Complete the sentence:

A positive number cubed will always be …………………

positive

A negative number cubed will always be …………………

negative

7 $x^3 = 71$. What is $(-x)^3$? Explain how you know.

-71, as $(-x)^3 = -x^3$

8 $\sqrt[3]{p} = 43$. What is $\sqrt[3]{-p}$?

-43

ESTIMATING SQUARE ROOTS AND CUBE ROOTS

- If $a^2 < x < b^2$, then $a < \sqrt{x} < b$
- To estimate square roots:
  1. Identify two perfect squares between which the given number lies.
  2. The square root of the number lies between the square roots of these perfect squares.

- To get the exact value, you'll usually need to use a calculator.

Example Estimate square roots

$\sqrt{\mathbf{2}}$	Why did we choose $\sqrt{1}$ and $\sqrt{4}$, rather than $\sqrt{3}$?
1. $\sqrt{2}$ is between $\sqrt{1}$ and $\sqrt{4}$ 2. $\sqrt{2}$ is between 1 and 2 Check using a calculator: $\sqrt{2} = 1.4142 \dots$	*$\sqrt{1}$ and $\sqrt{4}$ make …………… numbers.*

Estimate the value of these square roots.

a $\sqrt{13}$

$\sqrt{13}$ is between $\sqrt{9}$ and $\sqrt{16}$

$\sqrt{13}$ is between …. and ……

$\sqrt{13}$ is between 3 and 4

b $\sqrt{17}$

$\sqrt{17}$ is between $\sqrt{\quad}$ and $\sqrt{\quad}$

$\sqrt{17}$ is between …… and ……

$\sqrt{17}$ is between 4 and 5

c $\sqrt{68}$

$\sqrt{68}$ is between $\sqrt{\quad}$ and $\sqrt{\quad}$

$\sqrt{68}$ is between …… and ……

$\sqrt{68}$ is between 8 and 9

Key ideas

1. We can estimate square roots if we know which two ………… numbers it lies between.

1 Complete the number line.

Using the number line, between which two integers does each value lie?

i $\sqrt{50}$ 7 and 8	**ii** $\sqrt{29}$ 5 and 6	**iii** $\sqrt{45}$ 6 and 7	**iv** $\sqrt{63}$ 7 and 8

2 Estimate the value of these square roots and plot their approximate location on a number line. $\sqrt{3}$ has been done for you.

a $\sqrt{1}$ $\sqrt{1} = 1$	**b** $\sqrt{2}$ $1 < \sqrt{2} < 2$	**c** $\sqrt{3}$ $\sqrt{1} < \sqrt{3} < \sqrt{4}$ $1 < \sqrt{3} < 2$	**d** $\sqrt{7}$ $2 < \sqrt{7} < 3$
e $\sqrt{16}$ $\sqrt{16} = 4$	**f** $\sqrt{35}$ $6 < \sqrt{35} < 7$	**g** $\sqrt{50}$ $7 < \sqrt{50} < 8$	**h** $\sqrt{64}$ $\sqrt{64} = 8$

Did you place $\sqrt{3}$ before or after $\sqrt{2}$? Why?

After, since $\sqrt{3}$ must be larger than $\sqrt{2}$

Check the location of your estimates using a calculator.

3 Estimate the value of these cube roots and plot their approximate location on a number line.

a $\sqrt[3]{8}$ $\sqrt[3]{8} = 2$	**b** $\sqrt[3]{16}$ $\sqrt[3]{8} < \sqrt[3]{16} < \sqrt[3]{27}$	**c** $\sqrt[3]{80}$ $4 < \sqrt[3]{80} < 5$	**d** $\sqrt[3]{310}$ $6 < \sqrt[3]{310} < 7$

EVALUATE EXPRESSIONS WITH ROOTS

ORDER OF OPERATIONS

- Evaluate roots after operations in brackets and before multiplication/division.
- If both indices and roots are present, evaluate from left to right.
- **Note**: There are invisible brackets inside square roots. $\sqrt{a+b} = \sqrt{(a+b)}$

Write a new line for every operation you do

Operations in **B**rackets	$(\square)$	Operations in innermost brackets first
Indices/Roots	$\square^2 \quad \sqrt{\square}$	Left to right
Division/**M**ultiplication	$\times \quad \div$	Left to right
Addition/**S**ubtraction	$- \quad +$	Left to right

Example Evaluate expressions with roots.

$\mathbf{3^3 - \sqrt{9}}$ $= 27 - 3$ $= 24$	Which operations did we do first? *We did .... and .... first*
$\mathbf{\sqrt{8^2 + 6^2}}$ $= \sqrt{64 + 36}$ $= \sqrt{100}$ $= 10$	Add brackets to the expression. Which operations did we do first? *We did .... and .... because they were inside ....*

Evaluate these expressions.

a $\sqrt{81} - 3$

6

b $\sqrt{121} - 2^4$

-5

c $\sqrt{3^2 + 4^2}$

5

d $3^2 - \sqrt{9}$

6

e $\sqrt[3]{10^2 + 5^2}$

5

f $\sqrt{\frac{20\times3+15}{3}}$

5

g $\left(\sqrt{9}\right)^3 + 5 \times \sqrt{100}$

77

h $\left(\sqrt{7^2} - \sqrt{16}\right) \div \sqrt{144}$

$\frac{1}{4}$

i $3\left(\sqrt{4} + \sqrt{25}\right)^2$

147

1 Evaluate these expressions according to the order of operations.

a $\sqrt{11+5}\times 2$

8

b $6\times\sqrt{3+1}$

12

c $45\div\sqrt{17+8}$

9

d $50\div 5^2+8$

10

e $100\div(4+1)^2$

4

f $100\div\sqrt{20+5}$

20

g $\sqrt{3^2+4^2}$

5

h $\sqrt{5^2-3^2}$

4

i $\sqrt{9}\times\sqrt{64}\div\sqrt{36}$

2

j 4^3+2^2

68

k $3^3+2\times 4^2$

59

l $5^2\div\sqrt{9+16}$

5

m $\frac{5\times(3+1)^2}{17+3}$

4

n $\sqrt{\frac{100-64}{9}}$

2

o $\sqrt{\frac{10^2-8^2}{3^2}}$

2

p $\sqrt[3]{\frac{5^2-3^2}{2}}\times\sqrt[3]{8}$

4

q $\sqrt{\frac{9-5}{9}}$

$\frac{2}{3}$

r $\sqrt{\frac{28+4}{28+22}}+5$

$\frac{29}{5}$

2 Evaluate the following.

a $12 + 4 \times \sqrt{9}$

24

b $(12 + 4) \times \sqrt{9}$

48

c $12 + \sqrt{4 \times 9}$

18

d $\sqrt{12 + 4} \times 9$

36

e $12 + \sqrt{4} \times \sqrt{9}$

30

f $12 \times \sqrt{4} + 9$

33

g $12 \times \sqrt{4} - 9$

15

h $12 \times (\sqrt{4} - 9)$

-84

i $12 - 9 \times \sqrt{4}$

-6

j $12^2 - 9 \times \sqrt{4}$

126

k $(12^2 - 9) \times \sqrt{4}$

270

l $12^2 - \sqrt{9 \times 4}$

138

3 Explain what is wrong with this solution and provide the correct solution.

$$\begin{aligned}\left(\sqrt{81} - \sqrt{36}\right)^2 &= \left(\sqrt{81}\right)^2 - \left(\sqrt{36}\right)^2 \\ &= 81 - 36 \\ &= 45\end{aligned}$$

Didn't follow order of operations.

$(9 - 6)^2 = 3^2 = 9$

4 Evaluate the following:

a $\sqrt{9} + \sqrt{16} \times \sqrt{25}$

23

b $\left(\sqrt{9} + \sqrt{16}\right) \times \sqrt{25}$

35

c $\left(\sqrt{9} + \sqrt{16}\right)^2 \times \sqrt{25}$

245

d $2\left(\sqrt{9} + \sqrt{16}\right)^2 \times \sqrt{25}$

490

5 Evaluate the following.

a $\sqrt[3]{59+5}$ 4

b $\sqrt[3]{64\times 1000}$ 40

c $\sqrt[3]{27}+\sqrt[3]{8}$ 5

d $\sqrt[3]{64}-4+\sqrt{81}$ 9

e $\sqrt[3]{125}+\sqrt{100}$ 15

f $\left(\sqrt[3]{216}-\sqrt[3]{64}\right)^2\times 25$ 100

g $\left(\sqrt[3]{5}\right)^3+\sqrt{25}+11$ 21

h $\frac{\sqrt[3]{64}}{8}$ $\frac{1}{2}$

6 Show the working out to evaluate the following. Check your answer using a calculator.

a $(6\times 6)\div 3^2-1+11^2$ 124

b $10+\left((10-4)\times(2^3-6)\right)^2\div 2+2$ 84

c $\sqrt{\left(12\times 2^2-(4^2-4)\right)\times 3}$ 18

d $\sqrt{\frac{2+4^2}{8-2\times 3}}$ 3

e $\sqrt{\left((5^2-17)+(6^2-7)+2\right)\div 3}$ $\sqrt{13}$

f $\sqrt{\frac{(45\div(30-5\times 3))^3\times\sqrt{4+5}}{(-3)^2}}$ 3

7 Evaluate the following expression.

$$\frac{\sqrt{49}-1}{\sqrt[3]{-64}} \times \frac{\sqrt{64}}{\sqrt{25}} \div \frac{(-2)^2}{2^3} \times \frac{\sqrt[3]{125}}{3^2}$$

$-\frac{8}{3}$

8 Evaluate the following.

a $\left(\frac{1}{5}\right)^3$ $\frac{1}{125}$	**b** $\left(\frac{4}{7}\right)^2$ $\frac{16}{49}$	**c** $\left(2\frac{1}{4}\right)^2$ $\frac{81}{16}$
d $\sqrt{\frac{1}{4}}$ $\frac{1}{2}$	**e** $\sqrt[3]{-\frac{8}{27}}$ $-\frac{2}{3}$	**f** $\sqrt{1\frac{24}{25}}$ $\frac{7}{5}$
g 0.5^3 $\frac{1}{8}$	**h** $\sqrt{0.04}$ 0.2	**i** $\sqrt[3]{0.343}$ 0.7
j $\left(\frac{1}{2}+\frac{1}{3}\right)^2$ $\frac{25}{36}$	**k** $\left(\frac{1}{2}\right)^2 + \left(\frac{1}{3}\right)^3$ $\frac{31}{108}$	**l** $\left(\sqrt{49} \times \frac{1}{5}\right)^3$ $\frac{343}{125}$
m $\sqrt{\frac{2}{5} \times 1\frac{3}{5}}$ $\frac{4}{5}$	**n** $(1.8-0.9)^2$ 0.81	**o** $\sqrt{1.2-1+0.05}$ 0.5
p $\sqrt{6\frac{19}{25}}$ $\frac{13}{5}$	**q** $\sqrt[3]{1.728}$ $\frac{6}{5}$	**r** $\sqrt{3\frac{1}{9} \times 1\frac{1}{6} \times \frac{2}{3}}$ $\frac{14}{9}$

CHECK YOUR UNDERSTANDING

Square roots

1	A square has an area 64 cm^2. What is the length of one side of the square?							
	a	4 xm	**b**	6 cm	**c**	8 xm	**d**	32 xm
2	What is the square root of 9?							
	a	3	**b**	4.5	**c**	81	**d**	18
3	$\sqrt{36}$							
	a	6	**b**	18	**c**	40	**d**	9
4	$\sqrt{64}$							
	a	4	**b**	6	**c**	8	**d**	32
5	$\sqrt{144}$							
	a	72	**b**	12	**c**	36	**d**	20 736
6	Which statement is true?							
	a	$\sqrt{16} = 8$	**b**	$\sqrt{4} = 16$	**c**	$\sqrt{16} = 4$	**d**	$\sqrt{40} = 4$
7	Between what two numbers does $\sqrt{71}$ lie between?							
	a	35 and 36	**b**	8 and 9	**c**	7 and 8	**d**	9 and 10

Cube roots

1	$\sqrt[3]{27}$							
	a	3	**b**	9	**c**	81	**d**	327
2	$\sqrt[3]{125}$							
	a	5	**b**	25	**c**	$\frac{125}{3}$	**d**	375
3	What two whole numbers does $\sqrt[3]{65}$ lie between?							
	a	8 and 9	**b**	7 and 8	**c**	5 and 6	**d**	4 and 5
4	What two whole numbers does $\sqrt[3]{32}$ lie between?							
	a	2 and 3	**b**	3 and 4	**c**	9 and 10	**d**	10 and 11

Evaluating expressions with roots

1	$5^3 + \sqrt{9}$							
	a	18	**b**	24	**c**	128	**d**	134
2	Which of these expressions does not evaluate to an integer?							
	a	$\sqrt{1} + \sqrt{4}$	**b**	$\sqrt{81} + \sqrt[3]{2}$	**c**	$\sqrt[3]{27} + \sqrt[3]{1}$	**d**	$\sqrt{8} + \sqrt{8}$
3	Which of these expressions does not evaluate to an integer?							
	a	$\sqrt{25} + \sqrt{16}$	**b**	$\sqrt{49} + \sqrt[3]{16}$	**c**	$\sqrt[3]{64} + \sqrt[3]{1}$	**d**	$\sqrt{100} + \sqrt{4}$
4	$\sqrt{8^2}$							
	a	8	**b**	64	**c**	4	**d**	16
5	Tom says $\sqrt{16} + \sqrt{9} = 7$ Katie says $\sqrt{16 + 9} = 7$ Who is correct?							
	a	Only Tom	**b**	Only Katie	**c**	Both	**d**	Neither