Planner

Powers and roots

- Finding squares and square roots
- Cubing numbers
- Finding the cube root of a number
- Using power notation
- Using a calculator to find square roots and cube roots

Keywords

You should know

explanation 1 — online

Remember the correct order when you work out the value of expressions.

First brackets.
Then squares and square roots.
Then division and multiplication.
Finally addition and subtraction.

1 Work these out.

a 9^2 **b** 6^2 **c** 13^2 **d** 15^2

e $3^2 + 5^2$ **f** $8^2 + 7^2$ **g** $12^2 - 4^2$ **h** $4^2 + 7^2 - 3^2$

i $11^2 - 6^2 - 4^2$ **j** $15^2 + 5^2 - 9^2$ **k** 20^2 **l** $10^2 + 30^2$

2 Work these out.

a $\sqrt{16}$ **b** $\sqrt{49}$ **c** $\sqrt{25}$ **d** $\sqrt{100}$

e $\sqrt{144}$ **f** $\sqrt{100} + \sqrt{49}$ **g** $\sqrt{196} - \sqrt{64}$ **h** $\sqrt{81} + \sqrt{25}$

i $3^2 \times \sqrt{121}$ **j** $\sqrt{169} \times \sqrt{36}$ **k** $\sqrt{16} \times \sqrt{100}$ **l** $\sqrt{1600}$

3 What do you notice about the answers to question **2**, parts **k** and **l**?

4 Copy and complete these.

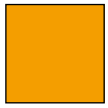
a $\sqrt{400} = \sqrt{(\square \times 100)} = \square \times 10 = \square$

b $\sqrt{2500} = \sqrt{(\square \times \square)} = \square \times \square = \square$

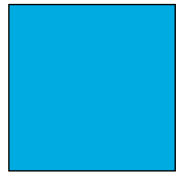
c $\sqrt{6400} = \sqrt{(\square \times \square)} = \square \times \square = \square$

5 Find the area of each square.

a



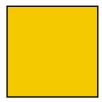
b



c

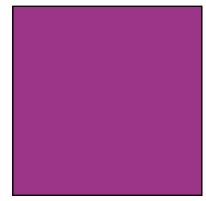
6 Find the length of one side of each square.

a



b

c



7 $2^2 = 4$. This can be written as the sum of two prime numbers: $2 + 2 = 4$.

$3^2 = 9$. This can be written as the sum of two prime numbers: $2 + 7 = 9$.

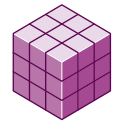
Is it possible to write every square number up to 12^2 as the sum of two prime numbers?

explanation 2

8 Here is a sequence of diagrams showing the cube numbers 1, 8, 27.

$1^3 = 1 \times 1 \times 1 = 1$

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



$3^3 = 3 \times 3 \times 3 = 27$

Copy and complete this table.

Number	1	2	3	4	5	6	7	8	9	10
Number cubed										

9 Work these out.

a $3^3 + 2^3$ **b** $6^3 - 4^3$

c $7^3 + 5^3 - 3^3$ **d** $5^3 \times 2^3$

e half of 8^3 **f** double 10^3

g $9^3 + 2^3$ **h** $5^3 \div 1^3$

Remember the correct order when you work out the value of expressions.

First brackets.
Then squares, cubes, square roots and cube roots.
Then division and multiplication.
Finally addition and subtraction.

10 Work these out.

$(-1)^3 = -1 \times -1 \times -1 = (-1 \times -1) \times -1 = 1 \times -1 = -1$

a $(-4)^3$ **b** 0.1^3 **c** $(-6)^3$ **d** 0.3^3

e $5^3 + (-2)^3$ **f** $1^3 - 0.1^3$ **g** $(-8)^3 - (-9)^3$ **h** $0.5^3 + 0.4^3$

explanation 3

11 Work these out.

a $\sqrt[3]{1}$ **b** $\sqrt[3]{64}$

c $\sqrt[3]{216}$ **d** $3 \times \sqrt[3]{8}$

e $\sqrt[3]{27} + \sqrt[3]{64}$ **f** $2 \times \sqrt[3]{512}$

g $\sqrt[3]{1} + \sqrt[3]{343} - \sqrt[3]{125}$ **h** $\sqrt[3]{1000} \times \sqrt[3]{8}$

12 Copy and complete these.

You will find it helpful to learn these results.

$10 = 10^1$
$100 = 10 \times 10 = 10^2$
$1000 = \square \times \square \times \square = 10^{\square}$
$10\,000 = \square \times \square \times \square \times \square = \square^{\square}$
$100\,000 = \square \times \square \times \square \times \square \times \square = \square^{\square}$
$1\,000\,000 = \square^{\square}$

a Describe the pattern in the numbers in the left-hand column.

b What happens to the powers of 10 as the starting numbers increase?

13 Write each expression using powers. The first one has been done for you.

a $3 \times 3 \times 3 \times 3 = 3^4$ **b** $7 \times 7 \times 7 \times 7 \times 7$

c $9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9$ **d** $13 \times 13 \times 13 \times 13$

explanation 4 online

14 Use your calculator to work these out.

a 18^2 **b** 27^2 **c** 65^2 **d** 81^2

e 120^2 **f** $109^2 - 96^2$ **g** $74^2 + 33^2$ **h** $55^2 - 16^2 - 39^2$

15 Use your calculator to work these out.

a 2.5^2 **b** 5.8^2 **c** 6.1^2 **d** 8.9^2

e 7.3^2 **f** 10.2^2 **g** 9.4^2 **h** 3.3^2

16 Use your calculator to work these out.

a 13^3 **b** 20^3 **c** 16^3 **d** 25^3

e 1.8^3 **f** 3.7^3 **g** 4.5^3 **h** 10.1^3

explanation 5 online

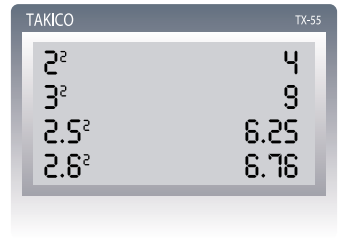
17 Copy and complete using consecutive whole numbers.

a $\square < \sqrt{6} < \square$ **b** $\square < \sqrt{24} < \square$ **c** $\square < \sqrt{45} < \square$

d $\square < \sqrt{88} < \square$ **e** $\square < \sqrt{152} < \square$ **f** $\square < \sqrt{200} < \square$

18 $\sqrt{8}$ lies between 2 and 3. Using only the x^2 button on your calculator it is possible to find a more accurate estimate.

Try 2.5 and continue trying other numbers to find the closest values, to 1 decimal place, to complete $\square < 8 < \square$.



19 Use this method to find better estimates for the square roots of the numbers in question **17**.

20 Use the $\sqrt{\ }$ button on your calculator to check your answers to question **19**.