

Powers and Roots

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (4 marks)

- (a) Write down the value of 9^2

9^2 means 9×9

$$9 \times 9 = 81$$

Answer: 81

Tip: 9^2 means 9×9 , not 9×2 .

- (b) Write down the value of $\sqrt{49}$

Which number times itself makes 49?

$$7 \times 7 = 49$$

Answer: 7

- (c) Write down the value of 4^3

4^3 means $4 \times 4 \times 4$

$$4 \times 4 = 16$$

$$16 \times 4 = 64$$

Answer: 64

- (d) Write down the value of $\sqrt[3]{1000}$

Which number, used three times in a multiplication, makes 1000?

$$10 \times 10 \times 10 = 1000$$

Answer: 10

2 (2 marks)

Here is a list of numbers.

4 8 12 16 27 36 64 100

From the list, write down

- (a) a number that is both a square number and a cube number,

Square numbers in the list: 4, 16, 36, 64, 100

Cube numbers in the list: 8, 27, 64

64 is in both lists: $64 = 8^2$ and $64 = 4^3$

Answer: 64

Tip: A cube number is a number times itself times itself ($4 \times 4 \times 4 = 64$), not a number times 3.

- (b) all the numbers that are powers of 4

Powers of 4 are what you get by multiplying 4 by itself again and again.

$$4^1 = 4$$

$$4^2 = 4 \times 4 = 16$$

$$4^3 = 16 \times 4 = 64$$

$$4^4 = 64 \times 4 = 256, \text{ which is too big.}$$

8, 12 and 36 are multiples of 4, but not powers of 4.

Answer: 4, 16, 64

Tip: Powers of 4 (4, 16, 64, ...) are not the same as multiples of 4 (4, 8, 12, 16, ...).

3 (2 marks)

Work out $\sqrt{2^4 + 3^2}$

Work out inside the square root first.

$$2^4 = 2 \times 2 \times 2 \times 2 = 16$$

$$3^2 = 3 \times 3 = 9$$

$$16 + 9 = 25$$

$$\sqrt{25} = 5$$

Answer: 5

Marks: 1 mark for 25. 1 mark for 5.

4 (3 marks)

- (a) Use your calculator to work out $\frac{\sqrt{27.8}}{1.6^3}$

Write down all the figures on your calculator display.

Work out the top: $\sqrt{27.8} = 5.272570 \dots$

Work out the bottom: $1.6^3 = 1.6 \times 1.6 \times 1.6 = 4.096$

Divide: $5.272570 \dots \div 4.096 = 1.287248 \dots$

Answer: 1.287248...

Tip: Use the fraction button on your calculator so the whole top is divided by the whole bottom. Write down all the figures before you round.

Marks: 1 mark for 5.27... or 4.096. 1 mark for 1.287248...

- (b) Write your answer to part (a) correct to 3 significant figures.

1.287248 ...

The first three significant figures are 1, 2, 8.

The next figure is 7, which is 5 or more, so round up.

1.28 becomes 1.29

Answer: 1.29

5 (1 mark)

Find the value of n when $2^n = 128$

Keep doubling from 2 and count the 2s:

2, 4, 8, 16, 32, 64, 128

That is seven 2s multiplied together.

So $2^7 = 128$

Answer: 7

6 (1 mark)

Write down a square number between 50 and 70

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

Only 64 is between 50 and 70.

$64 = 8 \times 8$

Answer: 64

Tip: Write the value, 64. Writing 8^2 or 8 is not enough.

7 (2 marks)

Priya says 2^3 is bigger than 3^2

Is Priya correct?

You must show your working.

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

$$3^2 = 3 \times 3 = 9$$

9 is bigger than 8, so 3^2 is bigger.

Priya is not correct.

Answer: No, $3^2 = 9 > 8 = 2^3$

Marks: 1 mark for working out 8 and 9. 1 mark for “No” with a correct reason.

8 (2 marks)

Find the value of $\sqrt{0.16} + 0.2^2$

$$\sqrt{0.16} = 0.4, \text{ because } 0.4 \times 0.4 = 0.16$$

$$0.2^2 = 0.2 \times 0.2 = 0.04$$

$$0.4 + 0.04 = 0.44$$

Answer: 0.44

Tip: Count the decimal places: 0.2×0.2 has 2 decimal places, so it is 0.04, not 0.4.

Marks: 1 mark for 0.4 or 0.04. 1 mark for 0.44.

9 (2 marks)

Estimate the value of $\sqrt{90}$ to 1 decimal place.

You must show your working.

Find the square numbers either side of 90:

$$9^2 = 81 \text{ and } 10^2 = 100$$

So $\sqrt{90}$ is between 9 and 10.

90 is about halfway between 81 and 100, so try 9.5:

$$9.5^2 = 90.25, \text{ which is just over 90.}$$

So $\sqrt{90}$ is just under 9.5, about 9.5 to 1 decimal place.

Answer: 9.5 (accept 9.4 to 9.5)

Marks: 1 mark for using $9^2 = 81$ and $10^2 = 100$ (or trying a value such as 9.5^2). 1 mark for an answer from 9.4 to 9.5.

10 (2 marks)

Write these numbers in order of size.
Start with the smallest number.

$$2^5 \quad 5^2 \quad \sqrt{900} \quad 3^3$$

Work out each one:

$$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$$

$$5^2 = 5 \times 5 = 25$$

$$\sqrt{900} = 30, \text{ because } 30 \times 30 = 900$$

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

In order: 25, 27, 30, 32

Answer: 5^2 , 3^3 , $\sqrt{900}$, 2^5

Marks: 1 mark for at least three values worked out correctly. 1 mark for the correct order.

11 (2 marks)

Show that $3^4 - 2^4 = 5 \times 13$

Work out the left side:

$$3^4 = 3 \times 3 \times 3 \times 3 = 81$$

$$2^4 = 2 \times 2 \times 2 \times 2 = 16$$

$$81 - 16 = 65$$

Work out the right side: $5 \times 13 = 65$

Both sides equal 65, as required.

Answer: $81 - 16 = 65 = 5 \times 13$

Tip: In a “show that” question, work out both sides and finish by saying that they are equal.

Marks: 1 mark for 81 or 16. 1 mark for showing that both sides equal 65.
