

Name _____

Date _____

1.6 Square roots and cube roots — worked answers

Understand square numbers, cube numbers, square roots and cube roots, and estimate the square root of a number that is not a square number. · 60 questions

A · Fluency — Squares, cubes and their roots.

1 $7^2 =$

Answer: 49

$7 \times 7 = 49.$

2 $12^2 =$

Answer: 144

$12 \times 12 = 144.$

3 $15^2 =$

Answer: 225

$15 \times 15 = 225.$

4 $9^2 =$

Answer: 81

$9 \times 9 = 81.$

5 $13^2 =$

Answer: 169

$13 \times 13 = 169.$

6 $20^2 =$

Answer: 400

$20 \times 20 = 400.$

7 $11^2 =$

Answer: 121

$11 \times 11 = 121.$

8 $14^2 =$

Answer: 196

$14 \times 14 = 196.$

9 $2^3 =$

Answer: 8

$2 \times 2 \times 2 = 8.$

10 $4^3 =$

Answer: 64

$4 \times 4 \times 4 = 64.$

11 $5^3 =$

Answer: 125

$5 \times 5 \times 5 = 125.$

12 $3^3 =$

Answer: 27

$3 \times 3 \times 3 = 27.$

13 $10^3 =$

Answer: 1000

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

14 $6^3 =$

Answer: 216

$6 \times 6 \times 6 = 216.$

15 $\sqrt{81} =$

Answer: 9

$9 \times 9 = 81$, so $\sqrt{81} = 9.$

16 $\sqrt{144} =$

Answer: 12

$12 \times 12 = 144$, so $\sqrt{144} = 12.$

17 $\sqrt{400} =$

Answer: 20

$20 \times 20 = 400$, so $\sqrt{400} = 20.$

18 $\sqrt{121} =$

Answer: 11

$11 \times 11 = 121$, so $\sqrt{121} = 11.$

19 $\sqrt{225} =$

Answer: 15

$15 \times 15 = 225$, so $\sqrt{225} = 15.$

20 $\sqrt{64} =$

Answer: 8

$8 \times 8 = 64$, so $\sqrt{64} = 8.$

21 $\sqrt{196} =$

Answer: 14

$14 \times 14 = 196$, so $\sqrt{196} = 14.$

22 $\sqrt{900} =$

Answer: 30

$30 \times 30 = 900$, so $\sqrt{900} = 30.$

23 $\sqrt[3]{27} =$

Answer: 3

$3 \times 3 \times 3 = 27$, so $\sqrt[3]{27} = 3$.

24 $\sqrt[3]{125} =$

Answer: 5

$5 \times 5 \times 5 = 125$, so $\sqrt[3]{125} = 5$.

25 $\sqrt[3]{1000} =$

Answer: 10

$10 \times 10 \times 10 = 1000$, so $\sqrt[3]{1000} = 10$.

26 $\sqrt[3]{8} =$

Answer: 2

$2 \times 2 \times 2 = 8$, so $\sqrt[3]{8} = 2$.

27 $\sqrt[3]{216} =$

Answer: 6

$6 \times 6 \times 6 = 216$, so $\sqrt[3]{216} = 6$.

28 $\sqrt[3]{343} =$

Answer: 7

$7 \times 7 \times 7 = 343$, so $\sqrt[3]{343} = 7$.

B · Reasoning — Combining roots and estimating.

29 Work out $\sqrt{9 \times 16}$.

Answer: 12

$9 \times 16 = 144$ and $\sqrt{144} = 12$. (You can also do $\sqrt{9} \times \sqrt{16} = 3 \times 4 = 12$.)

30 Work out $5^3 - 3^3$.

Answer: 98

$125 - 27 = 98$.

31 Work out $\sqrt{121} + \sqrt[3]{64}$.

Answer: 15

$\sqrt{121} = 11$ and $\sqrt[3]{64} = 4$, so the answer is 15.

32 Work out $\sqrt[3]{125} - \sqrt[3]{27}$.

Answer: 2

$\sqrt[3]{125} = 5$ and $\sqrt[3]{27} = 3$, so the answer is 2.

33 Work out $\sqrt{64} \div \sqrt[3]{64}$.

Answer: 2

$8^2 = 64$ so $\sqrt{64} = 8$; $4^3 = 64$ so $\sqrt[3]{64} = 4$. Hence $8 \div 4 = 2$.

34 The cube root of a number is 4. What is the square root of that number?

Answer: 8

The number is $4^3 = 64$, and $\sqrt{64} = 8$.

35 The square root of a number is 9. What is the number?

Answer: 81

$9^2 = 81$.

36 $\sqrt{50}$ lies between which two whole numbers?

- ☐ 6 and 7
☐ 7 and 8
☐ 8 and 9
☐ 9 and 10

Answer: 7 and 8

$49 < 50 < 64$, so $\sqrt{49} < \sqrt{50} < \sqrt{64}$, i.e. $7 < \sqrt{50} < 8$.

37 Which whole number is closest to $\sqrt{79}$?

Answer: 9

$8^2 = 64$ and $9^2 = 81$. 79 is much closer to 81 than to 64, so 9 is the closest integer.

38 $\sqrt{215}$ lies between two consecutive whole numbers. What is the smaller one?

Answer: 14

$14^2 = 196$ and $15^2 = 225$. 215 lies between them, so $\sqrt{215}$ is between 14 and 15.

39 Arun says " $\sqrt{36} = 6$, so $\sqrt[3]{36} = 3$ ". Is he right?

- ☐ Yes
☐ No

Answer: No

$\sqrt[3]{36}$ is not a whole number: $3^3 = 27$ and $4^3 = 64$, so $\sqrt[3]{36}$ is between 3 and 4.

40 Write the first six square numbers, separated by commas.

Answer: 1, 4, 9, 16, 25, 36

$1^2, 2^2, 3^2, 4^2, 5^2, 6^2$.

C · Challenge — Patterns, counting and inverse problems.

41 Work out $(-3)^3 + \sqrt{64}$.

Answer: -19

$(-3)^3 = -27$ and $\sqrt{64} = 8$, so $-27 + 8 = -19$.

42 Work out $\sqrt{(144 \div 4)}$.

Answer: 6

$144 \div 4 = 36$ and $\sqrt{36} = 6$.

43 Work out $\sqrt[3]{(8 \times 27)}$.

Answer: 6

$8 \times 27 = 216$ and $6^3 = 216$, so the answer is 6. (Also $\sqrt[3]{8} \times \sqrt[3]{27} = 2 \times 3 = 6$.)

44 Use the pattern $2^2 = 4$, $4^2 = 16$, $8^2 = 64$, $16^2 = 256$ to find 32^2 .

Answer: 1024

Each base doubles and each answer is multiplied by 4: 4, 16, 64, 256, so $32^2 = 256 \times 4 = 1\,024$.

45 How many square numbers are there between 1 and 200 inclusive?

Answer: 14

$14^2 = 196 \leq 200$ but $15^2 = 225 > 200$, so the square numbers are 1^2 up to 14^2 — 14 of them.

46 How many cube numbers are there between 1 and 200 inclusive?

Answer: 5

1, 8, 27, 64 and 125 are ≤ 200 , but $6^3 = 216$ is not — so 5 of them.

- 47** Which number is both a square number and a cube number, is greater than 1 and less than 100?

Answer: 64

$64 = 8^2$ and $64 = 4^3$. (The next one is 729.)

- 48** $n^2 = 169$. What is n if n is positive?

Answer: 13

$13 \times 13 = 169$, so $n = 13$.

D · Word problems — Areas, volumes and side lengths.

- 49** A square garden has an area of 144 m^2 . What is the length of one side, in metres?

Answer: 12

Side = $\sqrt{144} = 12 \text{ m}$.

- 50** A square patio is made of 225 identical square tiles arranged in a square. How many tiles are along one edge?

Answer: 15

$\sqrt{225} = 15$ tiles.

- 51** A cube has a volume of 125 cm^3 . What is the length of one edge, in cm?

Answer: 5

Edge = $\sqrt[3]{125} = 5 \text{ cm}$.

- 52** A cubic water tank holds 1 000 litres, which is $1\,000\,000 \text{ cm}^3$. What is the length of one edge, in cm?

Answer: 100

$\sqrt[3]{1\,000\,000} = 100 \text{ cm}$, because $100^3 = 1\,000\,000$.

- 53** A square field has a side of 13 m. What is its area, in m^2 ?

Answer: 169

$13^2 = 169 \text{ m}^2$.

- 54** A cube of side 6 cm is made of 1 cm cubes. How many small cubes are there?

Answer: 216

$6^3 = 216$.

- 55** A square poster has an area of 400 cm^2 . What is its perimeter, in cm?

Answer: 80

Side = $\sqrt{400} = 20 \text{ cm}$, so perimeter = $4 \times 20 = 80 \text{ cm}$.

- 56** A gardener wants a square lawn with an area as close as possible to 80 m^2 , using a whole number of metres for the side. What side length should she choose, in metres?

Answer: 9

$9^2 = 81$ which is only 1 away from 80, while $8^2 = 64$ is 16 away. So 9 m.

- 57** A box is a cube of side 7 cm. What is its volume, in cm^3 ?

Answer: 343

$7^3 = 343 \text{ cm}^3$.

- 58** A square carpet has an area of 196 m^2 . A border runs all the way around its edge. How long is the border, in metres?

Answer: 56

Side = $\sqrt{196} = 14 \text{ m}$, so the border is $4 \times 14 = 56 \text{ m}$.

- 59** A cubic crate has a volume of 343 m^3 . What is the area of one face, in m^2 ?

Answer: 49

Edge = $\sqrt[3]{343} = 7 \text{ m}$, so one face is $7 \times 7 = 49 \text{ m}^2$.

- 60** A square courtyard has an area of 500 m^2 . Between which two whole numbers does its side length lie? Give the smaller number, in metres.

Answer: 22

$22^2 = 484$ and $23^2 = 529$, so the side is between 22 m and 23 m.