Perfect Squares
Check your Understanding

Question 1

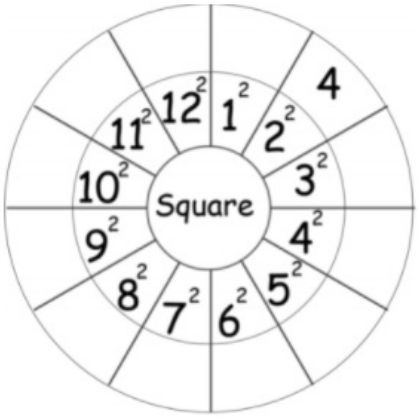
Complete the following as you work through the lesson. Show all your work as explained in the lessons. This will help you when reviewing later for a test. Do your best, then check you answers. If you do not understand how the answer is arrived at, check the video solution, or ask you teacher.

Use your calculator to determine the value of the following (hint: use the exponent key).

2^{15}	5^7	8^8	3^{13}	25^5	7^7	6^9

Question 2

Complete the outside of the circle with the correct perfect square ($2^2 = 4$ is done).



Question 3

List the factors of each of the following numbers. Which are perfect squares?

a. 169

b. 1522

c. 4762

d. 484

e. 571

f. 441

g. 289

Answer Key

Answer 1

32,768	78,125	16,777,216	1,594,323	97,656,625	823,543	10,077,696

Answer 2

1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144

Answer 3

a. 1, 13, 169 Yes (perfect squares have an odd number of factors)
b. 1, 2, 761, 1522 No (even number of factors, so not a perfect square)
c. 1, 2, 2381, 4762 No
d. 1, 2, 11, 22, 44, 121, 241, 484 No
e. 1, 571 No
f. 1, 3, 7, 9, 21, 49, 63, 147, 441 Yes
g. 1, 17, 289 Yes

Squares and Square Roots
Check your Understanding

Question 1

Find the principal square roots of the following. For square roots above $\sqrt{144} = 12$ show your work by listing the prime factors.

$\sqrt{625} =$ $\sqrt{81} =$

$\sqrt{100} =$ $\sqrt{784} =$

$\sqrt{289} =$ $\sqrt{64} =$

$\sqrt{361} =$ $\sqrt{0} =$

$\sqrt{900} =$ $\sqrt{484} =$

$\sqrt{196} =$ $\sqrt{400} =$

$\sqrt{576} =$ $\sqrt{49} =$

$\sqrt{676} =$ $\sqrt{441} =$

$\sqrt{676} =$ $\sqrt{441} =$

Question 2

Find the square roots of the following. Simplify any fractions if possible.

a. $\frac{\sqrt{4}}{\sqrt{16}} =$

b. $\sqrt{\frac{25}{225}} =$

c. $\frac{\sqrt{100}}{\sqrt{64}} =$

d. $\sqrt{\frac{81}{729}} =$

e. $\frac{\sqrt{1}}{\sqrt{36}} =$

f. $\sqrt{\frac{144}{576}} =$

g. $\pm\sqrt{2500} =$

h. $-\sqrt{256} =$

i. $\pm\sqrt{361} =$

j. $\pm\sqrt{\frac{196}{784}} =$

k. $-\sqrt{\frac{121}{484}} =$

l. $\pm\frac{\sqrt{16}}{\sqrt{81}} =$

Answer Key

Answer 1

$\sqrt{625} = 25$
(5x5) x (5x5)

$\sqrt{81} = 9$

$\sqrt{100} = 10$

$\sqrt{784} = 28$
(2x2)x (2x2) x (7x7)

$\sqrt{289} = 17$
(17x17)

$\sqrt{64} = 8$

$\sqrt{361} = 19$
(19x19)

$\sqrt{0} = 0$

$\sqrt{900} = 30$
(2x2) x (3x3) x (5x5)

$\sqrt{484} = 22$
(2x2) x (11x11)

$\sqrt{196} = 14$
(2x2) x (7x7)

$\sqrt{400} = 20$
(2x2) x (2x2) x (5x5)

$\sqrt{576} = 24$
(2x2) x (2x2) x (2x2) x (3x3)

$\sqrt{49} = 7$

$\sqrt{676} = 26$
(2x2) x (13x13)

$\sqrt{441} = 21$
(3x3) x (7x7)

Answer 2

a. $\frac{1}{2}$ b. $\frac{1}{3}$ c. $\frac{5}{4} = 1\frac{1}{4}$ d. $\frac{1}{3}$

e. $\frac{1}{6}$ f. $\frac{1}{2}$ g. ± 50 h. -16

i. ± 19 j. $\pm\frac{1}{2}$ k. $-\frac{1}{2}$ l. $\pm\frac{4}{9}$

Non-Perfect and Estimating Square Roots

Check your Understanding

Question 1

Use your square root estimation skills to fill in the blanks.

$\sqrt{200}$ is between 14 and 15

14 x 14 = 196 15 x 15 = 225

$\sqrt{134}$ is between ____ and ____

$\sqrt{8}$ is between ____ and ____

$\sqrt{80}$ is between ____ and ____

$\sqrt{37}$ is between ____ and ____

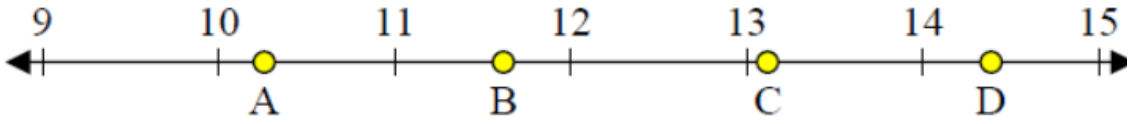
$\sqrt{350}$ is between ____ and ____

$\sqrt{500}$ is between ____ and ____

60 is between ____ and ____

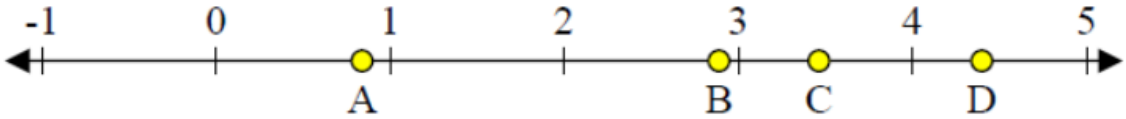
Question 2

$\sqrt{135}$



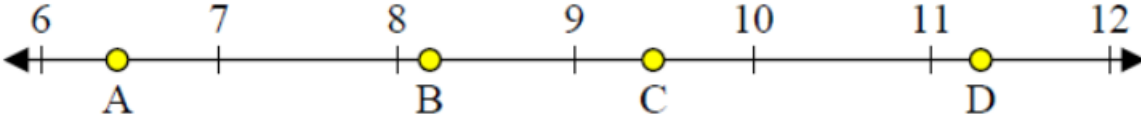
Question 3

$\sqrt{12}$



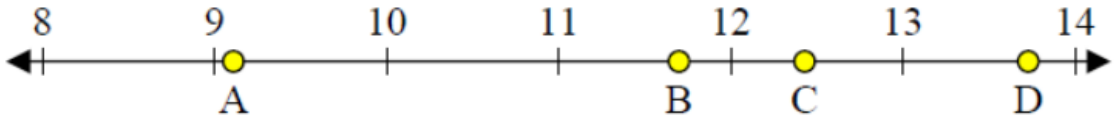
Question 4

$\sqrt{67}$



Question 5

$\sqrt{83}$



Question 6

What two integers is each square root between (hint: square root of a perfect square above and belov each)? Estimate the approximate value of the square root to the nearest tenth without using a calculator.

$\sqrt{20} =$

Question 7

What two integers is each square root between (hint: square root of a perfect square above and belov each)? Estimate the approximate value of the square root to the nearest tenth without using a calculator.

$\sqrt{75} =$

Question 8

What two integers is each square root between (hint: square root of a perfect square above and below each)? Estimate the approximate value of the square root to the nearest tenth without using a calculator.

$\sqrt{37} =$

Question 9

Use your calculator to evaluate. Round your answer to 3 decimal places. $\sqrt{87} =$

Question 10

Use your calculator to evaluate. Round your answer to 3 decimal places. $\sqrt{73} =$

Question 11

Use your calculator to evaluate. Round your answer to 3 decimal places. $\sqrt{3} =$

Question 12

Use your calculator to evaluate. Round your answer to 3 decimal places. $\sqrt{300} =$

Question 13

Use your calculator to evaluate. Round your answer to 3 decimal places. $\sqrt{37} =$

Question 14

Use your calculator to evaluate. Round your answer to 3 decimal places. $\sqrt{30,000} =$

Question 15

Use your calculator to evaluate. Round your answer to 3 decimal places. $\sqrt{500} =$

Answer Key

Answer 1

$\sqrt{200}$ is between 14 and 15

$\sqrt{37}$ is between 6 and 7

$\sqrt{134}$ is between 11 and 12

$\sqrt{350}$ is between 18 and 19

$\sqrt{8}$ is between 2 and 3

$\sqrt{500}$ is between 22 and 23

$\sqrt{80}$ is between 8 and 9

$\sqrt{60}$ is between 7 and 8

Answer 2

B

Answer 3

C

Answer 4

B

Answer 5

A

Answer 6

Perfect Square just below 20 is 16. $\sqrt{16} = 4$

Perfect square just above 20 is 25. $\sqrt{25} = 5$

20 is slightly closer to 16 but almost in the middle, so ≈ 4.4 or 4.5

Answer 7

Perfect Square just below 75 is 64. $\sqrt{64} = 8$

Perfect square just above 75 is 81. $\sqrt{81} = 9$

75 is closer to 81, so ≈ 8.7 (8.6 x 8.6 = 73.96; 8.7 x. 8.7 = 75.69)

Answer 8

Perfect Square just below 37 is 36. $\sqrt{36} = 6$

Perfect square just above 37 is 49. $\sqrt{49} = 7$

37 is very close to 36, so ≈ 6.1

Answer 9

9.327

Answer 10

8.544

Answer 11

1.732

Answer 12

17.321

Answer 13

6.083

Answer 14

173.205

Answer 15

22.361

The Pythagorean Theorem
Check your Understanding

Question 1

The area of the squares of the two legs are 15 cm^2 and 30 cm^2. What is the area of the hypotenuse on the right triangle?

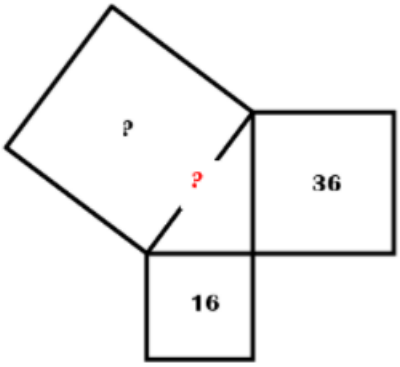
Question 2

The square on the hypotenuse of a right tringle has an area of 100 cm^2. The square on one leg has an area of 55 cm^2. What is the area of the square on the remaining leg of the right triangle?

Question 3

The area of the squares of two legs of a right triangle are 36 cm^2 and 16 cm^2.

a. What is the area of the square on the hypotenuse?
b. What is the length of the hypotenuse (round to one decimal place)?

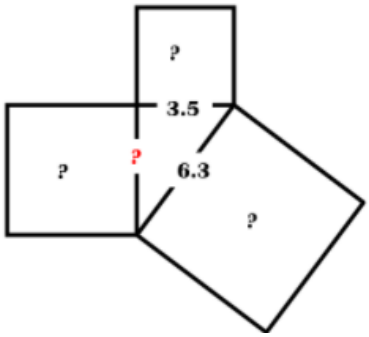


Question 4

The length of one leg of a right triangle is 3.5 m^2. The length of the hypotenuse is 6.3 m^2.

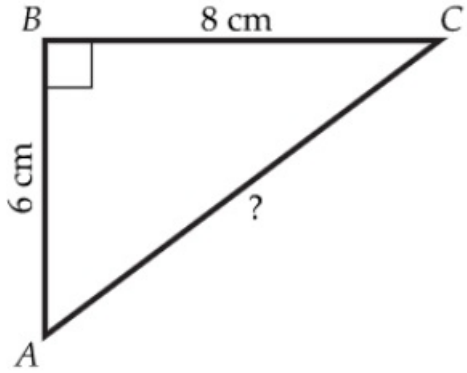
a. What is the area of the square on the remaining leg?

b. What is the length of the remaining leg (round to one decimal place)?



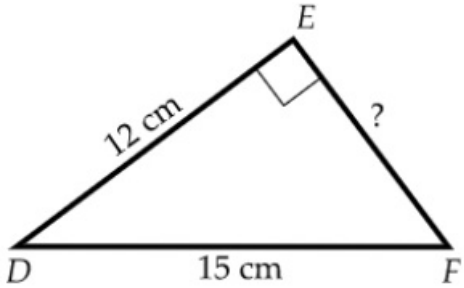
Question 5

Solve for the missing side. Round answers to one decimal place.



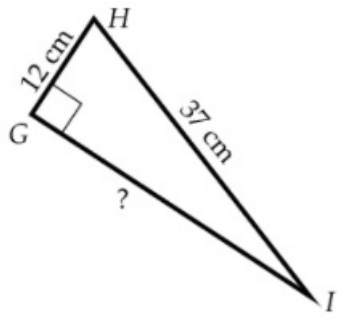
Question 6

Solve for the missing side. Round answers to one decimal place.



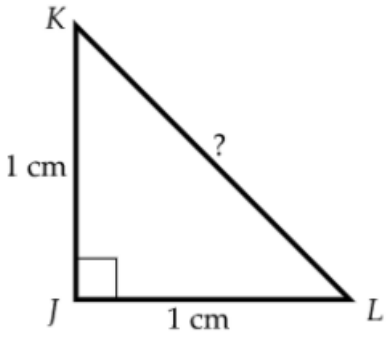
Question 7

Solve for the missing side. Round answers to one decimal place.



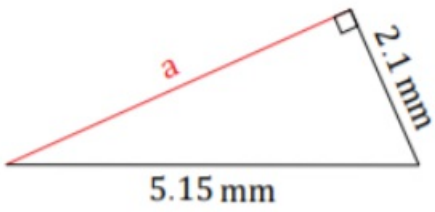
Question 8

Solve for the missing side. Round answers to one decimal place.



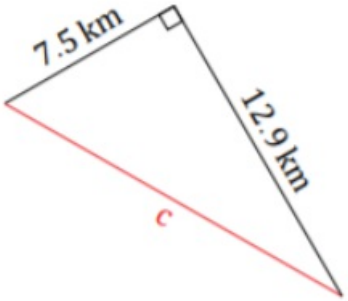
Question 9

Solve for the missing side. Round answers to one decimal place.



Question 10

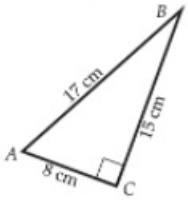
Solve for the missing side. Round answers to one decimal place.



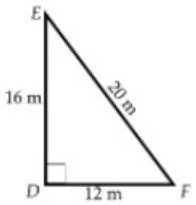
Question 11

Verify that the Pythagorean Theorem is true for each of the following triangles.

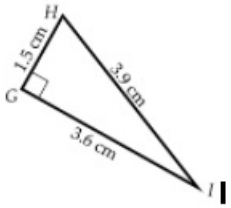
a.



b.



c.



Question 12

Determine whether the following three lengths of the sides of a triangle satisfy the equation $a^2 + b^2 = c^2$ making the triangle a right triangle.

a. $a = 7$ m, $b = 24$ m, $c = 25$ m

b. $a = 9$ mm, $b = 12$ mm, $c = 14$ mm

c. $a = 0.5$ cm, $b = 1.2$ cm, $c = 1.3$ cm

d. $a = 7$ m, $b = 14$ m, $c = 21$ m

Answer Key

Answer 1

45 cm^2

Answer 2

45 cm^2

Answer 3

(a) 52 cm^2 (b) 7.2 cm

Answer 4

(a) 27.44 m^2 (b) 5.2 m

Answer 5

10 cm

Answer 6

9 cm

Answer 7

35 cm

Answer 8

1.4 cm

Answer 9

4.7 mm

Answer 10

14.9 km

Answer 11

a. $8^2 + 15^2 = 17^2$
$289 = 289$
equation true, therefore Pythagorean Theorem verifies triangle is a right triangle

b. $12^2 + 16^2 = 20^2$
$400 = 400$
equation true, therefore Pythagorean Theorem verifies triangle is a right triangle

c. $1.5^2 + 3.6^2 = 3.9^2$
$15.21 = 15.21$
equation true, therefore Pythagorean Theorem verifies triangle is a right triangle

Answer 12

a. $7^2 + 24^2 = 25^2$
$625 = 625$
equation true, therefore Pythagorean Theorem verifies triangle is a right triangle

b. $9^2 + 12^2 = 14^2$
$225 \neq 196$
equation false, therefore triangle is NOT a right triangle

c. $0.5^2 + 1.2^2 = 1.3^2$
$1.69 = 1.69$
equation true, therefore Pythagorean Theorem verifies triangle is a right triangle

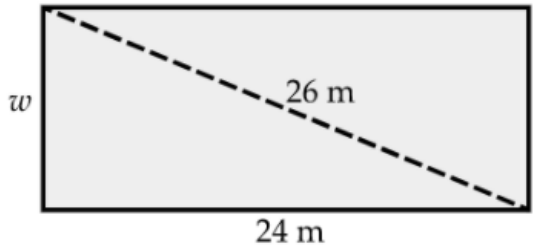
d. $7^2 + 14^2 = 21^2$
$245 \neq 441$
equation false, therefore triangle is NOT a right triangle

Applications of the Pythagorean Theorem

Check your Understanding

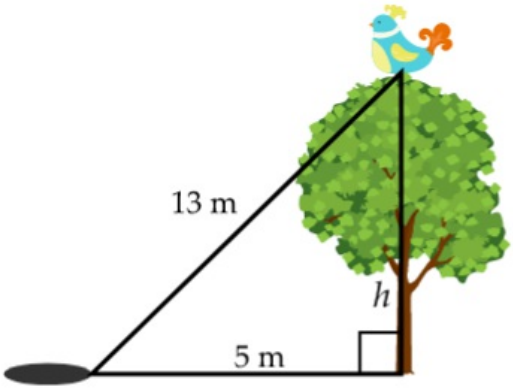
Question 1

The length of a rectangular garden is 24 m, and the length of the garden's diagonal is 26 m. What is the width of the garden?



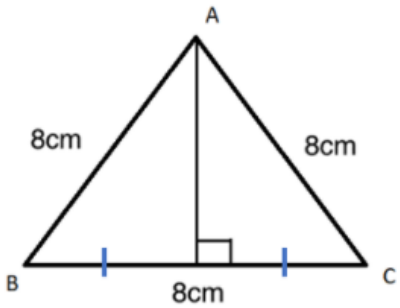
Question 2

A bird is on the top of a tree. It flies 13 m to the ground, and lands 5 m from the base of the tree. How tall is the tree?



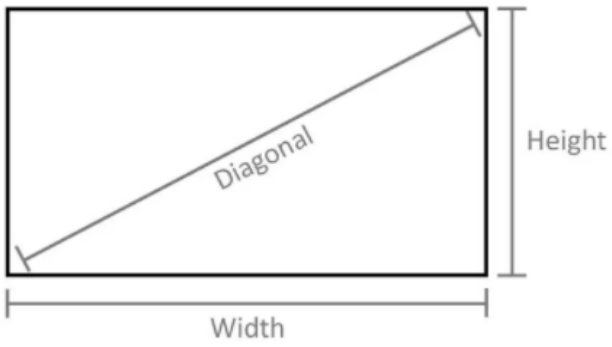
Question 3

An equilateral triangle has side lengths of 8 cm. What is the length of its height? Round answer to two decimal places.



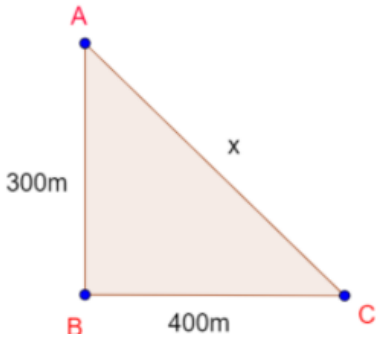
Question 4

A "22 inch" computer monitor has a diagonal measurement of 22 inches and a height of 10 inches. How wide is it? Round answer to one decimal place.



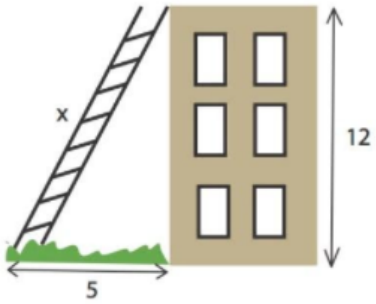
Question 5

Chao and Cacey usually walk home from school by going due south 300 m (from A to B), ther turn east (B to C) for 400 m. They decide to take a shortcut going directly from A to B. What i the distance of the shortcut?



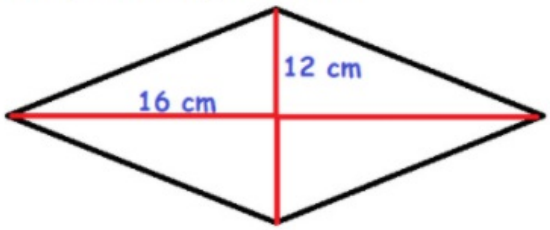
Question 6

A ladder's base is 5 m from the wall of a building. The top of the ladder comes to rest exactly 12m high on the building. How long is the ladder?



Question 7

Given a rhombus with diagonal lengths of 12 cm and 16 cm, find the perimeter.

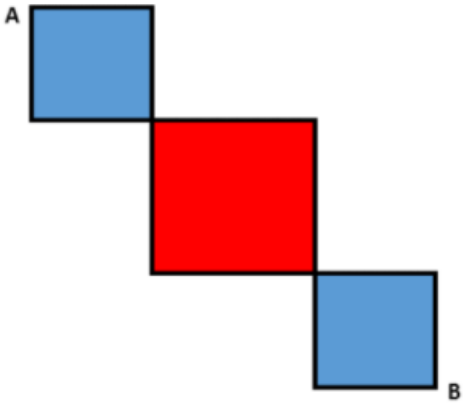


Question 8

For international matches soccer pitches (fields) must be of regulation size. They must be between 64 and 75 metres wide and between 100 and 110 metres long.
What is *the difference* between the length of the diagonal of the largest acceptable pitch and the length of the diagonal of the smallest acceptable pitch?
Give your answer in metres to the nearest metre.

Question 9

The red square below has sides of length 41mm, and the blue squares have sides of length 31mm. Find the distance from A to B in *centimetres* correct to one decimal place.



Answer Key

Answer 1

10 m

Answer 2

12 m

Answer 3

6.93 m

Answer 4

19.6 inches

Answer 5

500 m

Answer 6

13 m

Answer 7

40 cm

Answer 8

Difference of 14 m (14.4m)

Answer 9

14.6 cm

Perfect Cubes and Cube Roots
Check your Understanding

Question 1

Calculate the value of each cubed number.

28^3 = _____ 13^3 = _____ 17^3 = _____ 30^3 = _____

12^3 = _____ 2^3 = _____ 19^3 = _____ 29^3 = _____

8^3 = _____ 1^3 = _____ 31^3 = _____ 4^3 = _____

Question 2

Find the cube root of these perfect cubes.

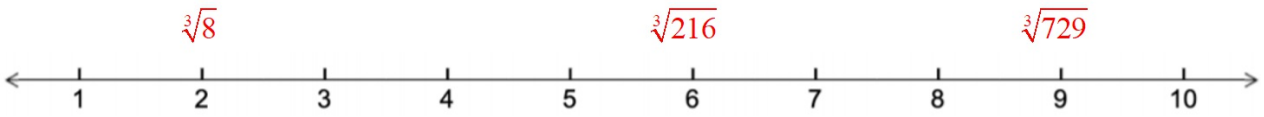
$\sqrt[3]{1728}$ = _____ $\sqrt[3]{343}$ = _____ $\sqrt[3]{-1}$ = _____ $\sqrt[3]{2197}$ = _____

$\sqrt[3]{-64}$ = _____ $\sqrt[3]{1000}$ = _____ $\sqrt[3]{-729}$ = _____ $\sqrt[3]{125}$ = _____

$\sqrt[3]{-512}$ = _____ $\sqrt[3]{2744}$ = _____ $\sqrt[3]{1331}$ = _____ $\sqrt[3]{-4096}$ = _____

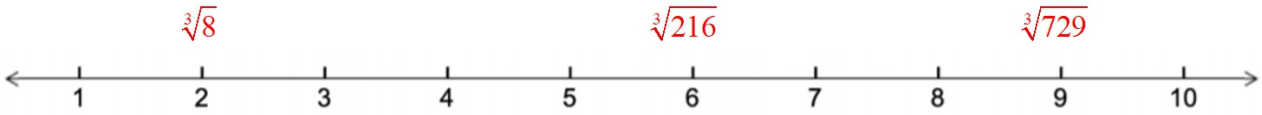
Question 3

Fill in the number line below with the missing cube roots.



Question 4

Use the given number line to estimate these cube roots to one decimal place.



$\sqrt[3]{45} =$ $\sqrt[3]{120} =$ $\sqrt[3]{280} =$ $\sqrt[3]{143} =$

$\sqrt[3]{946} =$ $\sqrt[3]{530} =$ $\sqrt[3]{24} =$ $\sqrt[3]{6} =$

Question 5

Identify the two closest perfect cubes, one greater than and one less than the radicand given. Then estimate the cube root to the nearest hundredth.

a) $\sqrt[3]{100}$

b) $\sqrt[3]{256}$

c) $\sqrt[3]{175}$

d) $\sqrt[3]{-31}$

e) $\sqrt[3]{400}$

f) $\sqrt[3]{-16}$

Answer Key

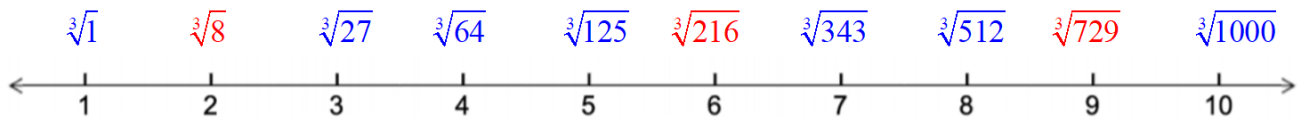
Answer 1

21,952	2,197	4,913	27,000
1,728	8	6,859	24,389
512	1	29,791	64

Answer 2

12	7	−1	13
−4	10	−9	5
−8	14	11	−16

Answer 3



Answer 4

Answers +/− 0.1 from these answers are considered accurate *estimates*.

3.6	4.9	6.5	5.2
9.8	8.1	2.9	1.8

Answer 5

a.	$\sqrt[3]{64}$	$\sqrt[3]{125}$	$\sqrt[3]{100} \approx 4.64$
b.	$\sqrt[3]{216}$	$\sqrt[3]{342}$	$\sqrt[3]{256} \approx 6.35$
c.	$\sqrt[3]{125}$	$\sqrt[3]{216}$	$\sqrt[3]{175} \approx 5.59$
d.	$\sqrt[3]{-64}$	$\sqrt[3]{-27}$	$\sqrt[3]{-31} \approx -3.14$
e.	$\sqrt[3]{343}$	$\sqrt[3]{512}$	$\sqrt[3]{400} \approx 7.37$
f.	$\sqrt[3]{-27}$	$\sqrt[3]{-8}$	$\sqrt[3]{-16} \approx -2.52$

(note: −64 is smaller than −27)