

Unit 2: Working With Rational Numbers

2.4 Square Roots of Rationals

*Recall – to square a number is to multiply the number by itself (ie. exponent 2)

Ex. Estimate and calculate the area of a square with side lengths of 7.1 cm.



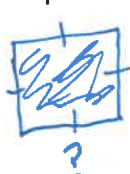
$$A = s^2$$

$$A = 7.1^2 = \boxed{50.41}$$

$$A \approx 7^2 = 49 \text{ cm}^2$$

A square root is the inverse (opposite) operation.

Ex. A square has an area of 81 m^2 . What is the length of each side?



$$A = s^2$$

$$81 = s^2$$

$$\sqrt{81} = s = \boxed{9}$$

Ex. Evaluate:

a) $\sqrt{9}$

$$\sqrt{9} = 3$$

b) $\sqrt{1}$

$$= 1$$

c) $\sqrt{576}$

$$= 24$$

Perfect Square: a number that can be expressed as a product of two equal ~~whole number~~ factors

Perfect Whole Number Squares: 1 4 9 16 25 36 49 64 81 100 121 144 169

Roots: 1 2 3 4 5 6 7 8 9 10 11 12 13

Ex. Which of the following are perfect rational squares? Determine the rational root if possible.

a) 169 ✓

$$\sqrt{169} = \boxed{13}$$

b) $\frac{25}{49}$ ✓

$$\sqrt{\frac{25}{49}} = \boxed{\frac{5}{7}}$$

c) $\frac{2}{9}$ ✗

2 is not a perfect square

d) 0.4

$$\frac{4}{10} \text{ ✗}$$

e) $\frac{121}{64}$ ✓

$$\sqrt{\frac{121}{64}} = \frac{11}{8}$$

f) 12.1

$$\frac{121}{100} \text{ ✗}$$

g) 1.21 ✓

$$\sqrt{\frac{121}{100}} = \frac{11}{10}$$

h) 0.121

0.0121 ✓

$$\frac{121}{1000} \text{ ✗}$$

Ex. Evaluate with and without a calculator:

a) $\sqrt{1.44}$

$$\sqrt{\frac{144}{100}} \\ = \frac{12}{10} \\ = \boxed{1.2}$$

b) $\sqrt{0.16}$

$$\sqrt{\frac{16}{100}} \\ = \frac{4}{10} \\ = 0.4$$

The roots of non-perfect squares can be estimated and verified with our calculator.

1 4 9 16 25 36 49 64 81 100 121

Ex. Estimate & calculate:

a) $\sqrt{11}$

$$\sqrt{9} \leftarrow 2 \rightarrow \sqrt{11} \leftrightarrow \sqrt{16} \\ \leftarrow \quad \quad \quad \rightarrow \\ 3 \quad \quad \quad 4$$

$$\approx 3.3$$

$$\sqrt{11} = 3.32$$

b) $\sqrt{30}$

$$\sqrt{25} \quad \sqrt{30} \quad \sqrt{36} \\ \downarrow \quad \quad \quad \downarrow \\ 5 \quad \quad \quad 6$$

$$\approx 5.4$$

$$\sqrt{30} = 5.48$$

c) $\sqrt{0.73}$

$$\sqrt{0.64} \quad \sqrt{0.81} \\ \downarrow \quad \quad \quad \downarrow \\ 0.8 \quad \quad \quad 0.9$$

$$\approx 0.85$$

$$\sqrt{0.73} = 0.844$$

d) $\sqrt{0.34}$

$$\sqrt{0.25} \quad \sqrt{0.36} \\ \downarrow \quad \quad \quad \downarrow \\ 0.5 \quad \quad \quad 0.6$$

$$\approx 0.58$$

$$\sqrt{0.34} = 0.583$$