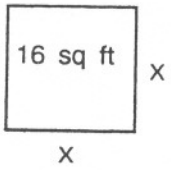
INTRODUCTION TO SQUARE ROOTS

Suppose we know the area of a square and we want to know the length of the side.



The area of the square is 16 square inches.

Since the area of a rectangle is length x width, it follows that the area of the square is $x \cdot x$. (Note that $x \cdot x$ can be written as x^2.)

Therefore $x^2 = 16$. Since $4 \cdot 4 = 16$, it follows that each side is 4 inches long. (Note that it is also true that $(-4) \cdot (-4) = 16$, but a negative number is impossible in this problem.)

The relationship between 16 and 4 can be expressed in two different ways.

16 is the ***square*** of 4	which is written as $16 = 4^2$
4 is the ***square root*** of 16	which is written as $4 = \sqrt{16}$

We can now give the following formal definition.

> $\sqrt{a} = b$ (where a is a non-negative number) means that b is the non-negative number such that $b^2 = a$.

Examples $\sqrt{9} = 3$ since $3^2 = 9$

$\sqrt{1} = 1$ since $1^2 = 1$

$\sqrt{0} = 0$ since $0^2 = 0$

It is good to have the following square roots memorized.

$\sqrt{0} = 0$	$\sqrt{16} = 4$	$\sqrt{64} = 8$	
$\sqrt{1} = 1$	$\sqrt{25} = 5$	$\sqrt{81} = 9$	*optional:*
$\sqrt{4} = 2$	$\sqrt{36} = 6$	$\sqrt{100} = 10$	$\sqrt{121} = 11$
$\sqrt{9} = 3$	$\sqrt{49} = 7$	$\sqrt{144} = 12$	$\sqrt{169} = 13$

Using a Calculator: For square roots of more difficult numbers, it is convenient to use a calculator. Most calculators can compute square roots. For example, to compute $\sqrt{2}$, you will need to press the number 2 and the key marked $\sqrt{x}$ or $\sqrt{\ }$. The result, 1.414214, should appear on your screen. Note that calculators vary. In some you start with the number and in others you begin with the square root key.

Problems

1. Use a calculator to obtain each of the following.

a) $\sqrt{4225}$

b) $\sqrt{5}$

c) $-\sqrt{3}$

d) $\sqrt{5} - \sqrt{3}$

e) $\sqrt{107.8}$

f) $\sqrt{1000000}$

g) $\sqrt{\frac{11}{4}}$ *

h) $\frac{\sqrt{11}}{4}$ *

i) $\frac{\sqrt{11}}{2}$

* Note the difference between problems g and h. In Problem g, the division comes first, and then the square root is computed. In Problem h, the square root of 11 is first computed and then the result is divided by 4.

2. Simplify each of the following without using your calculator.

a) $\sqrt{16} + \sqrt{9} - \sqrt{100}$

b) $\sqrt{25} - \frac{3}{\sqrt{16}} + \frac{\sqrt{9}}{4}$

c) $-\sqrt{36} + 2\sqrt{81} - \frac{\sqrt{64}}{\sqrt{1}}$

d) $\sqrt{0}\ \sqrt{1}\ \sqrt{49}\ \sqrt{100}$

e) $\sqrt{5+11} - \sqrt{25-16}$

f) $(\sqrt{9} + \sqrt{4})^2$

3. You should be able to do both of the following without using your calculator.

a) $(\sqrt{36})^2$

b) $(\sqrt{13.89})^2$

Answers

1. a) 65
   b) 2.236
   c) -1.732
   d) 0.5040
   e) 10.38
   f) 1000
   g) 1.658
   h) 0.8292
   i) 1.658

2. a) -3
   b) 5
   c) 4
   d) 0
   e) 1
   f) 25

3. a) 36
   b) 13.89