

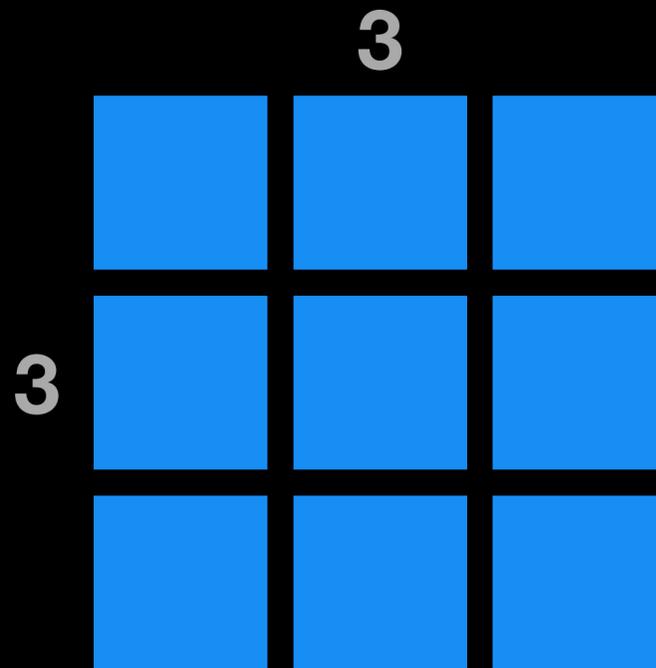
# Welcome!

---

Today's topic: Pythagorean Theorem

# Square Roots

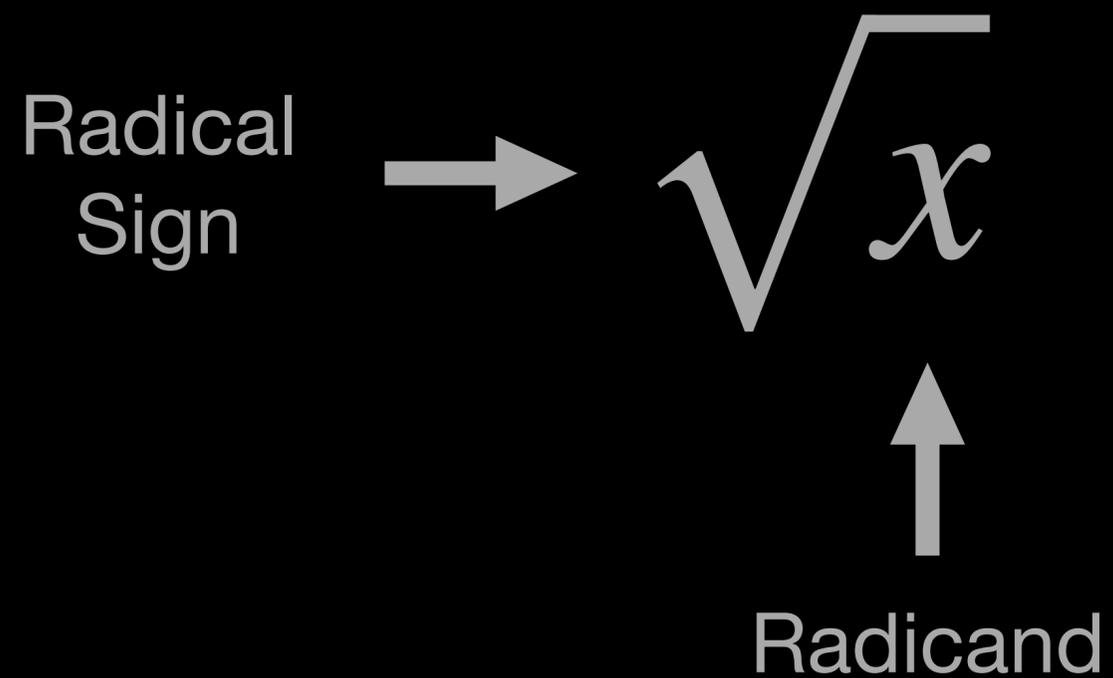
The square root of 9 is 3 because 3 times 3 is 9. If you imagine the square, then the square root of the area of the square is the side length.



In general, the square root of a positive number  $a$  is a positive number  $r$  such that  $r^2 = a$

# Square Roots

$\sqrt{x}$  is read as a square root of  $x$ . If  $\sqrt{x} = a$ , then  $a^2 = x$ . That is  $(\sqrt{x})^2 = x$ .



# Example

a).  $\sqrt{4}$

b).  $\sqrt{25}$

c).  $\sqrt{16}$

# Exercise 1

a).  $\sqrt{36}$

b).  $\sqrt{64}$

c).  $\sqrt{81}$

# Square Root Formula

Useful Formula: Let  $a$  and  $b$  be positive numbers

$$a) \sqrt{a * b} = \sqrt{a} * \sqrt{b}$$

$$b) \sqrt{a * a} = \sqrt{a} * \sqrt{a} = a$$

# Example

a).  $\sqrt{15}$

b).  $\sqrt{75}$

c).  $\sqrt{24}$

# Exercise 2

a)  $\sqrt{1}$

b)  $\sqrt{12}$

c)  $\sqrt{8}$

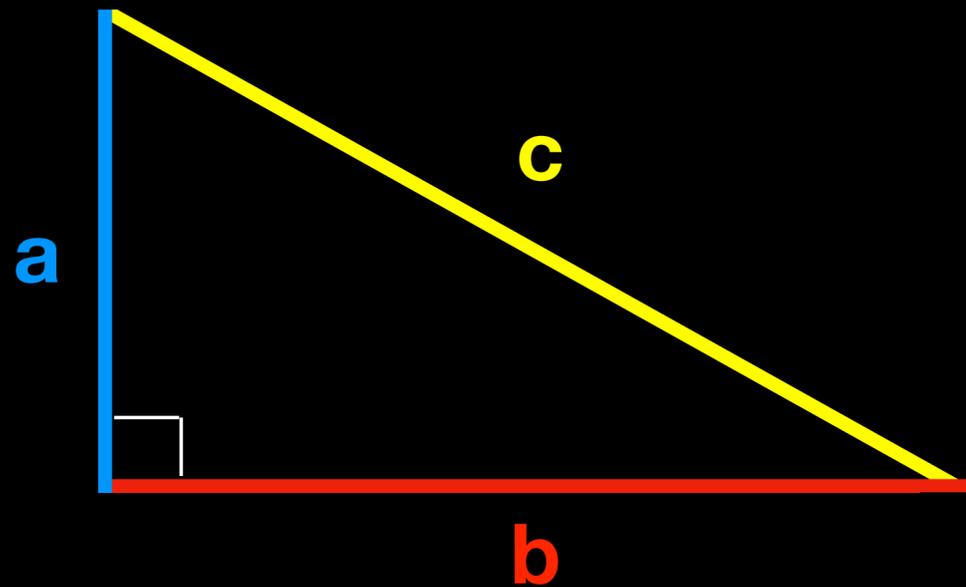
d)  $\sqrt{100}$

e)  $\sqrt{1000}$

f)  $\sqrt{50}$

# Pythagorean Theorem

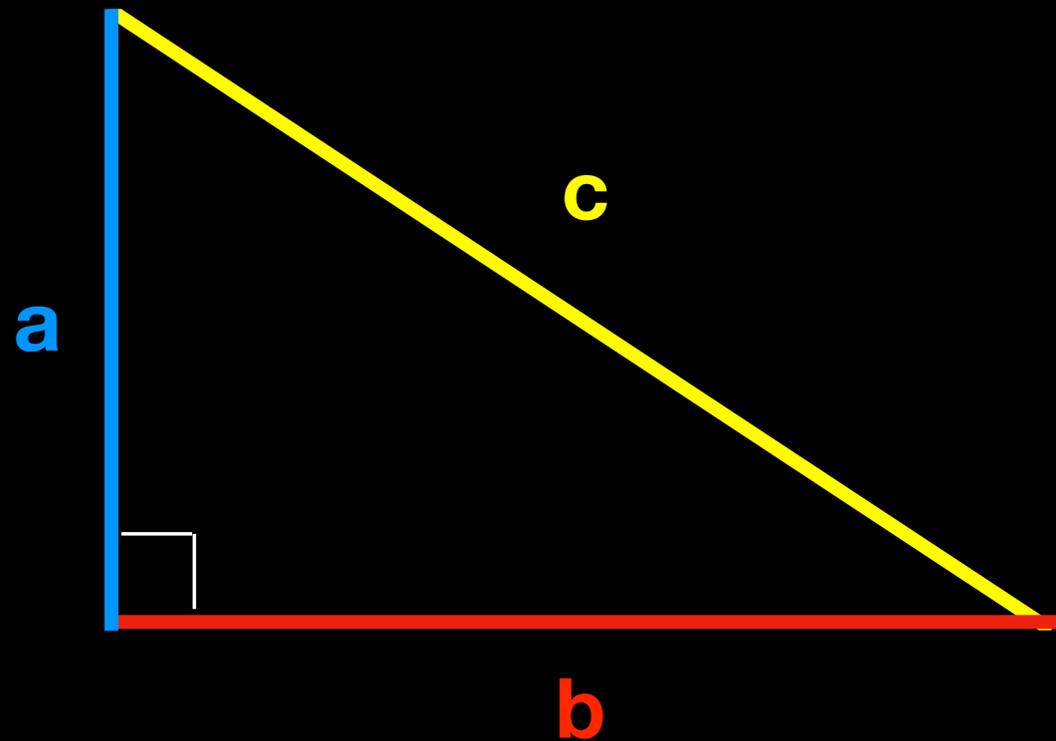
The square of the hypotenuse (the side opposite of the right angle) is equal to the sum of the square of the other two sides.



$$a^2 + b^2 = c^2$$

# Pythagorean Formulas

By using the pythagorean theorem, we can solve for the length of any side if we know the length of two other sides.



$$a = \sqrt{c^2 - b^2}$$

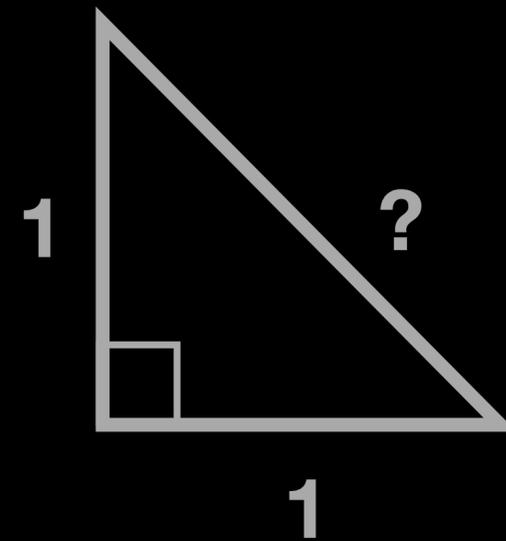
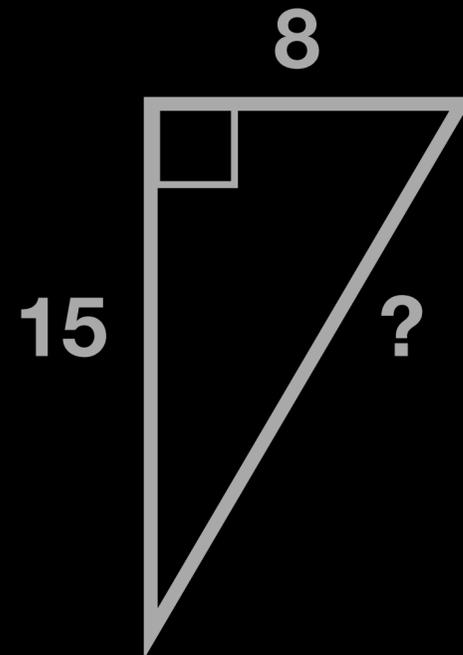
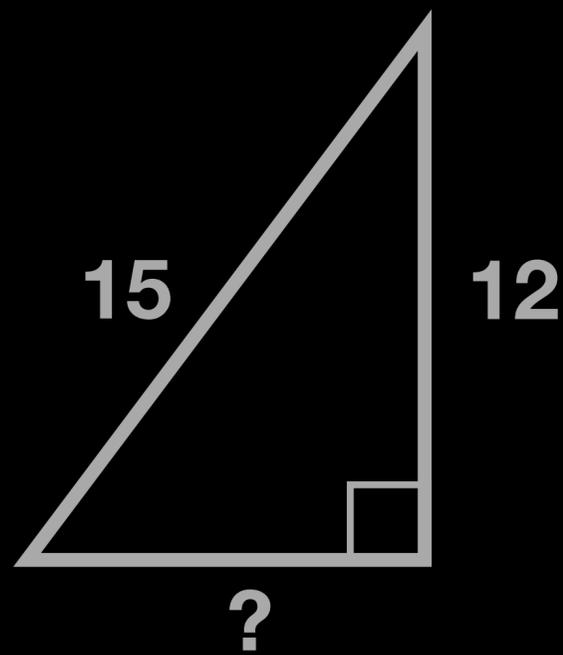
$$b = \sqrt{c^2 - a^2}$$

$$c = \sqrt{a^2 + b^2}$$

$$a^2 + b^2 = c^2$$

# Exercise 3

Solve for the length of the missing side.



# Pythagorean Triple

- A Pythagorean triple is three natural numbers which are arranged from the smaller number to the larger number and form side lengths of a right triangle.
- The easiest triple is 3, 4, 5. 5 is the length of the hypotenuse. 3 and 4 are the length of the two other sides.

# Pythagorean Triple

- We can take any multiple of this triple and still have the Pythagorean theorem work properly. Multiples of this triple include:

6, 8, 10

9, 12, 15

12, 16, 20

- There are also other Pythagorean Triples that are not multiples of the triple 3, 4, 5.

5, 12, 13

7, 24, 25

9, 40, 41

11, 60, 61

# Pythagorean Triples

Do you notice anything about these triples?

1. The last two numbers only differ by 1
2. The sum of the last two numbers is equal to the square of the first number

a	b	c	$a^2$	$\frac{a^2}{2}$
3	4	5	9	4.5
5	12	13	25	12.5
7	24	25	49	24.5
9	40	41	81	40.5
11	60	61	121	60.5

# Pythagorean Triple

- Knowing this, let's form a Pythagorean Triple with 13 being the first number!

# Pythagorean Triple

- Knowing this, let's form a Pythagorean Triple with 13 being the first number!
- We first take the square of 13:  $13^2 = 169$
- We then divide this square by 2:  $\frac{169}{2} = 84.5$
- Therefore, the Pythagorean Triple is 13, 84, 85

