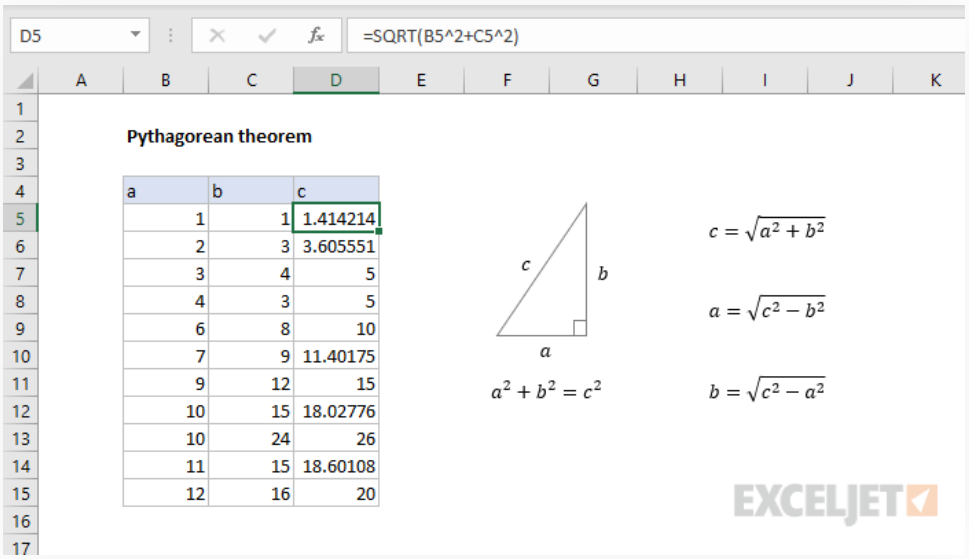
GEOMETRY

# Pythagorean theorem




## Summary

To calculate the longest side (the hypotenuse) of a right triangle in Excel, you can use a formula based on the Pythagorean theorem, adapted to use Excel's math operators and functions. In the example shown, the formula in D5, copied down, is:

```
= SQRT ( B5 ^ 2 + C5 ^ 2 )
```

which returns the length of the hypotenuse, given lengths of side a and aside b, given in columns B and C respectively.

# Explanation

The Pythagorean theorem is a key principle in Euclidean geometry. It states that the square of the longest side of a right triangle (the hypotenuse) is equal to the sum of the squares of the other two sides. The theorem is written as an equation like this:

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

When any two sides are know, this equation can be used to solve for the third side. When a and b are known, the length of the hypotenuse can be calculated with:

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

When b and c are known, the length of side a can be calculated with:

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

When a and c are known, length of side b can be calculated with:

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

To translate the above into Excel formula syntax, use the **exponentiation operator** (^) and the **SQRT function**, as seen below. The Pythagorean theorem can be written as:

```
=a^2+b^2=c^2 // Pythagorean theorem
```

And the formulas below can be used to solve for each of the three sides:

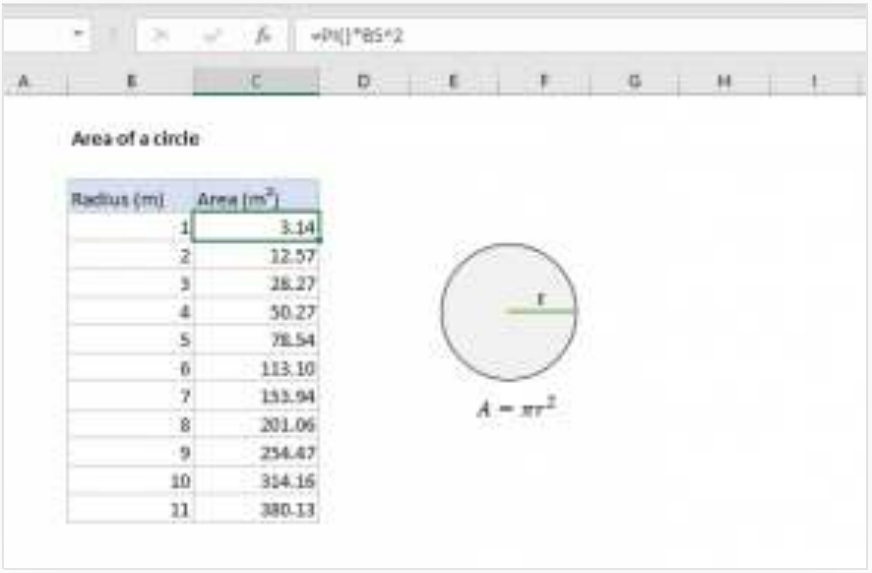
```
c=SQRT(a^2+b^2) // hypotenuse
a=SQRT(c^2-b^2) // side a
b=SQRT(c^2-a^2) // side b
```

Instead of the exponentiation operator, you can also use the POWER function like this:

```
c=SQRT(POWER(a,2)+POWER(b,2))
a=SQRT(POWER(c,2)-POWER(b,2))
b=SQRT(POWER(c,2)-POWER(a,2))
```

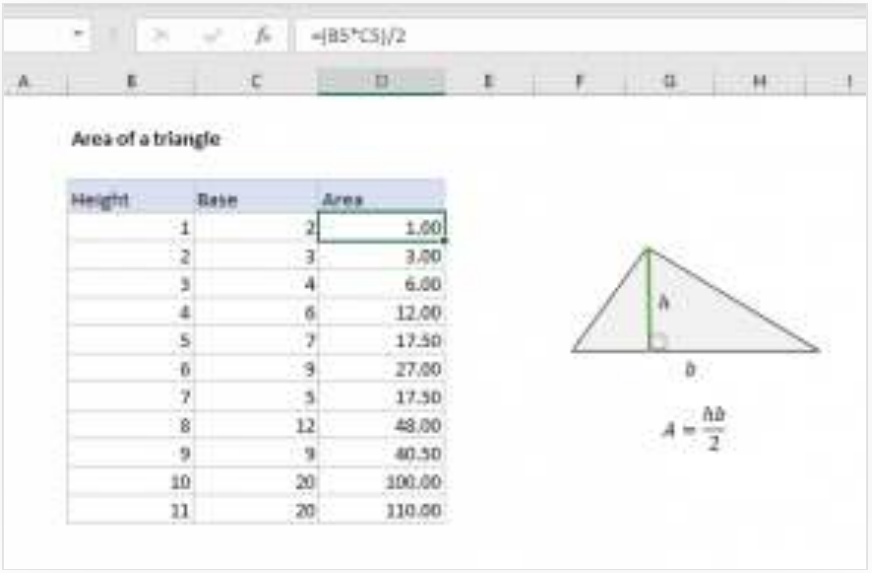
The formulas above are an example of **nesting** one function inside another.

# Related formulas




## Area of a circle

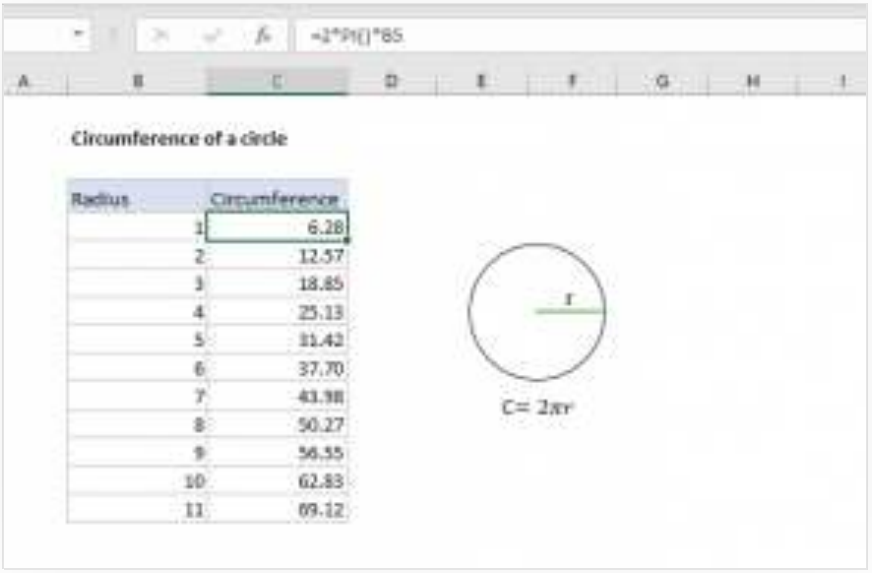
In geometry, the area enclosed by a circle with radius (r) is defined by the following formula: πr 2 The Greek letter π ("pi") represents the ratio of the circumference of a circle to its diameter. In Excel, π is represented in a formula with the PI function , which returns the number 3...




## Area of a triangle

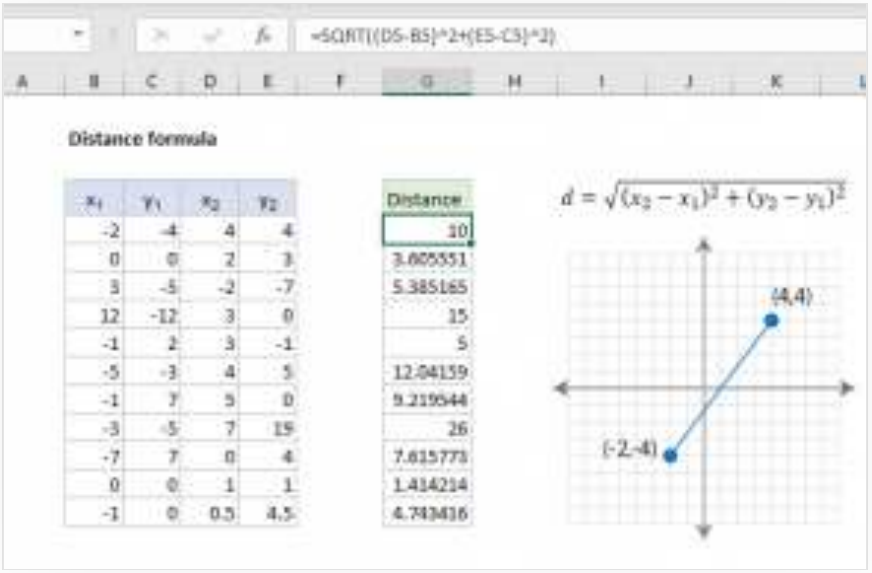
In geometry, the area enclosed by a triangle is defined by this formula: where b represents the base of the triangle, and h represents the height, measured at right angles to the base. In Excel, the same formula can be

represented like this: A=b*h/2 So, for example, to calculate the area of a...




## Circumference of a circle

In geometry, the circumference of a circle with radius (r) is defined by the following formula: =2πr The Greek letter π ("pi") represents the ratio of the circumference of a circle to its diameter. In Excel, π is represented in a formula with the PI function , which returns the number 3...




## Distance formula

The length of a line can be calculated with the distance

formula, which looks like this: Distance is the square root of the change in x squared plus the change in y squared, where two points are given in the form (x 1 , y 1 ) and (x 2 , y 2 ). The distance formula is an example of the Pythagorean...

**AUTHOR**

## Dave Bruns

Hi - I'm Dave Bruns, and I run Exceljet with my wife, Lisa. Our goal is to help you work faster in Excel. We create short videos, and clear examples of formulas, functions, pivot tables, conditional formatting, and charts.

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- Area of a triangle
- Circumference of a circle
- Distance formula



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