

Pythagoras of Samos and his pretty number patterns



Pythagoras (560 BC to 480 BC)

First watch the short video to learn about triangular and square numbers, and the magical world of Pythagoras:

<https://bit.ly/4mVIVa5>

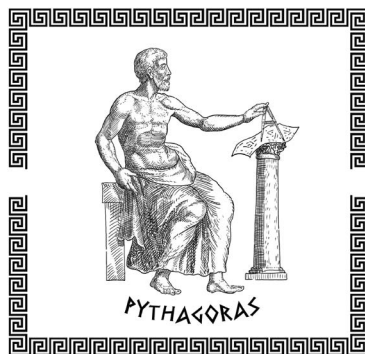


Then read the worksheet and do the activity to learn more.



"GOOD LUCK"
JOHNNY BALL

Pythagoras never wrote down his ideas. Everything we know comes from stories passed down, from people who lived after him. But he was the first person to call himself a 'philosopher' (someone who studies to understand the world), which is when something called the Greek Philosophical Age started.



Around 2,500 years ago, Pythagoras lived on a Greek island called Samos. Huge crowds of people visited to listen to him talk about maths and mathematical patterns. The King of Samos hated that Pythagoras was so popular, so he left Greece with lots of his followers. They sailed to Croton in Southern Italy and started a new community called The Pythagorean Brotherhood.

Pythagoras thought that even the simplest mathematical things were magical and wonderful.

A straight line could turn into a stretched rope along the edge of a field, a string about to be plucked to make a musical sound, or the shortest distance a bird might fly between two points.

Pythagoras taught his followers that numbers could do lots of magical things.

Odd numbers

Take the ODD NUMBERS in order:
1, 3, 5, 7, 9, 11, 13, 15 etc.

If you add the first two numbers in the sequence, they make 4. This is a square number as $2 \times 2 = 4$.

Now add the next one: 5. That makes $1 + 3 + 5 = 9$. This is also a square number.

Add 7 to get 16, or 4×4 .
Add 9 to get 25, or 5×5 .
Add 11 to get 36, or 6×6 .

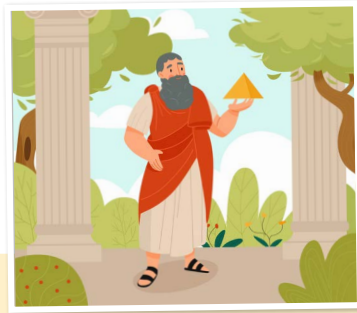
By using counters, you can make squares, with each new odd number making the square bigger.

1 3 5 7

3 3 5 7

5 5 5 7

7 7 7 7



Triangular numbers

Triangular numbers are numbers that can be arranged to make triangle shapes. You get them by adding one more number each time:

$$1$$

$$1 + 2 = 3$$

$$1 + 2 + 3 = 6$$

$$1 + 2 + 3 + 4 = 10$$

These triangular numbers could go on forever!

Here are the first few triangular numbers:
1, 3, 6, 10, 15, 21, 28, 36, 45, 55, 66, 78, 91, 105

You can even write the triangular numbers in a triangle shape:

1	3	6	10
	3 3	6 6	10 10
		6 6 6	10 10 10
			10 10 10 10

1
3 3
6 6 6
10 10 10 10

Can you keep going?

Now let's make triangular numbers into square numbers! A square number is made by multiplying a number by itself.

$$2 \times 2 = 4$$

$$3 \times 3 = 9$$

$$5 \times 5 = 25$$

Look at the triangular numbers in a row. Add two numbers next to each other. What do you notice?

1 3	3 3 6	6 6 6 10
3 3	3 6 6	6 6 10 10
	6 6 6	6 10 10 10
		10 10 10 10

$$1 + 3 = 4$$

$$3 + 6 = 9$$

$$10 + 15 = 25$$

$$15 + 21 = 36$$

Try using counters, buttons, or drawing dots to make triangle and square shapes.

Can you prove the patterns?

Now let's try making cube numbers!

A cube number is made by multiplying a number by itself three times.

1
3 5
7 9 11
13 15 17 19

Add each row:

1	= 1 = 1 × 1 × 1
3 + 5	= 8 = 2 × 2 × 2
7 + 9 + 11	= 27 = 3 × 3 × 3
13 + 15 + 17 + 19	= 64 = 4 × 4 × 4
21 + 23 + 25 + 27 + 29	= 125 = 5 × 5 × 5

For an extra challenge, can you build the triangle until it reaches 10,000? How far can you go?

