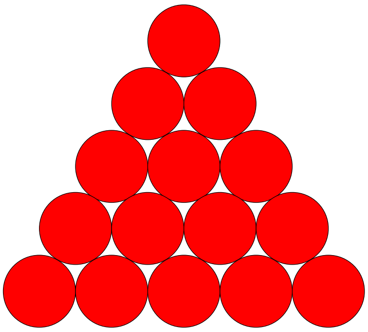
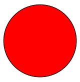
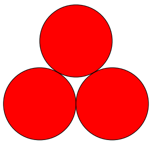


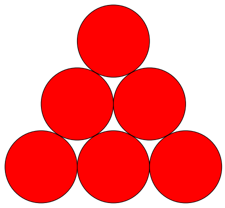
Triangular Numbers



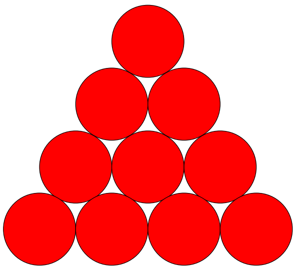
1



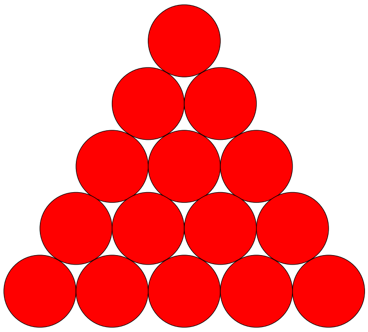
1+2=3



1+2+3=6



1+2+3+4=10



1+2+3+4+5=15

What is the twelfth number in this sequence?

n	1	2	3	4	5
T_n	1	3	6	10	15

The first numbers in the triangular numbers sequence are given in the table above. Which of these formulae give the numbers in terms of n? Write the correct solution in your books to T_n=

$$n(n+1)$$

$$\frac{n(n+1)}{2}$$

$$3n - 3$$

$$\frac{n(n-1)}{3}$$

$$n(n-1)$$

$$\frac{3n(n-1)}{2}$$

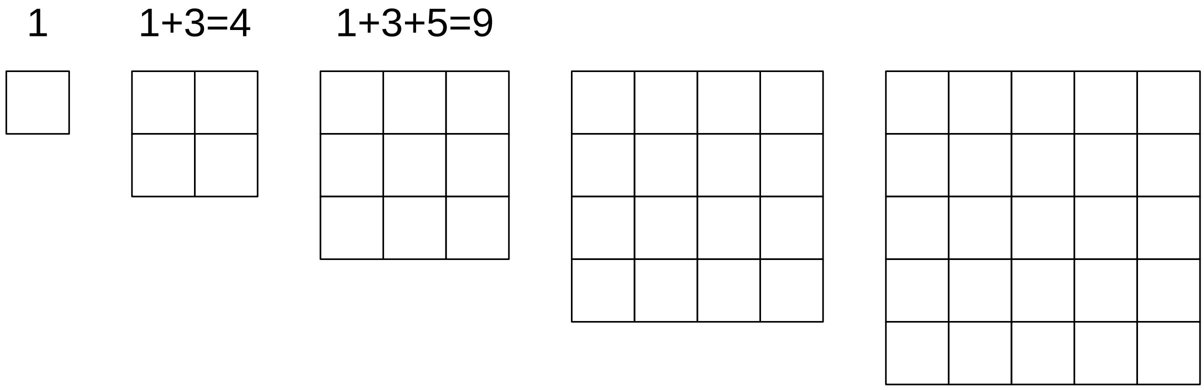
$$\frac{n(n-1)}{2}$$

You need the following items of equipment:

A3 paper, protractor, compass, ruler, sharp pencil.

Instructions:

1. Mark a centre and then draw a large circle.
2. Measure and mark the position of cities around the circumference of your circle. These cities should be at 30° intervals as measured from the centre.
3. Mark the first city on your map in bold. How many routes to the other cities are there that are marked in bold on your map? (The answer is 0 as there are no other cities marked in bold). Note this result in a table in your book.
4. Mark the second city on your map in bold. Draw a route from the first city to the second city on your map. How many cities do you have? How many routes do you have?
5. Continue the pattern joining each new city to the ones already there and note the number of routes.



Square numbers are types of polygonal numbers.

A sequence has been started above. Copy the sequence out and continue it in your books. Do not draw all the squares. See if you can figure out what is happening from the start of the sequence (shown above) and then figure out the next few numbers in the sequence.

1. Can you find the twelfth and fifteenth numbers in the sequence?

2. Let n be a number in the sequence, for example, the first number would be n=1, the second number would be n=2, the third number would be n=3 etc. Work out a formula, in terms of n, for the number in the sequence.

3. Simon says that if you add together the tenth and eleventh triangular numbers together, you get the eleventh square number. Is he correct? How do you know?

4. Can you make a different rule up about square and triangular numbers? Demonstrate that your rule works.

Pentagonal Numbers

The first two pentagonal numbers are **1**, 1+4=**5**. The sequence continues as shown in the table below:

n	1	2	3	4	5	6	7	8
P_n	1	5	12	22	35	51	70	92

What would be the 9th number in this sequence?

Look at the formulae below. Which one describes P_n in terms of n?

$$\frac{n(5n+3)}{4} \qquad \frac{n(5n-3)}{4}$$

$$\frac{3n(2n-1)}{3} \qquad \frac{3n(2n+1)}{5} \qquad \frac{n(3n-1)}{2}$$

$$\frac{n(3n+1)}{2}$$

Use the formula to work out what the forty-third number in this sequence would be.