

1 2, 5, 10, 17, 26, ...
What is the next number in this pattern?

2 Mitchell made this pattern of triangles using matches.

- Which rule gives the number of matches needed for each figure?
- A Multiply the number of triangles by 3.
 - B Multiply the number of triangles by itself and then add 2.
 - C Multiply the number of triangles by 4 and then subtract 1.
 - D Double the number of triangles and then add 1.

3 1, 2, 4, 7, 11, ...
What is the ninth number in this pattern?

4 Sofia used the rule 'double the previous number and subtract 3' to work out the numbers in a pattern. The first number in her pattern was 4. Which is **not** a number in the pattern?
A 5 B 7 C 9 D 11

5 A table shows pairs of numbers.

First number	1	2	4	7	12
Second number	19	18	16	13	8

What is the second number when the first number is 15?
A 3 B 4 C 5 D 6

Use this information to answer questions 6 and 7. The cost per person for a trip is given by the rule: 'Cost = \$960 divided by the number of people travelling'.

6 What is the cost per person when 12 people travel? \$

7 If the cost per person is \$30, how many people are travelling?

8 A pattern has been formed with shapes.
♦ ♥ ♠ ♣ ♠ ♥ ♦ ♦ ♥ ♠ ♣ ♠ ♥ ♦ ♦ ♥ ♠ ...
What is the 50th shape in this pattern?
A ♦ B ♥ C ♠ D ♣

9 3, 6, 4, 8, 6, 12, 10, 20, 18, ...
What is the 12th number in this pattern?

10 Cooper is drawing a rectangle on a grid. He has marked the position of three of the corners.
Where will the fourth corner go?
A (0, 4)
B (4, 0)
C (3, 4)
D (4, 3)

11 Here are some steps in a pattern:
Step 1: $1 \times 1 = 0 \times 2 + 1$
Step 2: $2 \times 2 = 1 \times 3 + 1$
Step 3: $3 \times 3 = 2 \times 4 + 1$
Step 4: $4 \times 4 = 3 \times 5 + 1$
Using this pattern, what is the answer to the question 99×99 ?

12 Jolene made a pattern of four shapes using matches and then recorded the number of matches needed for each shape in a table:

Shape	1	2	3	4
Number of matches	3	9	18	30

Jolene would need 108 matches to make which number shape?

13 2, 5, 8, 11, 14, ...
What is the 101st number in this pattern?
A 301 B 302 C 304 D 305

14 Flora used pins to make four shapes in a pattern.

How many pins would Flora need for Shape 21 in this pattern?

1 37 2 D 3 37 4 C 5 C 6 \$80 7 32 8 B 9 68
10 A 11 9801 12 8 13 B 14 64

- 1 2, 5, 10, 17, 26,
The differences between the terms are 3, 5, 7 and 9. The differences are consecutive odd numbers.
The next difference will be 11.
The next number = $26 + 11$
= 37



Draw up a table:

Number of triangles	1	2	3	4
Number of matches	3	5	7	9

Now consider each option:

'Multiply the number of triangles by 3.'

One triangle:

$$\text{Number of matches} = 3 \times 1 = 3 \quad \checkmark$$

Two triangles:

$$\text{Number of matches} = 3 \times 2 = 6 \quad \times$$

The rule is not 'Multiply the number of triangles by 3.'

'Multiply the number of triangles by itself and then add 2.'

One triangle:

$$\text{Number of matches} = 1 \times 1 + 2 = 3 \quad \checkmark$$

Two triangles:

$$\text{Number of matches} = 2 \times 2 + 2 = 6 \quad \times$$

The rule is not 'Multiply the number of triangles by itself and then add 2.'

'Multiply the number of triangles by 4 and then subtract 1.'

One triangle:

$$\text{Number of matches} = 4 \times 1 - 1 = 3 \quad \checkmark$$

Two triangles:

$$\text{Number of matches} = 4 \times 2 - 1 = 7 \quad \times$$

The rule is not 'Multiply the number of triangles by 4 and then subtract 1.'

'Double the number of triangles and then add 1.'

One triangle:

$$\text{Number of matches} = 2 \times 1 + 1 = 3 \quad \checkmark$$

Two triangles:

$$\text{Number of matches} = 2 \times 2 + 1 = 5 \quad \checkmark$$

Three triangles:

$$\text{Number of matches} = 2 \times 3 + 1 = 7 \quad \checkmark$$

Four triangles:

$$\text{Number of matches} = 2 \times 4 + 1 = 9 \quad \checkmark$$

The rule is 'Double the number of triangles and then add 1.'

- 3 1, 2, 4, 7, 11, ...

The differences between the terms are 1, then 2, then 3, then 4. The differences are increasing by 1 each time.

Continue the pattern:

$$11 + 5 = 16$$

$$16 + 6 = 22$$

$$22 + 7 = 29$$

$$29 + 8 = 37$$

The ninth number is 37.

- 4 'Double the number and subtract 3.'

The first number is 4.

$$\text{The second number} = 4 \times 2 - 3 = 5$$

$$\text{The third number} = 5 \times 2 - 3 = 7$$

$$\text{The fourth number} = 7 \times 2 - 3 = 11$$

5, 7 and 11 are all numbers in the pattern.

Of the choices, the number that is not in the pattern is 9.

- 5 [Study the pairs of numbers to find the rule connecting them.]

First number	1	2	4	7	12
Second number	19	18	16	13	8

The first number plus the second number is always equal to 20.

Now $15 + 5 = 20$

So, when the first number is 15, the second number will be 5.

- 6 'Cost = \$960 divided by the number of people travelling.'

When 12 people travel:

$$\text{Cost} = \$960 \div 12 = \$80$$

- 7 'Cost = \$960 divided by the number of people travelling.'

If the cost per person is \$30:

$$\$30 = \$960 \text{ divided by 'number of people'}$$

$$\text{Now } \$960 \div \$30 = 32$$

$$\text{So } \$960 \div 32 = \$30$$

The number of people is 32.

- 8

There are 8 shapes before the pattern begins to repeat.

So every eighth shape will be

Now $6 \times 8 = 48$ so the 48th shape will be

The 49th shape is the start of the new pattern so it is also

The 50th shape will be the second shape in the pattern.

The 50th shape is

9 3, 6, 4, 8, 6, 12, 10, 20, 18, ...

[The numbers in the pattern first increase then decrease, then increase, then decrease and so on. This suggests that there are two parts to the rule.]

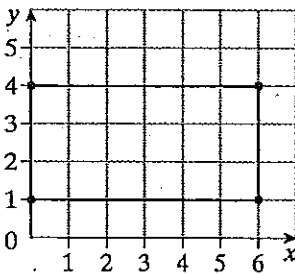
The rule for the pattern is to double the number, then subtract 2, then double that number and then subtract 2 and so on.

The tenth number will be $2 \times 18 = 36$.

The eleventh number will be $36 - 2 = 34$.

The twelfth number will be $2 \times 34 = 68$.

10 The fourth point needs to be at (0, 4).



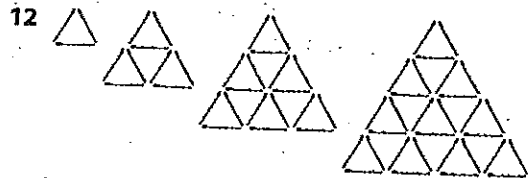
- 11 Step 1: $1 \times 1 = 0 \times 2 + 1$
 Step 2: $2 \times 2 = 1 \times 3 + 1$
 Step 3: $3 \times 3 = 2 \times 4 + 1$
 Step 4: $4 \times 4 = 3 \times 5 + 1$

In each step in the pattern the number that is multiplied by itself on the left side is the same as the step number. The first number on the right side is always 1 less than the step number and the second number on the right side is always 1 more than the step number. The final number on the right side is always 1.

So Step 99 would be:

$$99 \times 99 = 98 \times 100 + 1$$

$$\text{So } 99 \times 99 = 9800 + 1 = 9801$$



Shape	1	2	3	4
Number of matches	3	9	18	30

The pattern for the number of matches is 3, 9, 18, 30, ...

The differences between the terms are 6, then 9, then 12. The differences are increasing by 3 each time.

The next difference will be 15.

The number of matches needed for Shape 5 will be $30 + 15 = 45$.

The next difference will then be 18.

The number of matches needed for Shape 6 will be $45 + 18 = 63$.

Continue the pattern.

The next difference will be 21.

The number of matches needed for Shape 7 will be $63 + 21 = 84$.

The next difference will then be 24.

The number of matches needed for Shape 8 will be $84 + 24 = 108$.

So 108 matches will be needed for Shape 8.

13 2, 5, 8, 11, 14, ...

The numbers are increasing by 3 each time.

The first number is $3 - 1$.

The second number is $2 \times 3 - 1$.

The third number is $3 \times 3 - 1$.

The fourth number is $4 \times 3 - 1$.

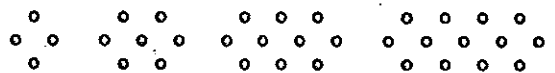
The fifth number is $5 \times 3 - 1$.

So the 101st number = $101 \times 3 - 1$

$$= 303 - 1$$

$$= 302$$

14 [Draw up a table.]



Shape	1	2	3	4
Number of pins	4	7	10	13

The number of pins increases by 3 each time.

Number of pins for Shape 1 = $3 + 1$

Number of pins for Shape 2 = $2 \times 3 + 1$

Number of pins for Shape 3 = $3 \times 3 + 1$

Number of pins for Shape 4 = $4 \times 3 + 1$

So, using this pattern,

Number of pins for Shape 21 = $21 \times 3 + 1$

$$= 63 + 1$$

$$= 64$$