

## Start up

Worksheet  
Brainstarters 3

Worksheet  
Classifying whole numbers

- List the first ten even numbers.
- Sort these numbers, putting all the even numbers in one group, and the odd numbers in another:

17	2002	371	134
60 023	2	748	691
90 704 006	1	95	13
2074	1 000 000	99 999	1256

- Find all the numbers that divide into 6.
- Find all the numbers that divide into 24.
- Find all the even numbers that divide into 36.
- Find all the odd numbers that divide into 90.
- How can you tell if a number is even without dividing it?
- How can you recognise an odd number?
- Write the next three numbers in each of these patterns:
 

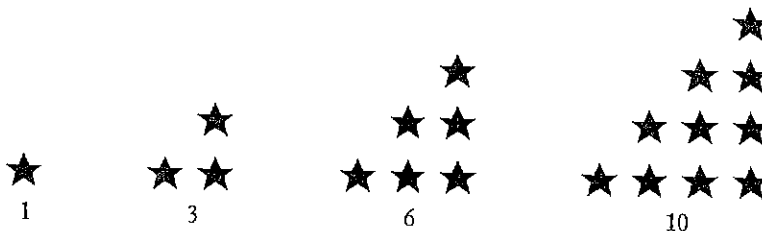
a 8, 10, 12, _____	b 27, 30, 33, _____
c 101, 103, 105, _____	d 39, 37, 35, _____
e 44, 39, 34, _____	f 7, 15, 23, _____
- What is 8 squared?
- What is  $\sqrt[3]{27}$ ?
- Find two numbers that have a product of 48.

## 3-01 Special number patterns

The numbers 1, 2, 3, 4, 5, ... are called the **counting numbers**. There are groups of counting numbers which make special patterns. We will investigate some of them.

### Exercise 3-01

- Triangular numbers are shown in the diagram below.



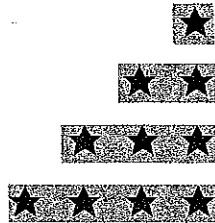
- a Why are they called 'triangular numbers'?
- b Work out all the triangular numbers less than 100.
- c Complete four more lines of this pattern:

$$1 = 1$$

$$1 + 2 = 3$$

$$1 + 2 + 3 = 6$$

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



- d Describe how the pattern in part c works.
- e Use what you have worked out to help you find the 100th triangular number.  
(Hint: Do you know a quick way to add up all the numbers from 1 to 100?)

2 Square numbers are shown in the diagram below.



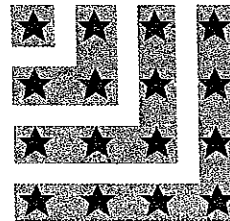
- a Why are these called 'square numbers'?
- b Work out all the square numbers up to 100.
- c Complete four more lines of this pattern:

$$1 = 1$$

$$1 + 3 = 4$$

$$1 + 3 + 5 = 9$$

$$1 + 3 + 5 + 7 = 16$$



- d Describe how the pattern works.
- e Work out another pattern to help you find the square numbers. What is the 50th square number?
- f Complete four more lines of these patterns:

i

$$1 = 1^2$$

$$1 + 2 + 1 = 2^2$$

$$1 + 2 + 3 + 2 + 1 = 3^2$$

ii

$$2^2 = 1^2 + (1 + 2)$$

$$3^2 = 2^2 + (2 + 3)$$

$$4^2 = 3^2 + (3 + 4)$$

g Each square number is said to be the sum of two consecutive triangular numbers.



Show that this is true for the square numbers up to 100.

h Find two numbers that are both triangular numbers and square numbers.

TLF L 1935

Circus towers:  
square stacks

345678

456

0123456

678901234567890

4567890123456789

901234567890123

456789012345678

90123456789012

345678901234567

89012345678901

23456789012345

67890123456789

01234567890123

45678901234567

89012345678901

2345678901234

56789012345678

90123456789012

34567890123456

7890123456789

0123456789012

45678901234567

89012345678901

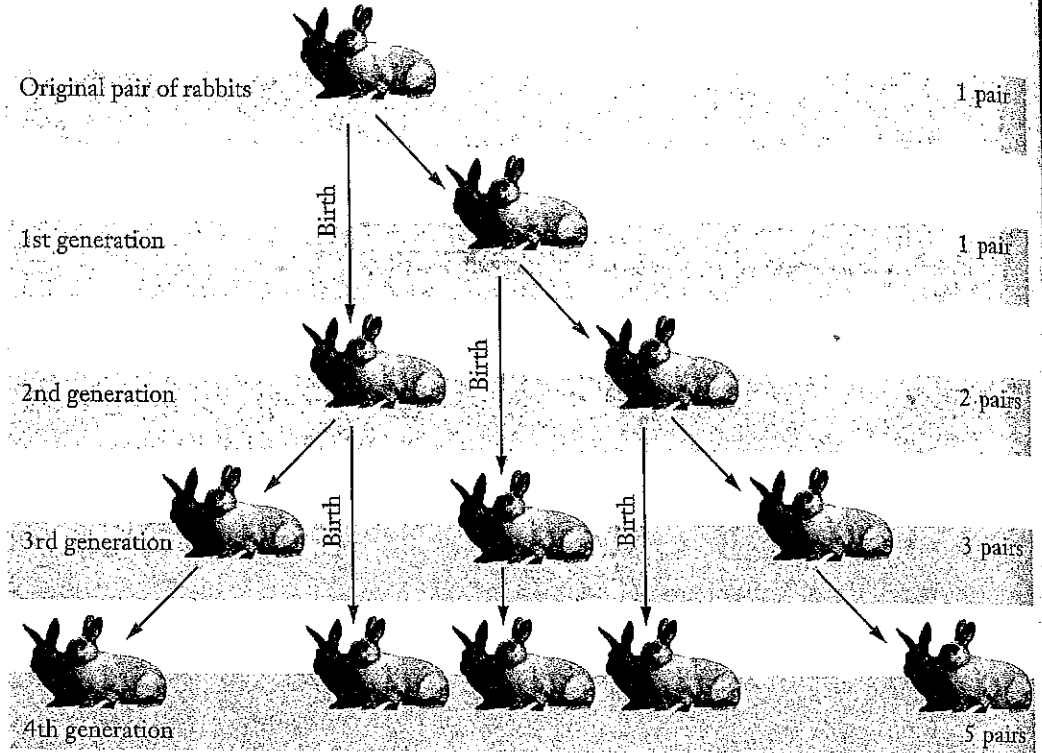
23456789012345

67890123456789

3 Leonardo **Fibonacci** was an Italian mathematician who lived in the early 13th century. He discovered this pattern when studying the breeding habits of rabbits:

1, 1, 2, 3, 5, 8, 13, 21, ...

The diagram below illustrates this. The vertical arrows labelled 'Birth' indicate the new offspring of a pair of rabbits every two months. The unlabelled arrows indicate the same pair of rabbits. After each month, the number of pairs is a term in Fibonacci's pattern.



a How is the Fibonacci pattern formed?

b Add five more lines to this pattern:

1  
1  
 $1 + 1 = 2$   
 $1 + 2 = 3$   
 $2 + 3 = 5$   
 $3 + 5 = 8$

c Write the first 20 Fibonacci numbers.

- i Write every *third* Fibonacci number, beginning with 2. What number divides evenly into all these numbers?
- ii Write every *fourth* Fibonacci number, beginning with 3. What number divides evenly into all these numbers?
- iii Write every *fifth* Fibonacci number, beginning with 5. What number divides evenly into all these numbers?

- d i Find any triangular numbers in the Fibonacci numbers up to 100.
- ii Find any square numbers in the Fibonacci numbers up to 100.

e Pairs of Fibonacci numbers are found by counting along the spirals on pine cones. Investigate how and where else Fibonacci numbers occur in nature.

901234  
3789012345678  
8  
9012345678901234  
789012345678  
890123456789012  
0123456789012345  
7890123456789012  
5678  
36  
90123456789  
9012345678901234567  
9012  
78901234567890123456  
90123456789012345678901  
0123456789012345678901234  
56789012345678901234  
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