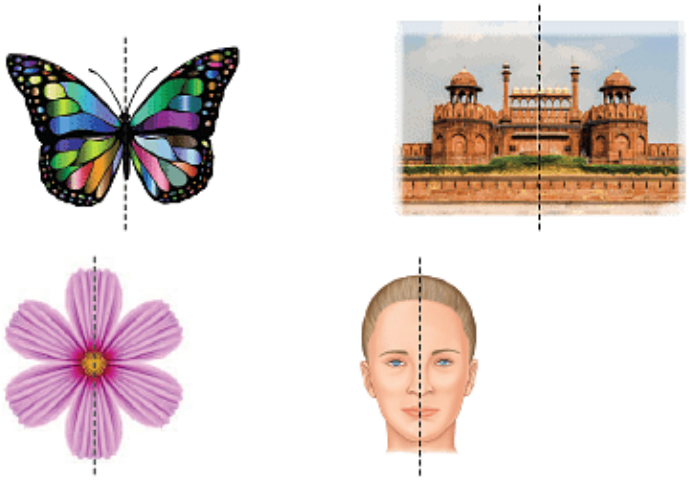
Patterns & Symmetry

Symmetry

Look at the figures given below and the dotted lines

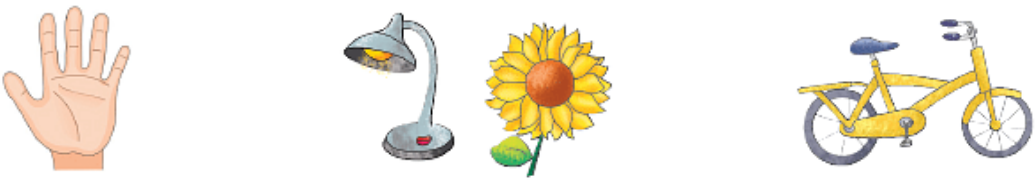


If you fold the above figures along the vertical line, you will find that one half exactly covers the other half. Such figures are called the **symmetrical figures.**

The vertical line that divides a figure into two equal parts is called the **line of symmetry** or the **axis of symmetry.**

Are all objects symmetrical?

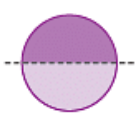
No, some objects like the ones given below are not symmetrical. They are called **non-symmetrical** objects or things.

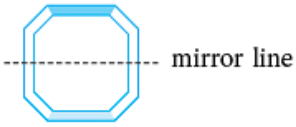


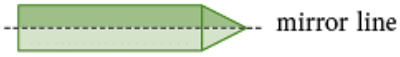
Reflection like a Mirror Image

When you look into a mirror, you see your reflection. The mirror image is the reflection of the image.

We can see that a symmetrical shape can be split in half by the line of symmetry. If we put a small mirror on the dotted line, we will see the whole shape. Thus, you can see that a shape has line symmetry when one half of it is the mirror image of the other half.



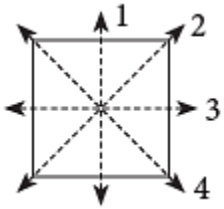




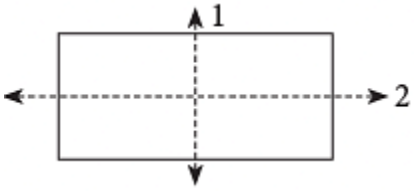
Thus, reflectional symmetry is also known as **mirror symmetry.**
Look at the reflection of some numbers and letters.

Symmetry in Some Geometrical Shapes

1. A square has four lines of symmetry.

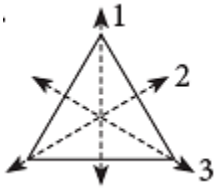


2. A **rectangle** has **two** lines of symmetry.



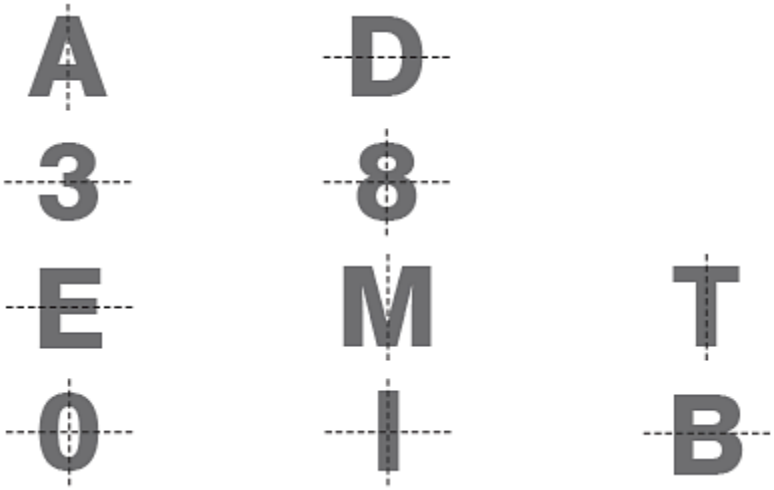
3. An **isosceles triangle** has only **one** line of symmetry.

4. An equilateral triangle has three lines of symmetry.



Symmetry in Letters and Numbers

Here are some capital letters and numbers which have lines of symmetry.



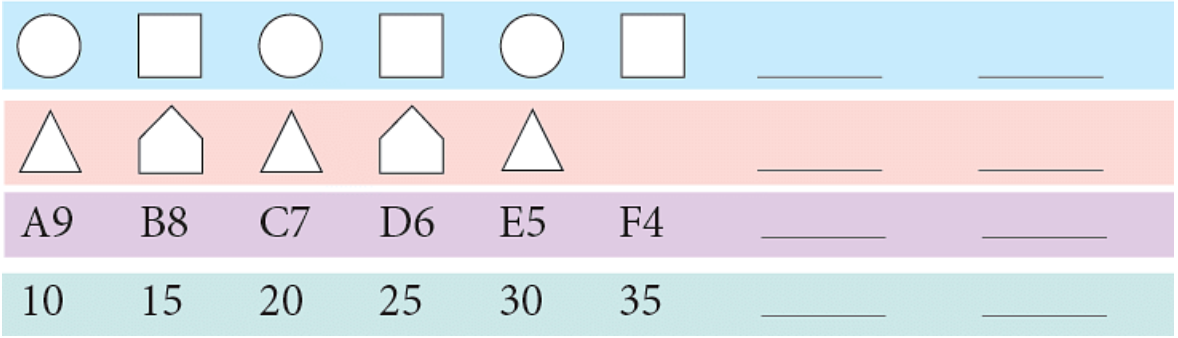
However, there are some letters and numbers which are not symmetrical.

F L P Q 2 5 9

Patterns

Patterns are shapes, designs and a group of numbers that repeat themselves in a **predictable** manner.

Let us look at some examples.



Patterns in Addition

Patterns of the sum of three consecutive numbers

$1 + 2 + 3 = 6$, 6 is a multiple of 3 and $3 \times 2 = 6$.
$2 + 3 + 4 = 9$, 9 is a multiple of 3 and $3 \times 3 = 9$.
$3 + 4 + 5 = 12$, 12 is a multiple of 3 and $3 \times 4 = 12$.
$4 + 5 + 6 = 15$, 15 is a multiple of 3 and $3 \times 5 = 15$.
$5 + 6 + 7 = 18$, 18 is a multiple of 3 and $3 \times 6 = 18$.

Rule

The sum of three consecutive numbers is a multiple of 3. Also, the sum is three times the middle term.

Patterns in Multiplication

I. Multiplication of a number ending in 5 by itself.

$25 \times 25 = 625$ (5×5, 2×3)

$45 \times 45 = 2025$ (5×5, 4×5)

$35 \times 35 = 1225$ (5×5, 3×4)

$55 \times 55 = 3025$ (5×5, 5×6)

Rule

Every product ends in 25 and the remaining digits are obtained by multiplying the digit at the tens place by its next higher number.

II. Multiplying the same number having all digits as 1.

We have,

$1 \times 1 = 1$
$11 \times 11 = 121$
$111 \times 111 = 12321$
$1111 \times 1111 = 1234321$

Sum of Digits in the Factors	Middle Digit of the Product
1	1
1+1 = 2	2
1+1+1 = 3	3
1+1+1+1 = 4	4

Rule
The middle digit in the product is the sum of the digits of one factor.

III. To multiply factors like 19 and 21.
$19 \times 21 = 399 = 400 - 1 = 20 \times 20 - 1$
$29 \times 31 = 899 = 900 - 1 = 30 \times 30 - 1$
$39 \times 41 = 1599 = 1600 - 1 = 40 \times 40 - 1$

Observing the above pattern, we can write
$49 \times 51 = 50 \times 50 - 1 = 2500 - 1 = 2499$
$59 \times 61 = 60 \times 60 - 1 = 3600 - 1 = 3599$

IV. To multiply a number by 11.

$13 \times 11 = 143$ (1 + 3)

$22 \times 11 = 242$ (2 + 2)

$25 \times 11 = 275$ (2 + 5)

$36 \times 11 = 396$ (3 + 6)

Observing the given pattern,

$29 \times 11 =$ _____

$2 \quad 9 = 319$

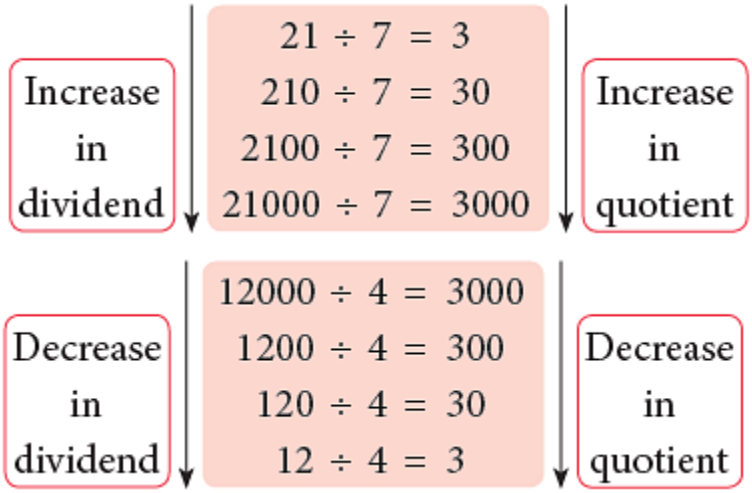
2 + 9 = 11; write 1 as the middle digit, carry 1 to 2; add to make 3.

$39 \times 11 = 3\ (3+9)\ 9 = 429$

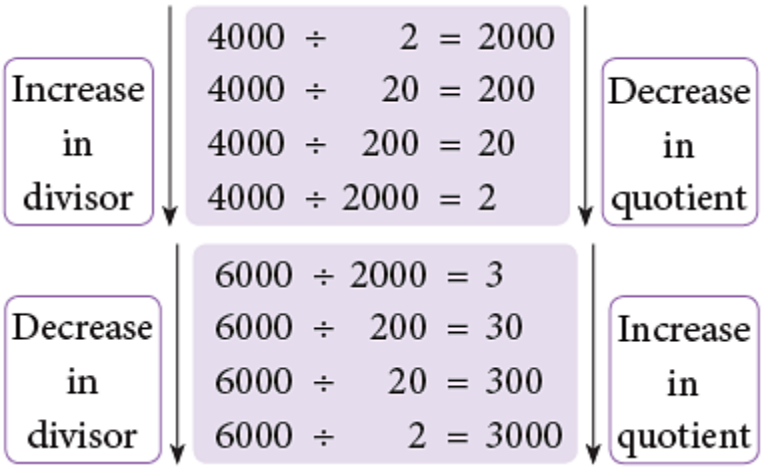
$77 \times 11 = 7\ (7+7)\ 7 = 847$

Patterns in Division

Observe the given patterns.



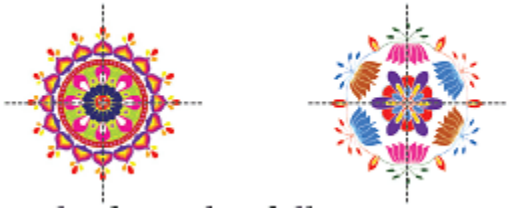
These patterns show that as the dividend increases (divisor remaining the same), the quotient also increases. As the dividend decreases, the quotient also decreases. Now, keeping the dividend same, let us increase or decrease the divisor and observe the effect on the quotient.



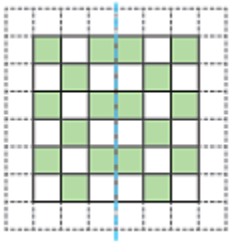
Now, look for the pattern in the following sequence of numbers and find the missing number. 3125, 625, 125, , 5, 1
The missing number is **25,** as per the rule for this pattern, the number is **divided by 5, each time.**

Geometrical Patterns Based on Symmetry

Rangoli patterns are drawn as decorations during the festival of Diwali. The pictures given here show two such patterns.

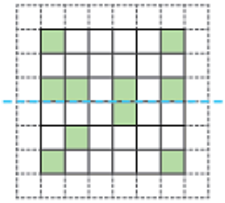


Now, look at the following patterns.



This pattern is **symmetrical.**
It can be folded in half, so all the lines and colours in each half fit exactly on top of each other.

Quilt patterns based on symmetry.



This pattern is **not symmetrical**.
When it is folded in half, some of the lines and colours do not match.