

# Standard VI

## MATHEMATICS

### Part - 2



**Government of Kerala**  
**Department of Education**  
**2016**

**State Council of Educational Research and Training (SCERT)**

## THE NATIONAL ANTHEM

Jana-gana-mana adhinayaka, jaya he  
Bharatha-bhagya-vidhata.  
Punjab-Sindh-Gujarat-Maratha  
Dravida-Utkala-Banga  
Vindhya-Himachala-Yamuna-Ganga  
Uchchala-Jaladhi-taranga  
Tava subha name jage,  
Tava subha asisa mage,  
Gahe tava jaya gatha.  
Jana-gana-mangala-dayaka jaya he  
Bharatha-bhagya-vidhata.  
Jaya he, jaya he, jaya he,  
Jaya jaya jaya, jaya he!

## PLEDGE

India is my country. All Indians are my brothers and sisters.  
I love my country, and I am proud of its rich and varied heritage. I shall always strive to be worthy of it.  
I shall give respect to my parents, teachers and all elders and treat everyone with courtesy.  
I pledge my devotion to my country and my people.  
In their well-being and prosperity alone lies my happiness.

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Dear children,

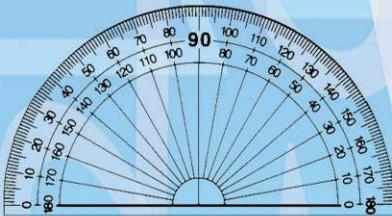
In five years, we have learnt many basic ideas of mathematics.

Numbers, Shapes, Fractions, ...

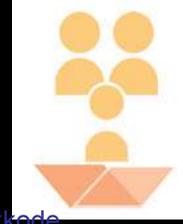
Thus we have seen something of the different branches of mathematics.

From this springboard, let's leap ahead into the wide world of math with confidence.

**Dr. J. Prasad**  
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# TEXTBOOK DEVELOPMENT



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2.5



Certain icons are used in this textbook  
for convenience



*Computer Work*



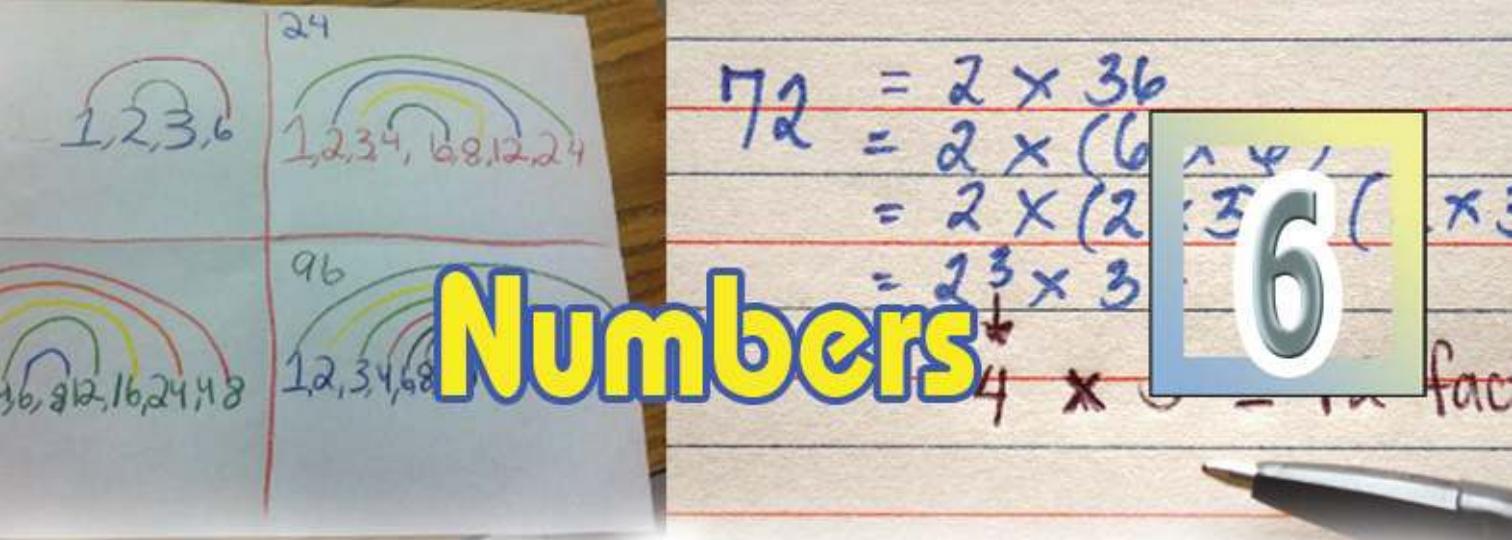
*Additional Problems*



*Project*



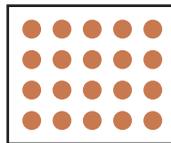
*Self Assessment*



# Numbers

## Let's make a rectangle

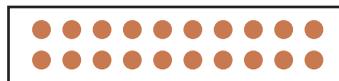
A rectangle with 20 dots:



5 dots wide, 4 dots high.

Can we make other rectangles, rearranging the dots?

How about this?



Also like this:



Any other?

What about the number of dots along the width and height?

Their product must be 20, right?

In what all ways can we write 20 as the product of two natural numbers?

Now make different rectangles with 24 dots. Also write down the number of dots along the width and height.

Width	Height



What about 30 dots?

Let's think about it, without actually making rectangles. What are the possible number of dots along the width and height?

The product of numbers in every row of the table is 30.

Width	Height
30	1
15	2

There's another way of stating this; all these numbers are factors of 30.

Now can you write down the different rectangles with 40 dots?

How about 45 dots?

And 60 dots?

What about 61 dots?

### Factor pairs

What are the factors of 72?

Two quick ones are 1 and 72.

We can divide 72 by 2 without any remainder. That is 2 is also a factor of 72. And 72 divided by 2 gives 36.

$$72 = 2 \times 36$$

So 36 is also a factor of 72.

Thus we can find factors in pairs.

Since

$$72 \div 3 = 24$$

We have

$$72 = 3 \times 24$$

This gives 3 and 24 as another pair of factors.

Can't we find other pairs like this?

- |         |         |
|---------|---------|
| (1, 72) | (2, 36) |
| (3, 24) | (4, 18) |
| (6, 12) | (8, 9)  |

Now try to find the factors of 90, 99, 120 as pairs.



- If 2 and 3 are factors of a number, should 6 also be a factor of that number?
- If 3 and 5 are factors of a number, should 15 also be a factor of that number?
- If 4 and 6 are factors of a number, should 24 also be a factor of that number?
- If 4 and 6 are factors of a number, what is the largest number we can say for sure is a factor of that number?
- Given Two factors of a number, under what conditions can we say for sure that the product of these factors is also a factor?

## Odd and even

We have found the factors of many numbers like 20, 24, 30, 40, 45, 60, 61, 72, 90, 99, 120.

See how many factors each has.

All of them have an even number of factors, right?

Why is this so?

Is it true for all numbers?

Write the factor pairs of 36.

(1, 36), (2, 18), (3, 12), (4, 9), (6, 6)

So what are the factors of 36?

1, 2, 3, 4, 6, 9, 12, 18, 36

9 factors in all.

Why is the number of factors odd in the case?

Can you find any other number with an odd number of factors?

Take 16, for example.

How about 25?

What is the speciality of numbers with an odd number of factors?

## Repeated multiplication

How many factors does 5 have?

How about 17?

5 and 17 are prime numbers, aren't they?

And a prime has only two factors, right? 1 and the number itself.

All composite numbers have more than two factors.

For example, let's have a look at 32.

Can you find all numbers between 1 and 100; which have an odd number of factors?



$$32 = 2 \times 2 \times 2 \times 2 \times 2$$

Taking the first 2 alone and all the other 2's together, we can write

$$32 = 2 \times 16$$

How about taking the first two 2 s together and then other 2's together?

$$32 = 4 \times 8$$

Taking all the 2's together can be written as

$$32 = 1 \times 32$$

Thus, the factors of 32 are the 6 numbers

$$1, 2, 4, 8, 16, 32$$

Let's look at the factors of 81 like this:

Writing 81 as a product of prime numbers, we get

$$81 = 3 \times 3 \times 3 \times 3$$

So we can write 81 as

$$3 \times 27$$

$$9 \times 9$$

$$1 \times 81$$

Thus we have five factors.

$$1, 3, 9, 27, 81$$

We can put this in a different way.

Taking 3's in groups we get the factors.

$$3$$

$$3 \times 3 = 9$$

$$3 \times 3 \times 3 = 27$$

$$3 \times 3 \times 3 \times 3 = 81$$

and find the 5 factors of 81 as 1, 3, 9, 27 and 81.

In these examples, 32 is a product of 2's; and 81 is a product of 3's.

Like this, can't we easily find the factors of a number, which can be factorized as repeated product of a single prime?

We can split 216 as

$$216 = 6 \times 6 \times 6$$

Can we say that the only factors of 216 are the 4 numbers 1, 6, 36, 24.

What are the other factors of 216?





- Find all the factors of the numbers below:  
 (i) 256    (ii) 625    (iii) 243    (iv) 343    (v) 121
- Which are the numbers between 1 and 100 having exactly three factors?

### Prime factors

How do we find the factors of 16?

The only prime factor of 16 is 2. Writing

$$16 = 2 \times 2 \times 2 \times 2$$

We see that the factors of 16, except 1, are products of 2's.

$$\begin{aligned} & 2 \\ & 2 \times 2 = 4 \\ & 2 \times 2 \times 2 = 8 \\ & 2 \times 2 \times 2 \times 2 = 16 \end{aligned}$$

Taking 1 also, we get all the factors of 16 as 1, 2, 4, 8, 16.

Now let's try  $16 \times 3 = 48$ .

$$48 = (2 \times 2 \times 2 \times 2) \times 3$$

To get its factors, we can multiply some of the 2's only; or some 2's and 3.

Taking only 2's, what we get are the factors of 16.

$$2, 4, 8, 16$$

What if we take 2's and 3?

$$\begin{aligned} (2 \times 3) &= 6 \\ (2 \times 2) \times 3 &= 4 \times 3 = 12 \\ (2 \times 2 \times 2) \times 3 &= 8 \times 3 = 24 \\ (2 \times 2 \times 2 \times 2) \times 3 &= 48 \end{aligned}$$

Thus we get also the factors.

$$6, 12, 24, 48$$

3 alone is also a factor. Also 1, which is a factor of every number.

We can separate these factors like this;

without 3	1	2	4	8	16
with 3	3	6	12	24	48

What is the relation between each number in the first row with the number below it.

Now let's take  $48 \times 3 = 144$

$$144 = (2 \times 2 \times 2 \times 2) \times (3 \times 3)$$

The factors can be got by taking only some 2's, some 2's and one 3 or some 2's and two 3's.

Taking 3's only we get 3 and 9.

And 1 also is a factor.

No 3	1	2	4	8	16
One 3	3	6	12	24	48
Two 3's	9	18	36	72	144

These can also be written in a table like this:

The numbers in the first row, multiplied by 3, give the numbers in the second row.

And numbers in the second row, multiplied by 3, give the numbers in the third row.

Let's look at the table along the columns.

First column is 1, 3, 9; these numbers do not have 2 as a factor.

Second column is 2, 6, 18; these have a single 2 as a factor.

What about the third and fourth columns?

	No 2	One 2	Two 2's	Three 2's	Four 2's
No 3	1	2	4	8	16
One 3	3	6	12	24	48
Two 3's	9	18	36	72	144

Thus the numbers in each column, multiplied by 2, give the numbers in the next column.

So, a factor of 144 can be found like this:

Multiply some 2's and 3's. The number of 2's must be less than or equal to 4 (we can also choose to take no 2 at all). The number of 3's must be less than or equal to 2 (or no 3 at all). Such factors, together with 1 give all the factors.

For example, 24 is the product of three 2's and one 3.

$$24 = 2 \times 2 \times 2 \times 3$$

And 18 is the product of a single 2 and two 3's.

Can you find the factors of 200 like this?

$$200 = 2 \times 2 \times 2 \times 5 \times 5$$

Make a table like this:

	No 2	One 2	Two 2's	Three 2's
No 5				
One 5				
Two 5's				



Find all the factors of the numbers below:

- (i) 242
- (ii) 225
- (iii) 400
- (iv) 1000

We have found the factors of 144.

Now let's try  $144 \times 5 = 720$

$$720 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5$$

We can separate the factors as those without 5 and those with 5.

The factors without 5 are factors of 144.

And these can be found as before.

	No 2	One 2	Two 2's	Three 2's	Four 2's
No 3	1	2	4	8	16
One 3	3	6	12	24	48
Two 3's	9	18	36	72	144

Multiplying all these by 5 gives the factors with 5.

	No 2	One 2	Two 2's	Three 2's	Four 2's
No 3	5	10	20	40	80
One 3	15	30	60	120	240
Two 3's	45	90	180	360	720

Let's write all these factors of 720 in a single table:

	No 2	One 2	Two 2's	Three 2's	Four 2's	
<b>No 3</b>	1	2	4	8	16	<b>No 5</b>
<b>One 3</b>	3	6	12	24	48	
<b>Two 3's</b>	9	18	36	72	144	
<b>No 3</b>	5	10	20	40	80	<b>One 5</b>
<b>One 3</b>	15	30	60	120	240	
<b>Two 3</b>	45	90	180	360	720	

What about  $144 \times 25 = 3600$ ?

We can expand the factor table of 720 like this:

	No 2	One 2	Two 2's	Three 2's	Four 2's	
<b>No 3</b>	1	2	4	8	16	<b>No 5</b>
<b>One 3</b>	3	6	12	24	48	
<b>Two 3's</b>	9	18	36	72	144	
<b>No 3</b>	5	10	20	40	80	<b>One 5</b>
<b>One 3</b>	15	30	60	120	240	
<b>Two 3's</b>	45	90	180	360	720	
<b>No 3</b>	25	50	100	200	400	<b>Two 5's</b>
<b>One 3</b>	75	150	300	600	1200	
<b>Two 3's</b>	225	450	900	1800	3600	



Factorize each of the numbers below as the product of primes and write all factors in a table. Write also the number of factors of each.

- |          |           |           |
|----------|-----------|-----------|
| (i) 72   | (ii) 108  | (iii) 300 |
| (iv) 96  | (v) 160   | (vi) 486  |
| (vii) 60 | (viii) 90 | (ix) 150  |



- (i) Find the number of factors of 6, 10, 15, 14, 21. Find some other numbers with exactly four factors.
- (ii) Is it correct to say that any number with exactly four factors is a product of two distinct primes?

### Number of factors

We know how to find all the factors of 64.

Without writing down all the factors, can we just find the number of factors?

$$64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$$

We can take one 2, two 2's, three 2's and so on to get factors. How many such factors are there?

Here there are six 2's. So we can take one to six 2's, and 1 is also a factor.

$$6 + 1 = 7 \text{ factors in all.}$$

Can we find the number of factors of 243 like this?

$$243 = 3 \times 3 \times 3 \times 3 \times 3$$

How many 3's?

Taking one 3, two 3's, three 3's and so on, how many factors do we get?

Together with 1?

$5 + 1 = 6$  factors in all.

If a number can be split as the repeated product of a single prime, how do we find the number of factors of that number quickly?

What if we have two primes?

For example, let's take  $64 \times 3 = 192$

$$192 = (2 \times 2 \times 2 \times 2 \times 2 \times 2) \times 3$$

1 and products of 2's give 7 factors as above; these factors multiplied by 3 give another 7 factors. Altogether 14 factors.

How about one more 3?

So how many factors does  $192 \times 3 = 576$  have?

$$576 = (2 \times 2 \times 2 \times 2 \times 2 \times 2) \times (3 \times 3)$$

We can separate the factors of 576 like this.

(i) Factors without 3

1      2      4      8      16      32      64

(ii) Product of these by 3

3      6      12      24      48      96      192

(iii) Product of the first factors by two 3's

9      18      36      72      144      288      576

7 of each type.  $7 \times 3 = 21$  in all.

We can put this in a different way. Take the products of 2's and 3's separately.

$$576 = 64 \times 9$$

Look at the three types of factors of 576 again

- (i) 1, 2, 4, 8, 16, 32, 64      - Factors of 64
- (ii) 3, 6, 12, 24, 48, 96, 192      - Products of the factors of 64 by the factor 3 of 9
- (iii) 9, 18, 36, 72, 144, 288, 576      - Products of the factors of 64 by the factor 9 of 9

We can also say that the factors we write first are the product of the factors of 64 by the factor 1 of 9.

Thus the factors of 576 are the product of each factor of 64 by each factor of 9.

64 has 7 factors and 9 has 3 factors. So  $64 \times 9 = 576$  has 3 groups of 7 factors.

That is  $7 \times 3 = 21$  factors.

Like this, can we find how many factors 1000 has?

$$1000 = (2 \times 2 \times 2) \times (5 \times 5 \times 5)$$

In this,  $2 \times 2 \times 2 = 8$  has 4 factors; and  $5 \times 5 \times 5 = 125$  also has 4 factors.

We can multiply each of the 4 factors of 8 by each of the 4 factors of 125 to get all factors of 1000. That is 4 groups of 4 factors, making  $4 \times 4 = 16$  in all.

Now let's see how many factors 3600 has.

$$3600 = (2 \times 2 \times 2 \times 2) \times (3 \times 3) \times (5 \times 5)$$

$2 \times 2 \times 2 \times 2 = 16$  has 5 factors,  $3 \times 3 = 9$  and  $5 \times 5 = 25$  have 3 factors each.

Multiplying each factor of 16 by each factor of 9 gives  $5 \times 3 = 15$  factors of  $16 \times 9$ .

Multiplying each of these by factors of 25 give all factors of  $16 \times 9 \times 25 = 3600$ .

That means  $15 \times 3 = 45$  factors

(Look once more the factor table of 3600 done earlier).

The number 4 has 3 factors and number 6 has 4 factors. Can we say that  $4 \times 6 = 24$  has  $3 \times 4 = 12$  factors? Multiply each factor of 4 by each factor of 6. Why did we get the number of factors wrong?





1. The factor table of a number is given below. Some of the factors are written.

	No 2	One 2	Two 2's	Three 2's	
No 5	○				No 7
One 5	2				
Two 5's					
No 5		○			One 7
One 5		490			
Two 5's					
No 5				100	Two 7's
One 5		○			
Two 5's			○		

- (i) What is the number with this factor table?
- (ii) Fill in the numbers in the circles
- (iii) Write the numbers below in the correct cells
- 4, 25, 140, 200
- (iv) Which of the numbers below cannot be in the table?

32, 40, 50, 200, 300, 350

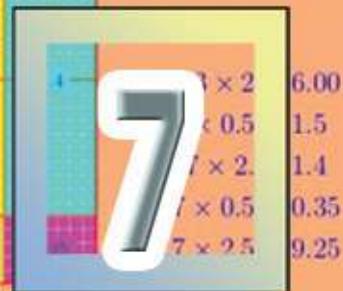
2. Find the number of factors of each of these numbers.
  - (i) 500    (ii) 600    (iii) 700
  - (iv) 800    (v) 900
3. How many factors does a product of three distinct primes have? What about a product of 4 distinct primes?
4.
  - i) Find two numbers with exactly five factors.
  - ii) What is the smallest number with exactly five factors?
5. How many even factors does 3600 have?



### Looking back

Learning outcomes	What I can	With teacher's help	Must improve
<ul style="list-style-type: none"> <li>• Forming and explaining the method to find all factors of a number.</li> </ul>			
<ul style="list-style-type: none"> <li>• Finding and explaining the logic of number relations.</li> </ul>			
<ul style="list-style-type: none"> <li>• Forming and justifying the method to find number of factors of a number without actually finding all factors.</li> </ul>			

# Decimal Operations



## Triangle problem

Anup made a triangle with three sticks of length 4 centimetres each.  
What is the perimeter of this triangle?

How did you do it?

Suma made a triangle using 4.3 centimetre sticks instead.

What is the perimeter?

$$4.3 + 4.3 + 4.3 = 12.9 \text{ cm.}$$

Instead of adding again and again, we only compute 3 times 4.3

How do we find it?

4.3 centimetres mean 43 millimetres. And 3 times 43 millimetres is  $43 \times 3 = 129$  millimetres.

This is 12.9 millimeters.

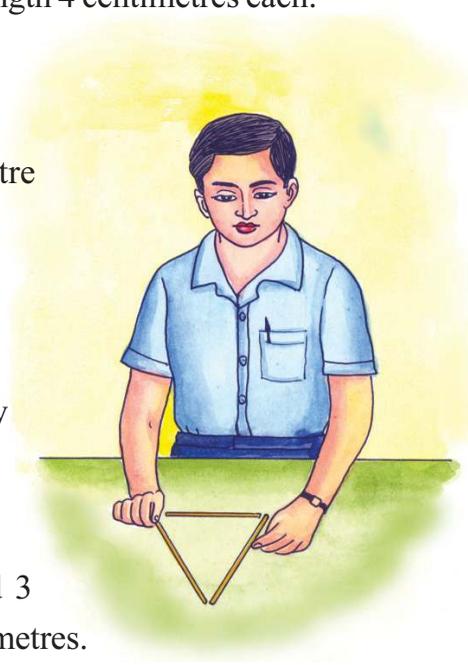
There's another way of doing this:

$$4.3 = 4 \frac{3}{10} = \frac{43}{10}$$

So, 3 times  $\frac{43}{10}$  is

$$\frac{43}{10} \times 3 = \frac{129}{10} = 12.9 \text{ cm.}$$

That is,  $4.3 \times 3 = 12.9$



### Cloth problem



To make a shirt for a boy in the class, 1.45 metres of cloth is needed, on average.

How much cloth is needed to make shirts for the 34 boys in the class?

We must calculate 34 times 1.45.

1.45 metres mean 145 centimetres;

And 34 times 145 is

$$145 \times 34 = 4930$$

How much metres is 4930 centimetres?

$$\frac{4930}{100} \text{ metre} = 49.30 \text{ metres}$$

How about doing this with fraction?

$$1.45 = 1 \frac{45}{100} = \frac{145}{100}$$

$$1.45 \times 34 = 1 \frac{45}{100} \times 34 = \frac{145}{100} \times 34 = \frac{4930}{100}$$

We can write it as a decimal.

$$\frac{4930}{100} = 49.30 = 49.3$$

Thus  $1.45 \times 34 = 49.3$

### Area

We know how to calculate the area of a rectangle of length 8 centimetres and height 6 centimetres.

What about a rectangle of length 8.5 centimetres and breadth 6.5 centimetres?

The lengths in millimetres are 85 and 65.

So area is  $85 \times 65 = 5525$  square millimetres.

How do we change it into square centimetres?

$$1 \text{ square millimetre} = \frac{1}{100} \text{ square centimetre.}$$

$$5525 \text{ square millimetres} = \frac{5525}{100} = 55.25 \text{ square centimetres.}$$

The area of a square of side 1 centimetre is 1 square centimetre and the area of a square of side 1 millimetre is 1 square millimetre. 1 centimetre is 10 millimetres. So in the bigger square we can stack 10 smaller squares each along the length and breadth  $10 \times 10 = 100$  small squares in all.

So the smaller square is  $\frac{1}{100}$  of the bigger square. That means



$$1 \text{ sq.mm.} = \frac{1}{100} \text{ sq.cm}$$

How about writing all measurements as fractions?

$$8.5 \text{ centimetres} = 8 \frac{5}{10} \text{ centimetres} = \frac{85}{10} \text{ centimetres}$$

$$6.5 \text{ centimetres} = 6 \frac{5}{10} \text{ centimetres} = \frac{65}{10} \text{ centimetres}$$

Area is  $\frac{85}{10} \times \frac{65}{10}$  square centimetres.

$$\frac{85}{10} \times \frac{65}{10} = \frac{5525}{100} = 55.25$$

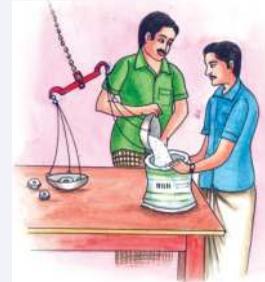
Thus area is 55.25 square centimetres.

Let's write the computation using numbers only.

$$8.5 \times 6.5 = 55.25$$



1. The sides of a square are of length 6.4 centimetres .What is its perimeter?
2. 3 rods of length 6.45 metres each are laid end to end .What is the total length?
3. A bag can be filled with 4.575 kilograms of sugar. How much sugar can be filled in 8 such bags?
4. The price of one kilogram of rice is 34.50 rupees. How much money do we need to buy 16 kilograms?
5. 6 bottles are filled with the coconut oil in a can. Each bottle contains 0.478 litres. How much oil was in the can, in litres?
6. The length and breadth of a rectangular room are 8.35 metres and 3.2 metres. What is the area of that room?



## Multiplication

What is the meaning of  $4.23 \times 2.4$ ?

$$4.23 \times 2.4 = \frac{423}{100} \times \frac{24}{10} = \frac{423 \times 24}{1000}$$

To compute this, we have to multiply 423 by 24 and then divide by 1000.

$$423 \times 24 = 10152$$

$$\frac{423 \times 24}{1000} = \frac{10152}{1000} = 10.152$$

In the answer, how many digits are there after the decimal point?

Why three?

Look at the fraction form of the answer. The denominator is 1000, right?

How did we get this 1000?

Look at the denominator of the fractions we multiplied.

So how do we complete  $4.23 \times 0.24$ ?

First find  $423 \times 24 = 10152$ .

$0.1 \times 0.1 = 0.01$   
 $0.01 \times 0.01 = 0.0001$   
 $0.001 \times 0.001 = 0.000001$   
 $0.0001 \times 0.0001 = 0.00000001$

Now how many digits are there after the decimal point in the product?

If we write  $4.23 \times 0.24$  as a fraction, what would be the denominator of the product?

4.23 as a fraction has denominator 100.

0.24 as a fraction has denominator 100. What about the denominator of the product?

So,  $4.23 \times 0.24 = \frac{10152}{10000} = 1.0152$

Like this, how do we do  $2.45 \times 3.72$ ?

First calculate  $245 \times 372$ .

Now we must find out the number of digits after the decimal point.

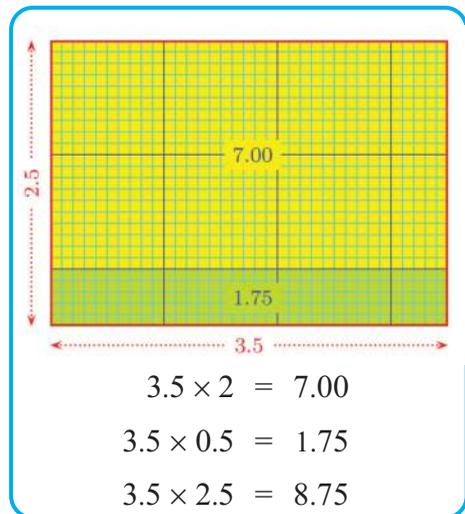
What is the denominator of 2.45 as a fraction.

And of 3.72?

What is the denominator of the product?

So,

$2.45 \times 3.72 = 9.1140 = 9.114$





- Calculate the products below:
  - $46.2 \times 0.23$
  - $57.52 \times 31.2$
  - $0.01 \times 0.01$
  - $2.04 \times 2.4$
  - $2.5 \times 3.72$
  - $0.2 \times 0.002$
- Given that  $3212 \times 23 = 73876$ , find the products below, without actually multiplying?
  - $321.2 \times 23 = \dots\dots\dots$
  - $0.3212 \times 23 = \dots\dots\dots$
  - $32.12 \times 23 = \dots\dots\dots$
  - $32.12 \times 0.23 = \dots\dots\dots$
  - $3.212 \times 23 = \dots\dots\dots$
  - $321.2 \times 0.23 = \dots\dots\dots$
- Which of the products below is equal to  $1.47 \times 3.7$ ?
  - $14.7 \times 3.7$
  - $147 \times 0.37$
  - $1.47 \times 0.37$
  - $0.147 \times 37$
  - $14.7 \times 0.37$
  - $0.0147 \times 370$
  - $1.47 \times 3.70$
- A rectangular plot is of length 45.8 metres and breadth 39.5 metres .What is its area?
- The price of petrol is 68.50 rupees per litre. What is the price of 8.5 litres?
- Which is the largest product among those below.
  - $0.01 \times .001$
  - $0.101 \times 0.01$
  - $0.101 \times 0.001$
  - $0.10 \times 0.001$

It is easy to calculate these products;

$$384 \times 10$$

$$230 \times 100$$

Now calculate these products:

- $3.25 \times 10$
- $13.752 \times 10$
- $3.45 \times 100$
- $1.345 \times 1000$
- $1.523 \times 1000$
- $4.2 \times 10$
- $4.765 \times 100$
- $14.572 \times 100$
- $2.36 \times 1000$

Have you found out an easy way to multiply decimals by numbers 10,100,1000 and so on?

**Let's divide!**

4 girls divided a 12 metre long ribbon among them.  
What length did each get?

It is not difficult to calculate this.

How about a 13 metre long ribbon?

12 metre divided into 4 equal parts give 3 metre long pieces; the remaining 1 metre divided into 4 gives  $\frac{1}{4}$  metre. Altogether  $3\frac{1}{4}$  metres.

So, each gets  $3\frac{1}{4}$  metres

We can write this as  $13 \div 4 = 3\frac{1}{4}$

We can also write it as a decimal.

$\frac{1}{4}$  metre means 25 centimetres; that is, 0.25 metres.

So, instead of  $3\frac{1}{4}$  metres, we can write 3.25 metres.

Look at this problem;

A square is made with a 24.8 centimetre long rope. What is the length of its side?

To find the length of a side, 24.8 must be divided into four equal parts.

24.8 centimetres means 24 centimetres and 8 millimetres. 24 centimetres divided into four equal parts give 6 centimetres each.

The remaining 8 millimetres divided into four equal parts give 2 millimetres each.

Thus the length of a side is 6 centimetres and 4 millimetres, that is 6.2 centimetres.

This problem also we can write using numbers only.

$$24.8 \div 4$$



The way we found the answer can also be written using just numbers.

24.8 mean 24 and 8 tenths. Dividing each by 4 gives 6 and 2 tenths; that is 6.2

These operations can be written in short hand as shown on the right.

$$\begin{array}{r} \frac{1}{10} \\ 6.2 \\ 4 \overline{) 24.8} \\ \underline{24} \phantom{0} \\ 8 \dots \frac{1}{10} \text{'s} \\ \underline{8} \\ 0 \end{array}$$

A line of length 13.2 centimetres is divided into 3 equal parts .What is the length of each part?

We first divide 12 centimetres of 13.2 centimetres into 3 equal parts, getting 4 centimetre long parts; 1 centimetre and 2 millimetres remaining.

That is, 12 millimetres are left.

Dividing this into 3 equal parts gives 4 millimetres each. So, 13.2 centimetres divided into 3 equal parts give 4 centimetres and 4 millimetres as the length of a part.

That is 4.4 centimetres.

How about writing this as a division of numbers?

$$13.2 \div 3 = 4.4$$

How did we do this?

13.2 mean 13 and 2 tenths. In this, dividing 13 by 3 gives quotient 4 and remainder 1.

Changing this 1 to tenths and adding them to the 2 tenths already there, we get 12 tenths. 12 divided by 3 gives 4.

Thus we get 4 and 4 tenths; that is 4.4.

These operations also we can write in shorthand.

$$\begin{array}{r} \frac{1}{10} \\ 4.4 \\ 3 \overline{) 13.2} \\ \underline{12} \phantom{0} \\ 12 \dots \frac{1}{10} \text{'s} \\ \underline{12} \\ 0 \end{array}$$

Let's look at another problem:

4 people shared 16.28 kilograms of rice. How much does each get?

If 16 kilograms is divided in to 4 equal parts, how much is each part?

0.28 kilograms means 280 grams.

What if we divide 280 grams into 4?

So, how much does each get?

How about writing this using only numbers?

$$16.28 \div 4 = 4.07$$

16.28 means 16 and 2 tenths and 8 hundredths.

16 divided by 4 gives 4.

Changing 2 tenths to 20 hundredths and adding to the original 8 hundredths give 28 hundredths.

28 divided by 4 gives 7

So the total quotient is 4 and 7 hundredths.

That is 4.07.

The operation can be written like this:

$\begin{array}{r} 4 \\ \hline 4 \overline{) 16.28} \\ \underline{16} \phantom{00} \\ 28 \phantom{00} \\ \underline{28} \phantom{00} \\ 0 \phantom{00} \end{array}$	$\begin{array}{r} 4 \\ \hline 4 \overline{) 16.28} \\ \underline{16} \phantom{00} \\ 28 \dots \frac{1}{100} \text{'s} \end{array}$	$\begin{array}{r} \frac{1}{10} \frac{1}{100} \\ 4.07 \\ \hline 4 \overline{) 16.28} \\ \underline{16} \phantom{00} \\ 28 \phantom{00} \\ \underline{28} \phantom{00} \\ 0 \phantom{00} \end{array}$
--	--	---

25.5 kilograms of sugar is packed into 6 bags of the same size. How much is in each bag?

24 kilograms divided into 6 equal parts give 4 kilograms each. The remaining 1.5 kilograms, changed to grams are 1500 grams.

Dividing this into 6 equal parts gives  $1500 \div 6 = 250$  grams.

So one bag contains 4 kilograms and 250 grams;  
that is 4.250 kilograms.

We usually write this as 4.25 kilograms.

As numbers, we find

$$25.5 \div 6 = 4.25$$

The method of finding the answer can also be written using only numbers.

25.5 means 25 and 5 tenths.

25 divided by 6 gives 4 and remainder 1.

The remaining 1, changed to tenths and added to the original 5 tenths give 15 tenths; divided this by 6 gives 2 tenths and remainder 3 tenths.

These 3 tenths can be changed into 30 hundredths ; and this divided by 6 gives 5 hundredths.

What then is the total quotient?

4 and 2 tenths and 5 hundredths

That is ,4.25

Let's write these operations in shorthand.

$$\begin{array}{r}
 4 \\
 6 \overline{) 25.5} \\
 \underline{24} \\
 15 \dots \frac{1}{10} \text{'s}
 \end{array}
 \qquad
 \begin{array}{r}
 \frac{1}{10} \\
 4.2 \\
 6 \overline{) 25.5} \\
 \underline{24} \\
 15 \dots \frac{1}{10} \text{'s} \\
 \underline{12} \\
 3
 \end{array}
 \qquad
 \begin{array}{r}
 \frac{1}{10} \frac{1}{100} \\
 4.25 \\
 6 \overline{) 25.5} \\
 \underline{24} \\
 15 \\
 \underline{12} \\
 30 \dots \frac{1}{100} \text{'s} \\
 \underline{30} \\
 0
 \end{array}$$



1. The total amount of milk given to the children in a school for the 5 days of last week is 132.575 litres. How much was given on average each day?
2. 8 people shared 33.6 kilograms of rice. Sujitha divided her share into three equal parts and gave one part to Razia. How much did Razia get?
3. A ribbon of length 0.8 metres is divided into 16 equal parts. What is the length of each part?
4. Do the problems below:
  - i)  $54.5 \div 5$       ii)  $14.24 \div 8$       iii)  $56.87 \div 11$
  - iv)  $3.1 \div 2$       v)  $35.523 \div 3$       vi)  $36.48 \div 12$
  - vii)  $16.56 \div 9$       viii)  $32.454 \div 4$
  - ix)  $425.75 \div 25$
5. Given  $105.728 \div 7 = 15.104$ , find the answer to the problems below, without actual division.
  - i)  $1057.28 \div 7$       ii)  $1.05728 \div 7$
  - iii)  $1.05728 \div 7$
6. A number multiplied by 9 gives 145.71. What is the number?



$16.34 \div 10 = 1.634$   
 $25.765 \div 100 = \dots\dots\dots$   
 $347.5 \div 100 = \dots\dots\dots$   
 $238.4 \div 1000 = \dots\dots\dots$   
 What have you found out about dividing a number in decimal form by 10, 100, 1000 and so on?

### Other Divisions

A rope of length 8.4 metres is cut into 0.4 metre long pieces. How many pieces can we make?

8.4 metres is 840 centimetres and 0.4 metre is 40 centimetres. So the number of pieces is  $840 \div 40 = 21$

We can write this as

$$8.4 \div 0.4 = 21$$

What does this mean?

8.4 is 21 times 0.4

How about doing this with fractions?

$$8.4 = \frac{84}{10}, 0.4 = \frac{4}{10}$$

$\frac{84}{10} \div \frac{4}{10}$  means, finding out the number,  $\frac{4}{10}$  of which is  $\frac{84}{10}$ .

And we know that it is  $\frac{10}{4}$  times  $\frac{84}{10}$ .

That is,  $\frac{84}{10} \div \frac{4}{10} = \frac{84}{10} \times \frac{10}{4} = 21$

Can we compute  $36.75 \div 0.5$  like this?

$$36.75 = \frac{3675}{100}, \quad 0.5 = \frac{5}{10}$$

$$\frac{3675}{100} \div \frac{5}{10} = \frac{3675}{100} \times \frac{10}{5} = \frac{735}{10}$$

That is,  $36.75 \div 0.5 = 73.5$

We can also write  $\frac{36.75}{0.5} = 73.5$

So how do we find  $\frac{48.72}{0.12}$ ?

$$\begin{aligned} \frac{48.72}{0.12} &= 48.72 \div 0.12 = \frac{4872}{100} \div \frac{12}{100} \\ &= \frac{4872}{100} \times \dots\dots\dots \\ &= \dots\dots\dots \\ &= \dots\dots\dots \end{aligned}$$



- The area of a rectangle is 3.25 square metres and its length is 2.5 centimetres. What is its breadth?
- A can contains 4.05 litres of coconut oil. It must be filled in to 0.45 litre bottles. How many bottles are needed?
- Calculate the quotients below:

i)  $\frac{35.37}{0.03}$

ii)  $\frac{10.92}{2.1}$

iii)  $\frac{40.48}{1.1}$

iv)  $\frac{0.045}{0.05}$

v)  $0.001 \div 0.1$

vi)  $5.356 \div 0.13$

vii)  $\frac{0.2 \times 0.4}{0.02}$

viii)  $\frac{0.01 \times 0.01}{0.001 \times 0.1}$

- 12125 divided by which number gives 1.2125?
- 0.01 multiplied by which number gives 0.00001?

## Fractions and decimals

Fractions written as decimals are of denominators 10, 100, 1000 and so on.

For some fractions, we can first change the denominator into one of these and then write in decimal form. For example,

$$\frac{1}{2} = \frac{5}{10} = 0.5$$

$$\frac{1}{4} = \frac{25}{100} = 0.25$$

$$\frac{3}{4} = \frac{75}{100} = 0.75$$

How do we write  $\frac{1}{8}$  in decimal form?

$$8 = 2 \times 2 \times 2$$

So, multiplying 8 by three 5's we can make it a product of 10's.

$$\begin{aligned} 8 \times (5 \times 5 \times 5) &= (2 \times 2 \times 2) \times (5 \times 5 \times 5) \\ &= (2 \times 5) \times (2 \times 5) \times (2 \times 5) \\ &= 10 \times 10 \times 10 \\ &= 1000 \end{aligned}$$

$5 \times 5 \times 5 = 125$ , right? So

$$\frac{1}{8} = \frac{125}{8 \times 125} = \frac{125}{1000} = 0.125$$

In much the same way,

$$\frac{5}{8} = \frac{5 \times 125}{8 \times 125} = \frac{625}{1000} = 0.625$$

How about  $\frac{1}{40}$ ?

$$40 = (2 \times 2 \times 2) \times 5$$

To get a product of 10's we have to multiply 40 by two 5's; that is

$$\begin{aligned} 40 \times 25 &= (2 \times 2 \times 2 \times 5) \times (5 \times 5) \\ &= (2 \times 5) \times (2 \times 5) \times (2 \times 5) \\ &= 10 \times 10 \times 10 \\ &= 1000 \end{aligned}$$

So,

$$\frac{1}{40} = \frac{25}{40 \times 25} = \frac{25}{1000} = 0.025$$

And  $\frac{21}{40}$ ?

$$\frac{21}{40} = \frac{21 \times 25}{40 \times 25} = \frac{525}{1000} = 0.525$$

Similarly, since  $125 \times 8 = 1000$ , we can write

$$\frac{121}{125} = \frac{121 \times 8}{125 \times 8} = \frac{968}{1000} = 0.968$$

Thus we can find the decimal form of any fraction whose denominator is a multiple of 2's and 5's.

Now look at this problem:

24 kilograms of sugar are packed into 25 packets of the same size. How much does each packet contain?

24 kilograms means 24000 grams. So each packet contains  $\frac{24000}{25}$  grams.

$$\frac{24000}{25} = 960$$

Thus each packet contains 960 grams or 0.96 kilograms.

We can do this in a different way. Each packet contains  $\frac{24}{25}$  kilograms.

$$\frac{24}{25} = \frac{24 \times 4}{25 \times 4} = \frac{96}{100} = 0.96$$

So, one packet contains 0.96 kilograms.



- Find the decimal forms of the fractions below:
  - $\frac{3}{5}$
  - $\frac{7}{8}$
  - $\frac{5}{16}$
  - $\frac{3}{40}$
  - $\frac{3}{32}$
  - $\frac{61}{125}$
- Write the answer to the questions below in decimal form.
  - 3 litres of milk is used to fill 8 identical bottles. How much does each bottle contain?
  - A 17 metre long string is cut into 25 equal parts. What is the length of each part?
  - 19 kilograms of rice is divided among 20 people. How much does each get?

3. What is the decimal form of  $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16}$ ?
4. A two digit number divided by another two digit number gives 4.375. What are the numbers?



1. What is the volume of a rectangular block of length 25.5 centimetres, breadth 20.4 centimetres and height 10.8 centimetres?
2. The heights of three boys sitting on a bench are 130.5 centimetres 128.7 centimetres and 134.6 centimetres .What is the average height?
3. Calculate  $\frac{4 \times 3.06}{3}$ .
4. The price of 22 pencils is 79.20 rupees. What is the price of 10 pencils?
5. Calculate the following:
  - i)  $\frac{2.3 \times 3.2}{0.4}$
  - ii)  $\frac{0.01 \times 0.001}{0.1 \times 0.01}$
6. Dividing 0.1 by which number gives 0.001?

### Looking back



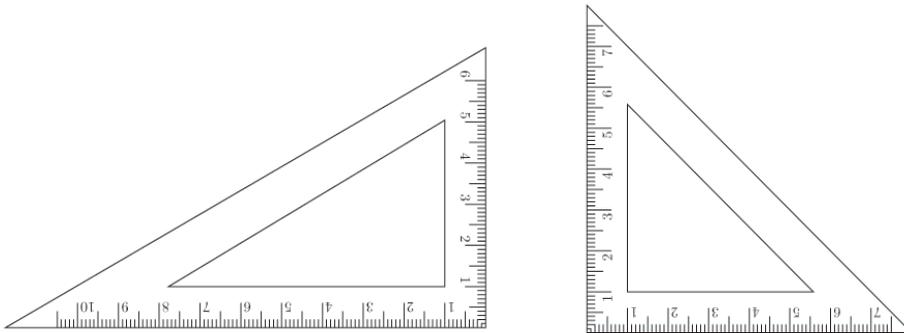
Learning outcomes	What I can	With teacher's help	Must improve
<ul style="list-style-type: none"> <li>• Explaining the methods of multiplying and dividing decimals.</li> </ul>			
<ul style="list-style-type: none"> <li>• Forming the method to multiply or divide a decimal by numbers such as 10, 100, 1000 and so on.</li> </ul>			
<ul style="list-style-type: none"> <li>• Solving problems involving multiplication or division of decimals</li> </ul>			

# Joining Angles



## Joining Angles

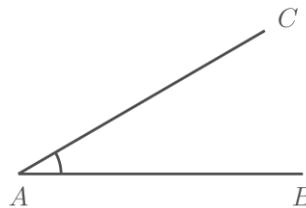
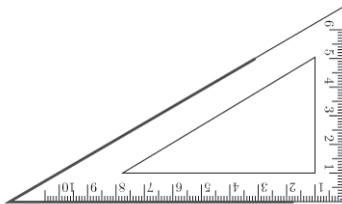
Your geometry box has two setsquares. Each of them has three angles.



Angles .....

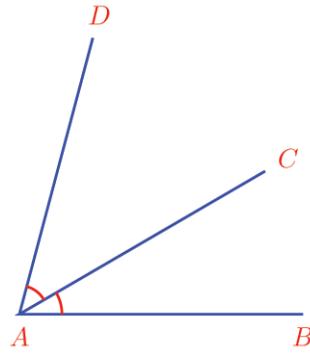
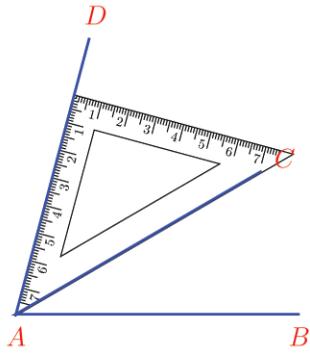
Angles .....

Look at an angle drawn with a corner of a setsquare.



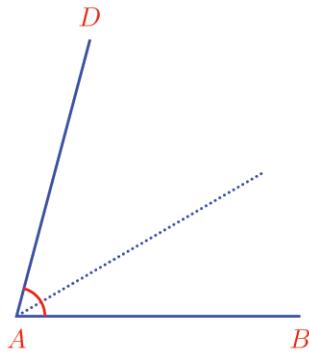
How much is  $\angle CAB$ ?

What if we draw another angle on top of this, using a corner of the other setsquare?

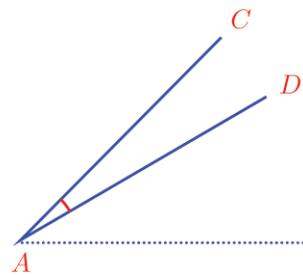
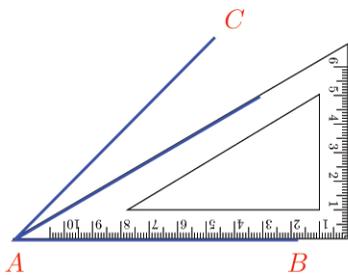
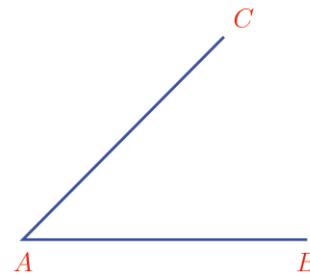
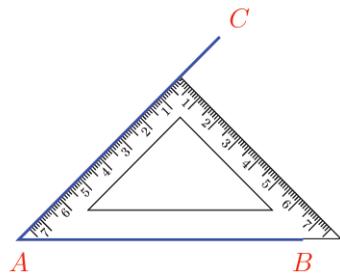


How much is  $\angle DAC$ ?

And  $\angle DAB$ ?



Now suppose we draw angles as shown below:

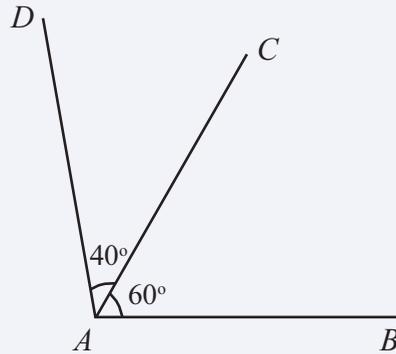


How much is  $\angle DAC$ ?

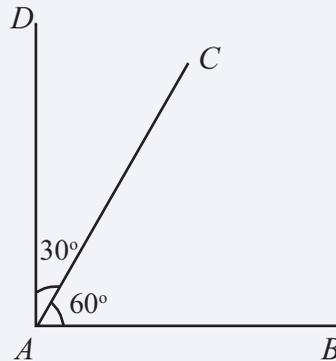
Like this, angles of what different measures can we draw using the two set squares?



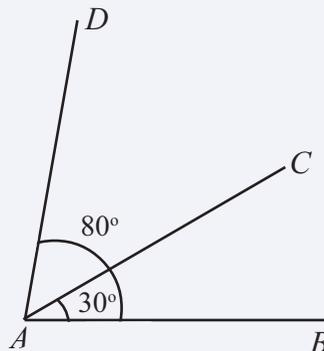
In each picture below, two angles are given. Calculate the third angle as a sum or difference;



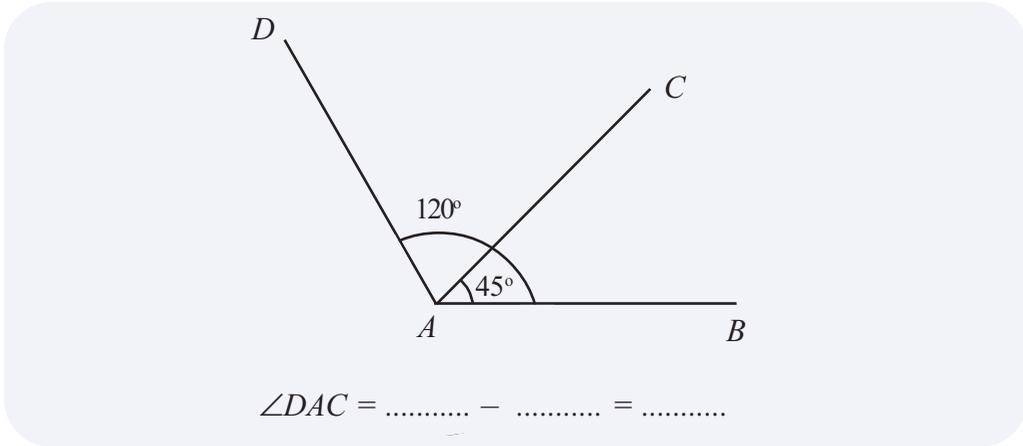
$$\angle DAB = \dots\dots\dots + \dots\dots\dots = \dots\dots\dots$$



$$\angle DAB = \dots\dots\dots + \dots\dots\dots = \dots\dots\dots$$

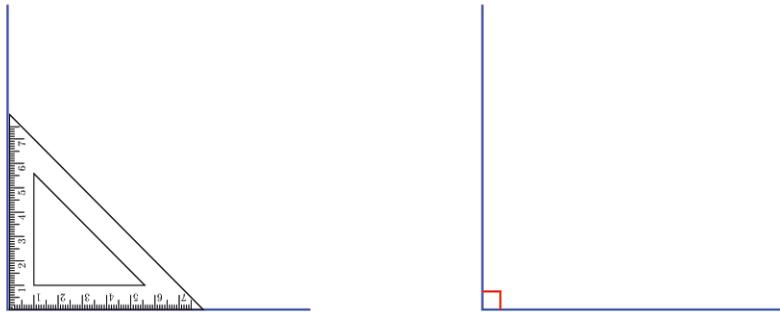


$$\angle DAC = \dots\dots\dots - \dots\dots\dots = \dots\dots\dots$$



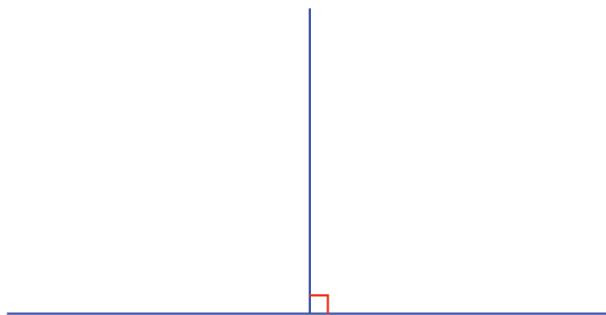
**Two sides**

Draw a line and then a perpendicular at one end.



We have noted that such an angle measures 90°.

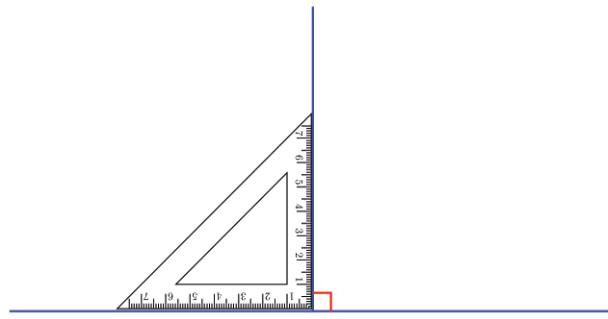
Now extend the horizontal line a bit to the left;



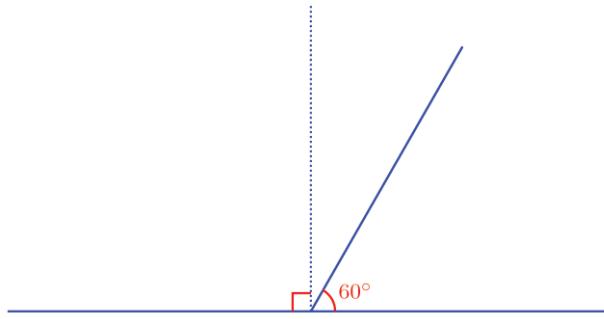
Now there is another angle on the left of the vertical line also. What is its measure?

Perpendicular means straight up, not leaning to the left or right.

So the angle on the left is also 90°.



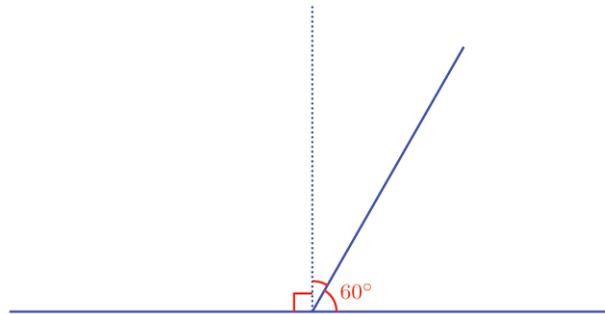
Now let's draw a slanted line through the foot of the perpendicular.



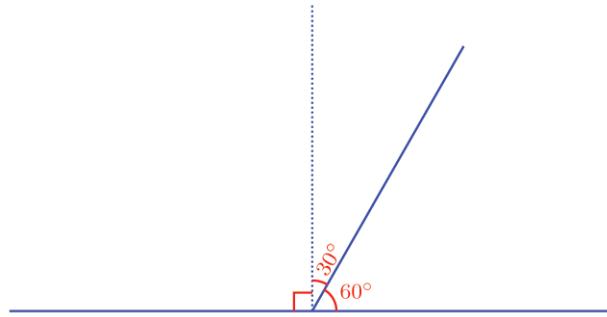
How much is the angle on the left of this slanted line?

A bit more than  $90^\circ$ , right?

How much more?



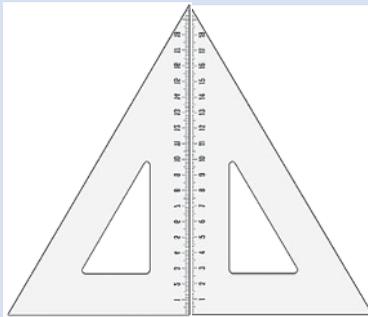
By how much is the angle on the right less than  $90^\circ$ ?



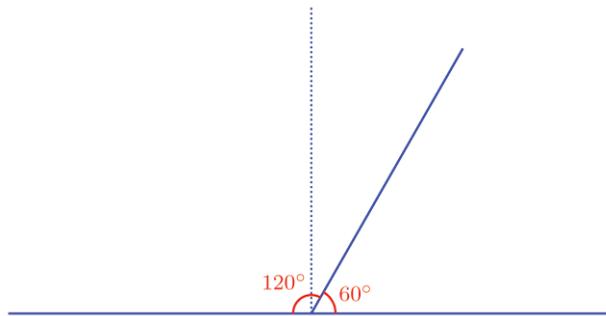
Now can't we calculate the angle on the left also?

**Joining setsquares**

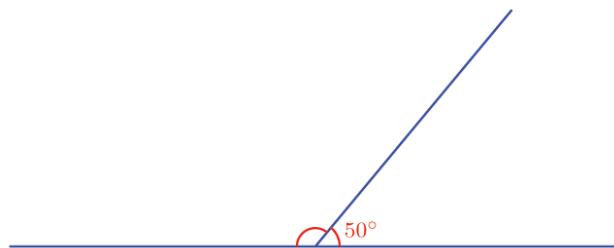
The picture shows two identical set squares placed together;



What are the measures of the angles of this triangle?



See this picture



How much is the angle on the left of the slanted line? Imagine a perpendicular through the point where the lines meet.

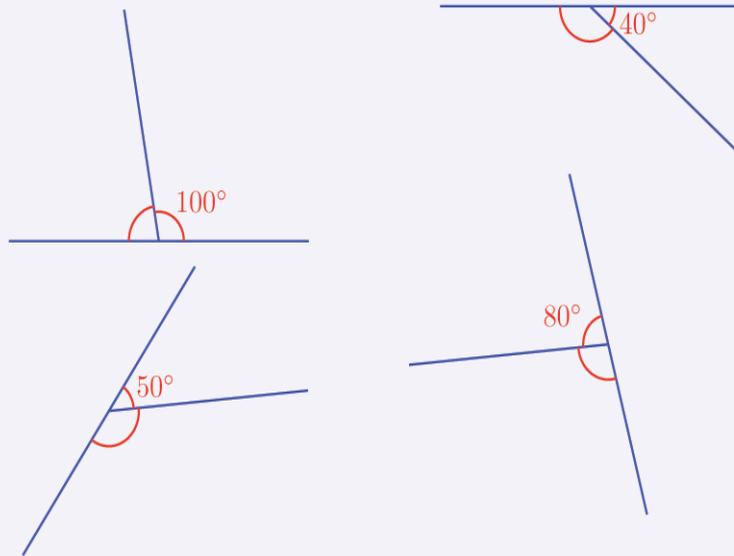
By how much is the angle on the right less than 90°?

So, by how much is the angle on the left more than 90°?

Thus the angle on the left is  $90^\circ + 40^\circ = 130^\circ$ .

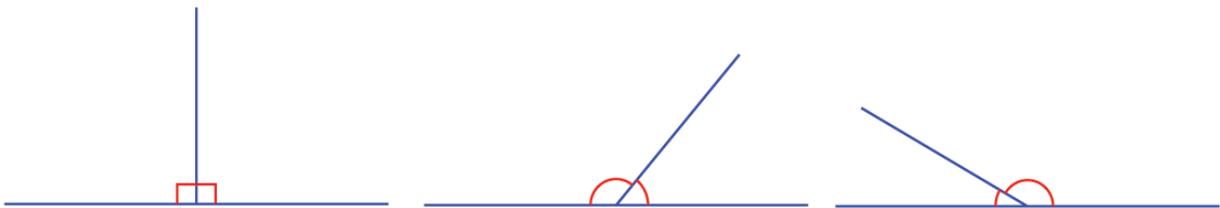


In the pictures below, two angles are marked and one of them is given. Find the other:



### Meeting lines

See these pictures:



All of them show two lines meeting ; and each has two angles, one on the left and one on the right.

In the first picture, both angles are  $90^\circ$ . In the second ,the angle on the right is less than  $90^\circ$  and the angle on the left is greater than  $90^\circ$ ; in the third picture , it is the other way round.

In the second and third picture, the angle on one side is that much more than  $90^\circ$  as the angle on the other side is less than  $90^\circ$ .

So, the sum of the angles on either side is  $90^\circ + 90^\circ = 180^\circ$ , right?

Thus we can write this as a general principle:

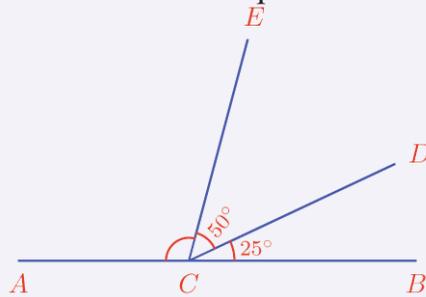
When two lines meet, the sum of the angles on either side is  $180^\circ$ .

Two such angles, made by two lines meeting is called a linear pair. So we can state this principle like this also:

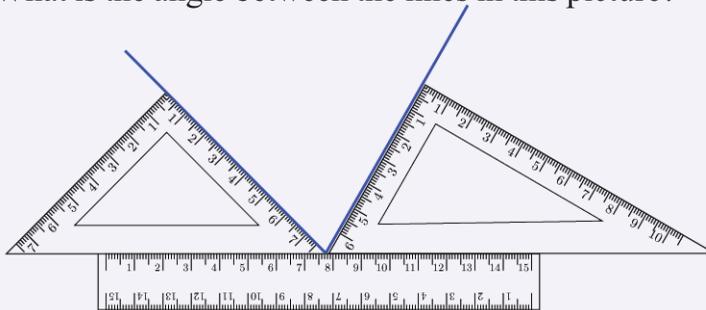
The sum of the angles in a linear pair is  $180^\circ$ .



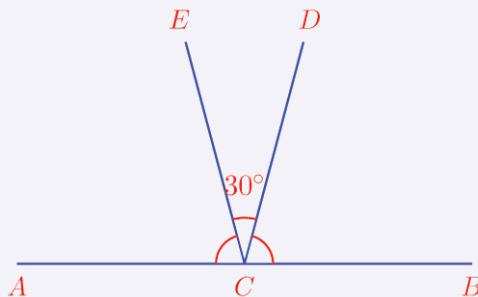
- 1) How much is  $\angle ACE$  in the picture below?



- 2) What is the angle between the lines in this picture?



- 3) In the picture below,  $\angle ACE = \angle BCD$ . Find the measure of each.

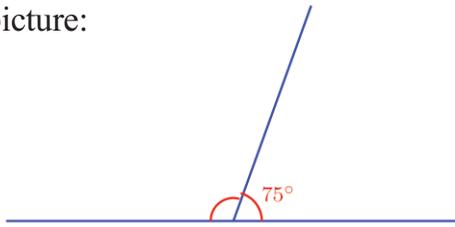


- 4) One angle of a linear pair is twice the other. How much is each?  
 5) The angles in a linear pair are consecutive odd numbers. How much is each?



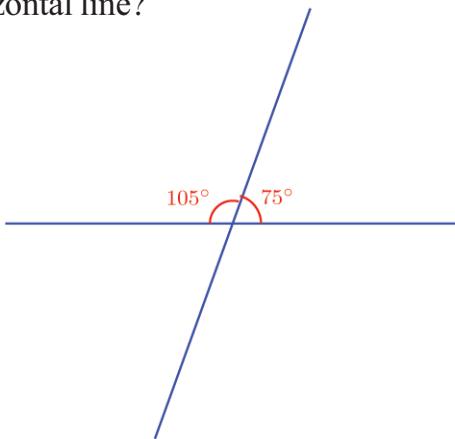
## Crossing lines

See the picture:



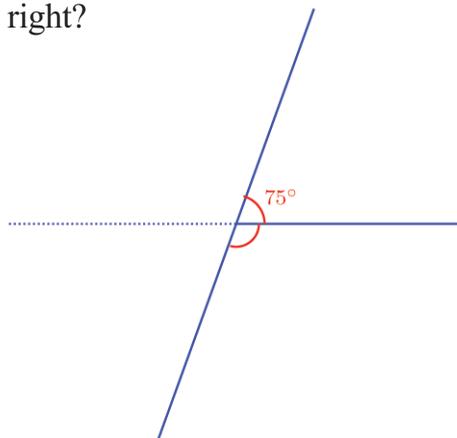
How much is the angle on the left?

What if we extend the top line downwards crossing the horizontal line?



Now we have two angles below also. What are their measures?

The angles above and below, on the right of the slanted line, form a linear pair, right?



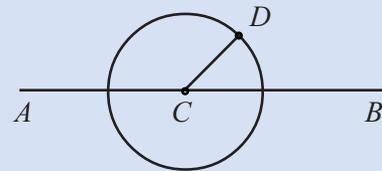
Thus don't we get one angle below?

Like this, the angle above and below on the left also form a linear pair.



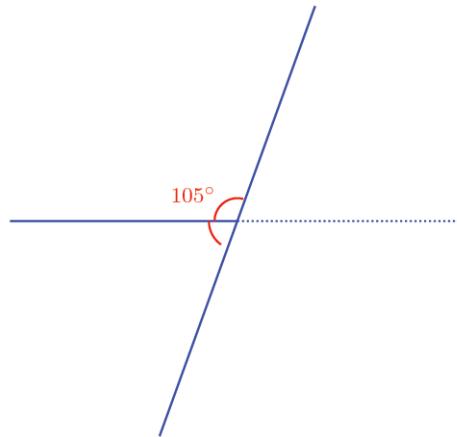
### Linear pair

Draw the line AB and a point C on it. Draw a circle centered at C. Mark a point D on the circle.

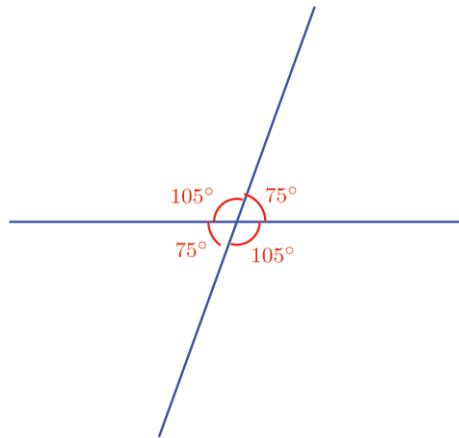


Join CD. Now we can hide the circle. By choosing **Angle** and clicking on B, C, D in order, we get the measure of  $\angle BCD$ . In the same way, click on A, C, D to get  $\angle ACD$ .

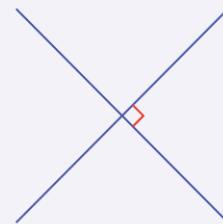
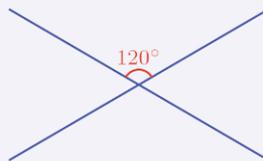
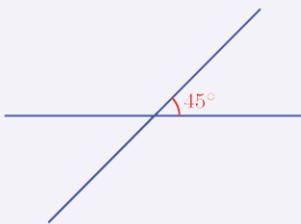
Using **Move**, change the position of D. How do the angles change? Look at the sum of  $\angle BCD$  and  $\angle ACD$ .



Thus we get the angle below on the left also. Let's look at all the angles together:



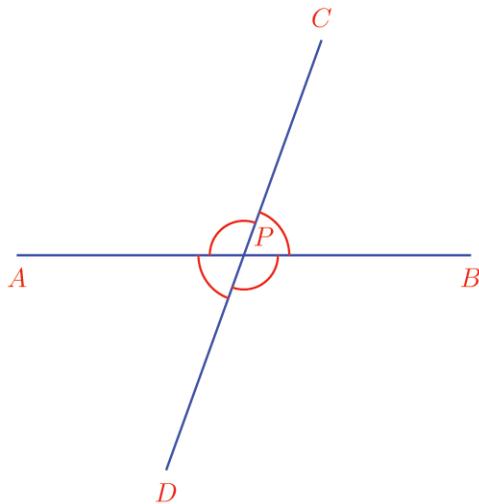
Some pictures showing two lines crossing each other are given below. One of the four angles so formed is given. Calculate the other three and write them in the pictures.





## Near and opposite

The picture shows the four angles made by the line  $CD$  crossing the line  $AB$ :



We can pair these four angles in various ways. Of these, four are linear pairs. Which are they?

- $\angle APC, \angle BPC$
- 
- 
- 
- 

These are nearby angles in the picture. What about the other two pairs?

- $\angle APC, \angle BPD$
- $\angle APD, \angle BPC$

They are not nearby angles; they are opposite angles.

What is the relation between them?

Look at  $\angle APC$  and  $\angle BPD$ . If we add  $\angle BPC$  to any of these, we get  $180^\circ$ . In other words, each of these is  $\angle BPC$  subtracted from  $180^\circ$ .

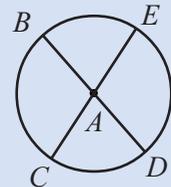
So,  $\angle APC = \angle BPD$ .

Similarly, can't you see that the other pair of opposite angles are also equal?



Draw a circle centred at a point  $A$ . Mark four points  $B, C, D, E$  on the circle.

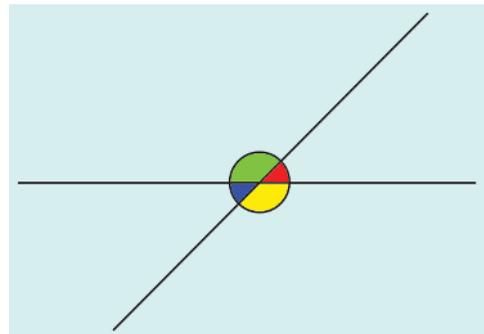
Draw the lines  $BD$  and  $CE$ . Now hide the circle.



Use **Angle** to mark the four angles in the picture.

Use **Move** to change the positions of  $B, C, D, E$ .

Observe what happens to the opposite angles.



In the picture above the sum of the green and red angles is  $180^\circ$  and the sum of the green and blue angles is also  $180^\circ$ . So the red and blue angles are equal. Can you see that the green and yellow angles are equal?

This we write as a general principle;

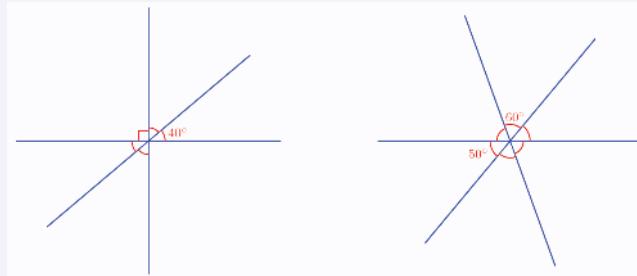
The opposite angles formed by two lines crossing each other are equal.

We can combine the general result on nearby and opposite angles.

Of the four angles formed by two lines crossing each other, the sum of the nearby angles is  $180^\circ$ , the opposite angles are equal.



- Two picture of lines passing through a point are given below. Some of the angles are given. Calculate the other angles marked and write in the figure:



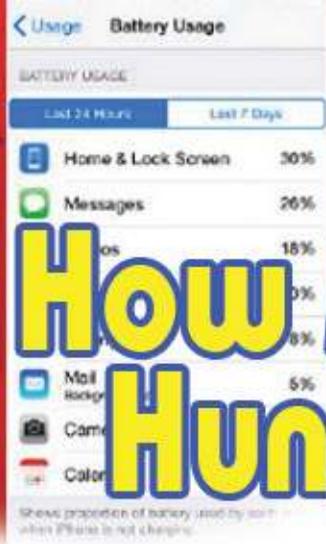
- Of the four angles made by two lines crossing each other, one angle is half of another angle. Calculate all four angles.
- Of the four angles formed by two lines crossing each other, the sum of two angles is  $100^\circ$ . Calculate all four angles.

### Looking back



Learning outcomes	What I can	With teacher's help	Must improve
<ul style="list-style-type: none"> <li>Justifying logically the fact that the sum of the angles in a linear pair is <math>180^\circ</math>.</li> </ul>			
<ul style="list-style-type: none"> <li>Justifying logically that opposite angles are equal.</li> </ul>			
<ul style="list-style-type: none"> <li>Solving problems using ideas of linear pair and opposite angles.</li> </ul>			

**SUPER SALE**  
Celebrate a Bigger, Better, Brighter Diwali with us  
**UP TO 50% OFF**  
from 17th Oct to 5th Nov



# How Much of Hundred?



## Sale

See the ad?

The table shows the original price of some of the things in this shop. We want to calculate the new prices: How?

It's 10 rupees less for every 100 rupees. So to compute the reduction in price, we must first find out how many 100's are there in the original price and then multiply it by 10.

For example, the original price of a fan is 1200 rupees.

That is 12 hundreds: so the reduction in price is

$$12 \times 10 = 120 \text{ rupees}$$

We can do both operations together:

$$\frac{1200}{100} \times 10 = 120$$

So the price of a fan now is  $1200 - 120 = 1080$  rupees.

Similarly, can't you compute the prices of others now?

**GRAND SALE!**  
**Rs.10 off on every Rs.100**

Fan	Rs. 1200
Clock	Rs. 500
Iron	Rs. 800
CFL Bulb	Rs. 250
Cooker	Rs. 1400
Mixer	Rs. 2500

## Loans

A co-operative bank offers agricultural loans. It must be paid back in one year; and for every hundred rupees, 12 rupees more should be given.

See the amounts of loan some people have taken out:

Sabu	Rs. 4000
Suma	Rs. 5500
Raji	Rs. 1550
Gokul	Rs. 3750
Nabeel	Rs. 3800

Calculate how much each should pay back.

To know how much more each should give back, we must find out how many hundreds are there in the loan and multiply it by 12.

As before, we need only divide by 100 and multiply by 12.

For example, Raji's loan is 1550 rupees.

To calculate how much more she has to pay back, we divide 1550 by 100 and multiply by 12:

$$\frac{1550}{100} \times 12 = 186$$

So, Raji has to pay back  $1550 + 186 = 1736$  rupees.

Like this, calculate how much each has to pay back.

## Percent

In the first problem, the reduction in price is 10 rupees for each hundred rupees.

We say that there is 10 percent reduction in price.

10 percent is written as 10%.

In the loan problem, 12 rupees more for every hundred rupees should be paid back.

That is, 12%(12 percent) more should be paid back.

The word *per* means for each. The *cent* part comes from the Latin word *centum* meaning hundred.

## Donations

Each month Joseph donates 8% of his earnings to the Medical Aid Fund. He earned 12000 rupees in January. How much should he donate that month?

8 percent means ,8 for each hundred. So we must find out the number of hundreds in 12000 and multiply it by 8:

$$\frac{12000}{100} \times 8 = 120 \times 8 = 960$$

So, Joseph would donate 960 rupees that month.

This can also be calculated as  $12000 \times \frac{8}{100}$ .

That is,  $\frac{8}{100}$  of 12000.

Joseph's friend Ali donates 12% of his monthly earnings. In January he earned 15000 rupees. How much would he give.

We can think of 12% as 12 for each hundred and calculate

$$\frac{15000}{100} \times 12$$

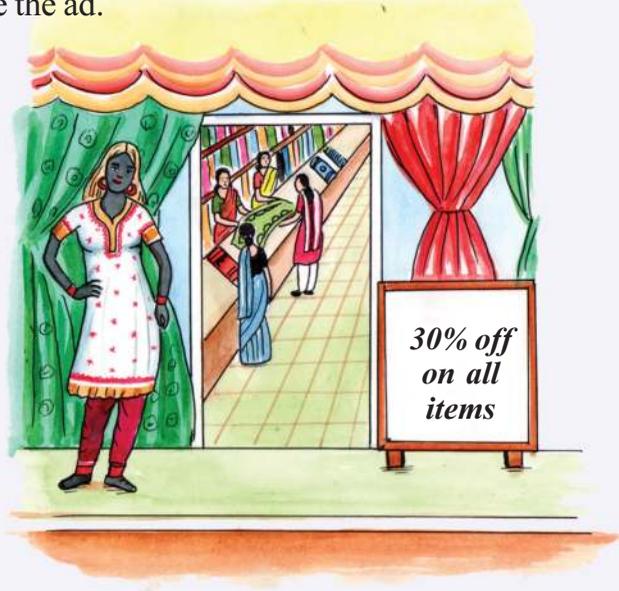
Or we can think of 12% as  $\frac{12}{100}$  and calculate.

$$15000 \times \frac{12}{100}$$

Do it any way you like.



1. See the ad.



Sheela bought cloths worth 1800 rupees. How much should she pay?

2. Johny save 15% of his earnings each month. In January he got 32000 rupees. How much would he save?
3. A TV manufacturer decides to raise prices by 5% next month. The price of a model is 26000 rupees now. What would be its price next month?
4. A car manufacturer decides to lower prices by 2% from next month .What would be the price next month for a car, now priced at 250000 rupees?
5. A company pays 8% of a month's salary as festival allowance. How much festival allowance would a person whose salary is 12875 rupees get?

### Another percent

In a school, 240 children took an exam and 40% of them got A grade in all subjects.

What does it mean?

There is no sense in saying that 40 children out of every 100 got A grade.

Here it means,  $\frac{40}{100}$  of the total number of children got A grades in all subjects.

That is, the number of children who got A grade is

$$240 \times \frac{40}{100} = 96$$

Let's look at another problem:

There are 40 children in a class and 50% of them are boys.  
How many boys are there in this class?

50% of the class are boys means,  $\frac{50}{100}$  of the total number of children in the class are boys.

That is,  $\frac{1}{2}$  of the total number, or half the total.

Half of 40 is 20.

So there are 20 boys in the class.

### Election

There are 1200 voters in a panchayat ward and 80% of them voted in an election. How many people voted?

The number of persons who voted is  $\frac{80}{100}$  of the total number of voters.

So the number of persons voted is  $\frac{80}{100}$  of 1200.

That is,  $1200 \times \frac{80}{100} = 960$

What is 20% of 60?  
What about 60% of 20.  
Are 40% of 30 and 30% of 40 equal?





1. In a company, 46% of the workers are women. It has 300 workers in all. How many of them are women?
2. In a class, 20% of the children are members of the Math Club. There are 35 children in the class. How many are members of the Math Club?
3. In an election, the candidate who won got 54% of the votes. 1450 votes were polled. How many votes did the winner get?
4. The price of a car is 530000 rupees now. The manufacturer decides to reduce the price by 2% next month. What would be the reduction in price? What would be the new price?
5. 1300 children took the NuMATS test and 65% of them scored more than 25. How many are they?

### The other percent

60% of the workers in a company are women.

What all things do we know from this statement?

$\frac{60}{100}$  of the total number of workers are women.

So what fraction of the workers are men?  $\frac{40}{100}$ , right?

That is 40% of the workers are men.

In other words,  $\frac{3}{5}$  of the workers are women and  $\frac{2}{5}$  of the workers are men (How come?)

There were 320 children in the sub-district camp for scout and guides. 55% of them were guides and the rest, scout. How many scouts were there?

The percent of scouts is  $100 - 55 = 45$ .

So the number of scouts is  $320 \times \frac{45}{100}$ .

This is easy to calculate, isn't it?



1. Of the 420 children in a school, 5% did not come one day. How many came to school that day?
2. There are 280 plants in Sabu's garden 70% of them are flowering. How many are non flowering?
3. There are 480 vehicles in a parking lot. Of these, 45% are motorbikes and 4% are cars. The rest are mini buses. How many minibuses are there?

### How many in all?

In a compound, there are 32 coconut trees and they form 50% of the total number of trees.

How many trees are there in all?

50% of the trees means  $\frac{50}{100} = \frac{1}{2}$  of the trees.

Thus, half the trees are coconut palms and so the total number of trees is double the number of coconut palms.

That is the total number of trees =  $2 \times 32 = 64$ .



In the sub-district Math fair, 60% of the children were girls. The actual number of girls was 108. How many children were there in all?

The number of girls is  $\frac{60}{100} = \frac{3}{5}$  of the total.

This means  $\frac{3}{5}$  of the total number is 108.

So the total number is  $\frac{5}{3}$  times 108.

That is,  $108 \times \frac{5}{3} = 180$ .

Thus we see that 180 children were there at the math fair.



1. 26 children of a class got A grade in an exam. It is 65% of the total number in the class. How many are there in the class?
2. Jayan spent 8400 rupees in a month for food and it is 35% of his earnings. How much did he earn that month?
3. 32 teachers of a school are male and they form 40% of the total number of teachers. How many teachers are there in the school?

### Percent of percent

A man spends 20% of his earnings on education and 25% of this amount on books. What percent of his total earnings does he spend on books?

It is  $\frac{25}{100}$  of  $\frac{20}{100}$  of the total earnings.

$\frac{25}{100}$  of  $\frac{20}{100}$  means

$$\frac{20}{100} \times \frac{25}{100} = \frac{1}{5} \times \frac{25}{100} = \frac{5}{100}$$

Thus the amount spend on books is 5% of the total earnings.

Now what percent of a number is 40% of its 30% percent?

### Changing percent

A shop offers 20% reduction in prices. Ravi bought a shirt worth 400 rupees from this shop. How much should he pay?

He need only pay  $\frac{20}{100}$  of 400 less.

$$400 \times \frac{20}{100} = 80$$

So, he must pay

$$400 - 80 = 320 \text{ rupees.}$$

There is another way to do this.

The reduction in price is 20% of 400.

So he needs to pay only 80% of 400

$$80\% \text{ of } 400 = 400 \times \frac{80}{100} = 320 \text{ rupees.}$$

Now look at another problem:



In a school, there were 800 children last year and this year, the number is 12% more. How many children are there now?

The increase is  $800 \times \frac{12}{100} = 96$

So then we can calculate the number of children now.

This we can do in a different way.

$$800 + \left(800 \times \frac{12}{100}\right) = 800 \times \left(1 + \frac{12}{100}\right)$$

$$= 800 \times \frac{112}{100} = 896$$

We can say  $\frac{112}{100}$  times is 112 percent (112%).

### Area

If the length and breadth of a rectangle are increased by 10%, by how much percent would the area increase? What if length is increased by 10% and the breadth decreased by 10%?

1. The price of a bicycle was 3400 rupees last month. Now it is reduced by 15%. What is the price now?
2. A watch priced at 3680 rupees is now sold for 20% less. What is the price now?
3. The amount of rainfall this year is calculated to be 20% more than last year. Last year's rainfall was 230 centimetres. What is the amount of rainfall this year?
4. A person earned 12000 rupees last month and it is 6% more this month. How much is this month's earning?



### Fractional percent

We have said that 25% of something means  $\frac{25}{100}$  of that number;

which means  $\frac{1}{4}$  of that.

What about 125% of something?

$\frac{125}{100}$  times it ; or  $1 \frac{1}{4}$  of it.

Thus percent of something means a fraction of it or certain times it.

We can put it in a different manner:

$$10\% \text{ means } 10 \text{ times } \frac{1}{100}$$

$$20\% \text{ means } 20 \text{ times } \frac{1}{100}$$

$$25\% \text{ means } 25 \text{ times } \frac{1}{100}$$

$$60\% \text{ means } 60 \text{ times } \frac{1}{100}$$

In this manner,  $12\frac{1}{2}$  times of  $\frac{1}{100}$  can be said to be  $12\frac{1}{2}\%$ .

What fraction is this?

$$\frac{1}{100} \times 12\frac{1}{2} = \frac{1}{100} \times \frac{25}{2} = \frac{1}{8}$$

Thus,  $12\frac{1}{2}\%$  of something means  $\frac{1}{8}$  of that.

$12\frac{1}{2}\%$  can also be written  $12.5\%$

So, what does  $33\frac{1}{3}\%$  mean?

$33\frac{1}{3}$  of  $\frac{1}{100}$ .

$$\frac{1}{100} \times 33\frac{1}{3} = \frac{1}{100} \times \frac{100}{3} = \frac{1}{3}$$

So,  $33\frac{1}{3}\%$  of something means  $\frac{1}{3}$  of that.



1. Explain each percent below as a fraction of something.

i)  $6\frac{1}{4}\%$     ii)  $6\frac{2}{3}\%$     iii)  $8\frac{1}{3}\%$     iv)  $16\frac{2}{3}\%$

v)  $62\frac{1}{2}\%$     vi)  $66\frac{2}{3}\%$     vii)  $83\frac{1}{3}\%$

## Fraction and percent

We have seen that any percent can be explained as a fraction .On the other hand, can we express every fraction of something as a percent?

For that, we look at percents in a different way.

For example,

$$10\% \text{ means } 10 \text{ times } \frac{1}{100} .$$

We can put it differently;

$$10\% \text{ means of } 10 \text{ times } \frac{1}{100} .$$

Similarly, we can say

$$20\% \text{ means } \frac{1}{100} \text{ of } 20 \text{ times.}$$

$$25\% \text{ means } \frac{1}{100} \text{ of } 25 \text{ times.}$$

$$12\frac{1}{2}\% \text{ means } \frac{1}{100} \text{ of } 12\frac{1}{2} \text{ times.}$$

That is the fraction expressing a percent as a part or times of something is  $\frac{1}{100}$  of the number given as a percent.

So the percent number is 100 times this fraction.

For example, let's compute what percent of something,  $\frac{2}{5}$  of it gives.

$\frac{2}{5}$  is  $\frac{1}{100}$  of the percent number.

So, the percent number is 100 times  $\frac{2}{5}$ .

$$\frac{2}{5} \times 100 = 40$$

Thus,  $\frac{2}{5}$  of something is 40% of it.

Now look at this problem:

In a school, 120 children appeared for SSLC examination. 110 children qualified for higher studies. What part of the children appeared for examination qualified?

$$\frac{110}{120} = \frac{11}{25}$$

That is, this fraction is the  $\frac{1}{100}$  parts of the percent of children qualified. Then percent of qualified children is 100 times of this. That is,

$$\frac{11}{25} \times 100 = 91 \frac{2}{3}$$

Therefore,  $91 \frac{2}{3}\%$  of children is qualified for higher studies.



1. There are 750 children in a school and 450 of them are girls. What is the percent of girls?
2. Rafi earns 20000 rupees a month and he spends 6400 rupees from this on food. What percent of his earnings is this?
3. Jameela's salary was 20000 rupees last month and 21000 rupees this month. By what percent has the salary increased?
4. Of 600 grams of sugar, 500 grams is used up. What percent is left?
5. The sides of a square are increased by 10% to make a larger square. By what percent is the area increased?
6. Ajayan's salary is 25% more than Vijayan's salary. By what percent of Ajayan's salary is Vijayan's salary less?



1. Express the percent each fraction below indicates.

i)  $\frac{3}{8}$

ii)  $\frac{7}{20}$

iii)  $\frac{2}{3}$

iv)  $\frac{28}{25}$

v)  $2\frac{1}{3}$

- What is the difference between 40% of 60 and 60% of 40?
- In a school there are 1240 children and 30% of them are girls. How many boys are there in the school?
- If 40% of 20 is added to 30% of 50, we get 50% of a number. What is this number?
- 23 percent of a number is 69. What is the number?
- 10 percent of a number is 1.5. What is the number?
- The price of an article was 1800 rupees last month. The price is reduced by 10% this month. The shopkeeper says this price would be increased by 10% next month. What would be the price next month?
- Kannan has 600 rupees. He gave 50% of this to Thomas. Thomas gave  $33\frac{1}{3}$  % of what he got to Hamza. How much did Hamza get?
- All children in class 7 passed the math exam. Details of grades are given below.

Grade	Percent	Number of children
A	40	
B	30	
C	25	
D		9

Fill in the blanks.

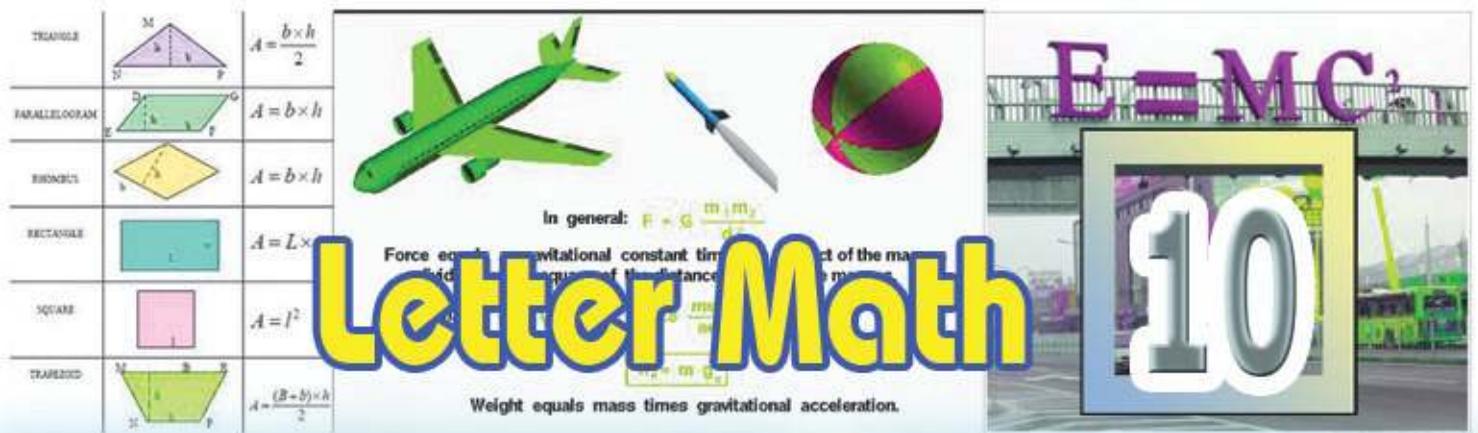


Looking back



Learning outcomes	What I can	With teacher's help	Must improve
<ul style="list-style-type: none"> <li>Explaining percent as a rate or as fraction of a number.</li> </ul>			
<ul style="list-style-type: none"> <li>Computing specified percent of a number.</li> </ul>			
<ul style="list-style-type: none"> <li>Explaining the method to compute a number, given a specified percent of it.</li> </ul>			
<ul style="list-style-type: none"> <li>Solving practical problems involving percent.</li> </ul>			
<ul style="list-style-type: none"> <li>Expressing a specific percent of a number as a fraction of the number and expressing a specific fraction of a number as a percent of the number.</li> </ul>			





## Addition and Subtraction

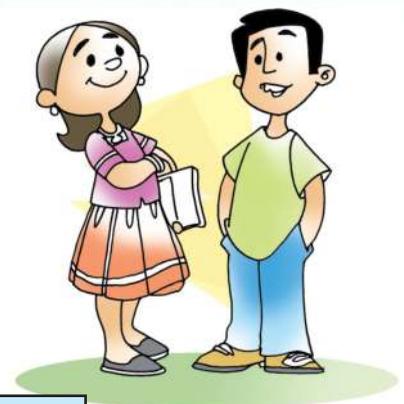
Mary is now 4 years old; and her brother Johny is 8.

What would be Mary's age after 2 years?

And Johny's age?

What were their ages 3 years ago?

Can you fill up the blanks in the table.



Mary's age	Johny's age
1	
	6
	7
4	8
5	

In this, how do we compute Johny's age from Mary's age?

Adding 4 to Mary's age gives Johny's age, right?

We can shorten it like this:

Johny's age = Mary's age + 4

There's a trick to shorten it further. Let's write  $m$  for Mary's age and  $j$  for Johny's age. Then we can write

$$j = m + 4$$

**One fact different ways**

We can say the same fact in different ways.

- (i) Johny is 4 years older than Mary.
- (ii) Mary is 4 years younger than Johny.
- (iii) The difference in ages between Johny and his younger sister Mary is 4 .

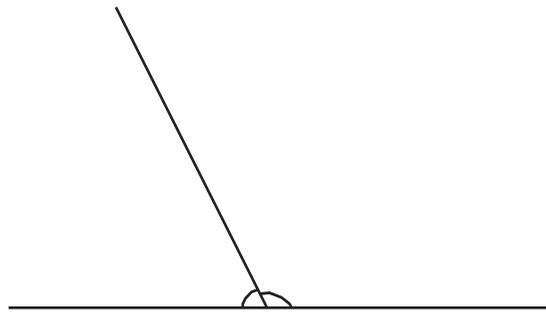
When we write such relations using letters also, we can put them in different ways. If we write  $j$  for Johny's age and  $m$  for Mary's age, the statements above become

- (i)  $j = m + 4$
- (ii)  $m = j - 4$
- (iii)  $j - m = 4$

Here, the letter  $m$  which stands for Mary's age can be any of the numbers 1, 2, 3 and so on. Accordingly we get the numbers 5, 6, 7 and so on as  $j$ .

Another problem:

See this figure;



However we draw the slanted line, what is the relation connecting the angles on the left and right?

We can write it like this:

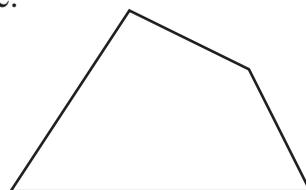
In what all ways can we state the relationship between the angles a line makes on the two sides of another line?  
Can you write each of these using letters?

The sum of the angles on the left and right is  $180^\circ$ .

What if we write the measure of the angle on the left as  $l^\circ$  and the measure of the angle on the right as  $r^\circ$ , then we can shorten this as:

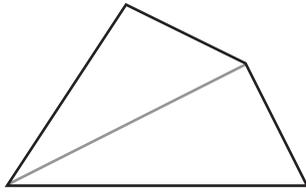
$$l + r = 180$$

Now look at this figure:

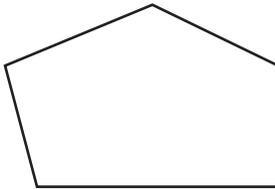




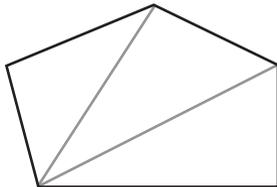
A figure of four sides. Drawing a line from one corner to the opposite corner, we can split it into two triangles;



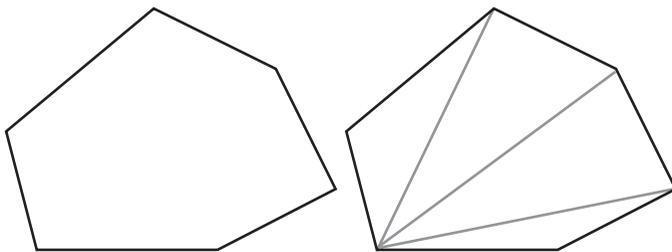
What about a five sided figure?



We can draw lines from one corner to two other corners to get three triangles.



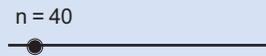
And a six sided figure?



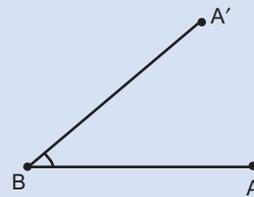
### Changing angles

We can use a slider to make an angle which can be changed as we like

Choose **slider** and click on the Graphic view. In the window which opens up, choose **Integer** and give **Min** = 0, **Max** = 180. Click **Apply**. We get a slider named n.



Mark two points A, B.



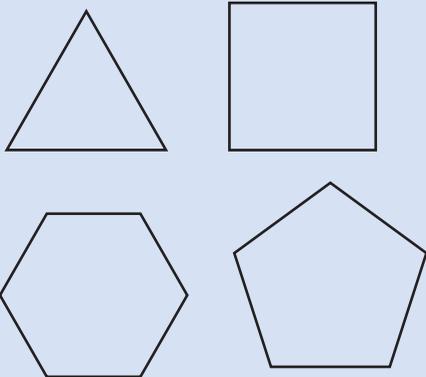
Choose **Angle with Given size** and click on A and B in order. In the window which opens up, give  $n^\circ$  as the size of the angle and click **OK**. We get a new point A'. Draw the lines BA and BA'. As we move the slider, the size of angle B changes.

Draw seven sided and eight sided figures like this .From one particular corner, draw lines to other corners to split them into triangles. Make a table like this:



### Regular polygons

Polygons with equal sides and equal angles are called regular polygons.



We can easily draw such figures using Geogebra. We use **Regular polygon** to do this.

Choose this and click on two positions. In the window, which opens up give the number of sides and click **OK**.



Sides	Lines	Triangles
4	1	2
5	2	3
6	3	4
7		
8		

In a 12 sided figure, how many such lines can be drawn from one particular corner?

- What is the relation connecting the number of sides and number of lines in general?
- What is the relation connecting the number of sides and the number of triangles?
- What is the relation connecting the number of lines and the number of triangles?

Writing the number of sides as  $s$ , the number of lines as  $l$  and the number of triangles as  $t$ , how do we write these relations?

This is how Sneha wrote them:

- $s - 3 = l$
- $t + 2 = s$
- $t - l = 1$

In what other ways can we write them?

Try!

Now look at this problem:

A shopkeeper decides to sell something for a price 100 rupees more than what he bought it for. If he had bought it for 500 rupees, at what price would he sell it? What if the price at which he bought is 600 rupees? Here what is the relation between the prices at which he bought and the price at which he sells?

This hundred rupee increase in price is called the profit in the sale. If he wants a profit of 150 rupees, what would be the relation between how much the shopkeeper bought it for and how much he sells it for? What if he wants a profit of 200 rupees? Write down these relations using letters.

How do we write in general, the relation between the price at which a shopkeeper buys something, the price at which he sells it and the profit? Adding the profit to the price at which it is bought gives the price at which it is sold.

Writing the price at which it is bought as  $b$ , the profit as  $p$  and the price at which it is sold as  $s$ , we get

$$s = b + p$$



In what other ways can you write this relation?

- For getting books through post, 25 rupees has to be added to the price of the book, as postage. Fill in the blanks of the table below:

Price of book	Postage	Total cost
120	25	
115	25	
	25	125
	25	110

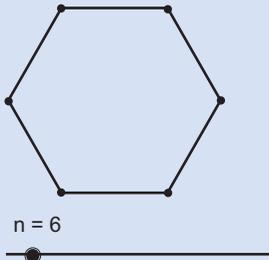
In what all ways can we say the relation between the price of a book and the total cost? Write these using letters. What if the postage is 30 rupees? What if it is 35 rupees?





We can draw regular polygon with as many sides as we like , using a slider.

Choose slider and click. In the window which opens up, choose Integer and type 3 for min. We get a slider named n.



Choose Regular polygon and click on two positions. In the window which opens up, give n as the number of sides instead of a specific number

Click and drag the dot on the slider to change the number n. The number of sides of the polygon changes accordingly.

Now if the postage also changes according to the price of the book, in what all ways can we say this relation?

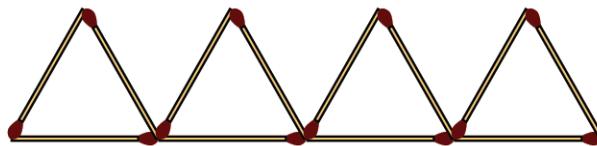
Write them using letters.

2. Make a table showing the number of girls, the number of boys and the total number of children in each class of your school. What are the different ways of stating the relation between these numbers? Write these using letters.
3. The sides of a triangle are 4 centimetres, 6 centimetres and 8 centimetres. What is its perimeter?

Denoting the length of the sides as  $a, b, c$  and the perimeter as  $p$ , how do we write the relation between them?

### Letter multiplication

Rani is making triangles with matchsticks:



- How many triangles are there in the picture?
- How many matchsticks are used to make them?
- How did you calculate it?
- Did you add repeatedly as  $3 + 3 + 3 + 3 = 12$ ?
- Or multiply as  $3 \times 4 = 12$ ?

How many matchsticks do we need to make 10 triangles like this?

In general, the number of matchsticks is three times the number of triangles.

How about writing this in shorthand, using letters?

If we take the number of triangles as  $t$  and the number of matchsticks as  $m$ , what is the relation between the numbers  $t$  and  $m$ ?

$$m = 3 \times t$$

When we write numbers as letters, we don't usually write the multiplication sign; that is, we omit the multiplication in  $3 \times t$  and write it simply as  $3t$ . Thus if we take the number of matchsticks Rani needs to make  $t$  triangles as  $m$ , then we usually write the relation between the numbers  $m$  and  $t$  as

$$m = 3t$$

Now let's see how many triangles can be made with 45 matchsticks. The number of matchsticks is three times the number of triangles. So the number of triangles is a third of the number of matchsticks.

So with 45 matchsticks, we can make  $\frac{45}{3} = 15$  triangles.

In general, the number of triangles is the number of matchsticks divided by 3.

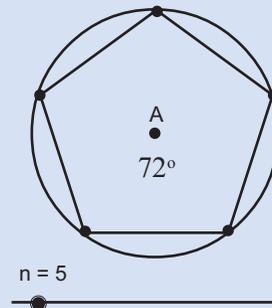


### Inside a circle

We have seen in the lesson **Angles** how regular polygons can be drawn by dividing a circle into equal parts.

Let's see how we can do this in GeoGebra.

Make an Integer slider named  $n$ . Draw a circle centred at a point  $A$  and mark a point  $B$  on it. Choose **Angle with Given Size** and click on  $B, A$  in order. In the window which opens up, give the angles as  $(360/n)^\circ$ . We get a new point  $B$  on the circle. Choose **Regular Polygon** and click on  $B, B'$ . Give the number of sides as  $n$ .



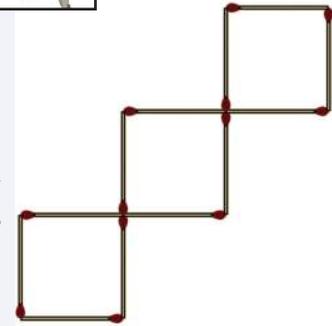
We can write this also using letters.

$$t = m \div 3.$$

We usually write this as  $t = \frac{m}{3}$ .



- How many squares are there in the picture? How many matchsticks are used to make it? How many matchsticks are needed to make five squares like this? In what different ways can we state relation between the number of squares and number of matchsticks?



Write them using letters.

- All children in the school bought pens from the co-operative store, at 5 rupees each. Write in the table, how much the children of various classes paid.

Class	Number of children	Total amount
6 A	34	
6 B	32	
6 C	36	

In what all ways can we say the relation between the number of children and the amount they paid? Write them using letters.

- What is the perimeter of a square of side 5centimetres. What about a square of perimeter 6 centimetres? In what all ways can we say the relation between the length of a side and perimetre of a square? Write all these using letters.
- How much money does 5 ten rupee notes make? What about 7 ten rupee notes? In what all ways can we say the number of ten rupee notes and the total amount? Using  $t$  to denote the number of ten rupee notes and  $a$  to denote the total amount, in what all ways can we write this relation?

## Multiplication again

What is the area of a rectangle of length 5 centimetres and breadth 3 centimetres?

How about a rectangle of length  $5\frac{1}{2}$  centimetres and breadth  $3\frac{1}{4}$  centimetres?

Whatever be the length and breadth, area is their product, right?

How do we write this using letters?

Taking the length as  $l$  centimetres, breadth as  $b$  centimetres and area as  $a$  square centimetres,

$$a = l \times b = lb$$

See how we have omitted the multiplication sign here also.

Like this, the volume of a rectangular block is the product of its length, breadth and height.

This also we can write using letters. Taking length as  $l$  centimetres, breadth as  $b$  centimetres, height as  $h$  centimetres and volume as  $v$  cubic centimetres, we can write

$$v = lbh$$

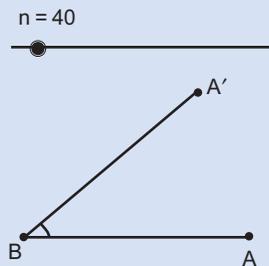


1. What is the total price of 5 pens, each of price 8 rupees?  
What is the price of 10 notebooks, each of price 12 rupees?
  - i. In what all ways can we say the relation between the price of something, the number bought and the total price?

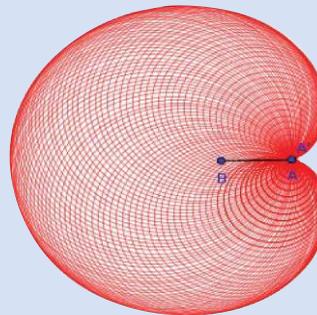


Using the angles drawn in changing angle, we can draw a nice picture.

First change the values of slider  $n$  from 0 to 360. Use **Circle with Centre through Point** to draw a circle centred at  $A'$  through  $A$ . Right click on the circle and choose trace on.



Now right click on the slider and choose Animation on. Don't you get a picture like this?



- ii. Taking the price of an article as  $p$ , their number as  $n$  and the total price as  $t$ , in what all ways can we write the relations between  $p$ ,  $n$  and  $t$ ?
- 2. One litre of kerosene weighs 800 grams.
  - i. What is the weight of 2 litres of kerosene?
  - ii. What is the weight of  $\frac{1}{2}$  litre of kerosene?
  - iii. What is the weight of 1 millilitre of kerosene?
  - iv. Taking the weight of  $v$  millilitres of kerosene as  $w$  grams, write a relation between  $v$  and  $w$ .
- 3. One cubic centimetre of iron weighs 7.8 grams.
  - i. Taking the volume of an iron object as  $v$  cubic centimetres and weight  $w$  grams, write a relation between  $v$  and  $w$ .
  - ii. Taking the length, breadth and height of a rectangular block of iron as  $l$ ,  $b$ ,  $h$  and its weight as  $w$ , write a relation between  $l$ ,  $b$ ,  $h$  and  $w$ .

### Multiplication and addition

Ravi has 3 ten rupee notes and a one rupee coin; Lissy has 5 ten rupee notes and a one rupee coin.

#### Sequence rule

Look at these numbers:

1, 1, 2, 3, 5, 8, .....

Can you say what the next number is?

For any three consecutive numbers  $a, b, c$  of this sequence, we must have

$$a + b = c$$

Now try writing some more numbers of this. It is called Fibonacci sequence.

How much money does Ravi have?

And Lissy?

How did you calculate?

Similarly how much does 25 ten rupee notes and a one rupee coin make?

$$(10 \times 25) + 1 = 251$$

In general, how much money does some ten rupee notes and a one rupee coin make?

We have to multiply the number of notes by 10 and add 1, right?

Let's write it using letters.

Take the number of ten rupee notes as  $t$ .

So how much money is  $t$  ten rupee notes and a one rupee coin?

What about 8 ten rupee notes and 7 one rupee coins?

What is the general method to calculate the amount of money, some ten rupee notes and some one rupee coins make?

Multiply the number of notes by 10 and add the number of coins.

How do we write this using letters?

$t$  ten rupee notes and  $c$  coins make  $10t + c$  rupees.



1. How much money does 8 ten rupee notes and 2 five rupee notes make? What about 7 ten rupee notes and 4 five rupee notes?
  - i. How do we say the relation between the number of ten rupee notes, the number of five rupee notes and the total amount?
  - ii. Taking the number of ten rupee notes as  $t$ , the number of five rupee notes as  $f$  and the total amount as  $a$  how do we write the relation between  $t, f$  and  $a$ ?
2. The price of a pen is 7 rupees and the price of a notebook is 12 rupees.
  - i. What is the total price of 5 pens and 6 notebooks?
  - ii. What about 12 pens and 7 notebooks?
  - iii. What is the relation between the number of pens, the number of books and the total price?
  - iv. Taking the numbers of pens as  $p$ , the number of notebooks as  $n$  and total price as  $t$ , how do we write the relation between them?

3. What length of wire is needed to make a triangle of sides 10 centimetres each? To make a square of side 10 centimetres?
  - i. What is the total length needed to make 5 such triangles and 6 such squares?
  - ii. What about 4 triangles and 3 squares?
  - iii. What is the relation between the number of triangles, the number of squares and the total length of wire?
  - iv. Taking the number of triangles as  $t$ , the number of squares as  $s$  and the total length as  $l$ , how do we write the relation between  $t$ ,  $s$  and  $l$ ?

### Addition and multiplication

Four friends went to buy pens and note books. The price of a pen is 8 rupees and the price of a notebook is 12 rupees. The shopkeeper calculated like this:

$$\text{Price of 4 pens is } 8 \times 4 = 32 \text{ rupees}$$

$$\text{Price of 4 notebooks is } 12 \times 4 = 48 \text{ rupees}$$

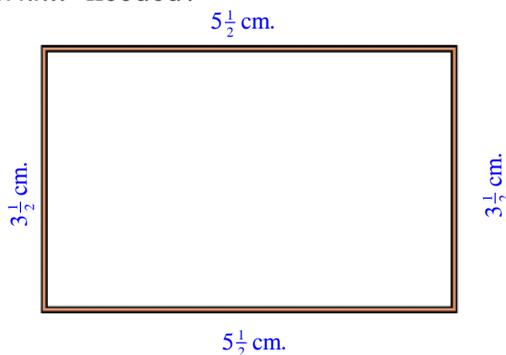
$$\text{Total 80 rupees}$$

The friends calculated like this:

$$\text{The amount one has to spend is } 8 + 12 = 20 \text{ rupees}$$

$$\text{Total expense } 20 \times 4 = 80 \text{ rupees}$$

Another problem: we want to make a rectangle with *eerkkil* bits; of length  $5\frac{1}{2}$  centimetres and breadth  $3\frac{1}{2}$  centimetres. What is the total length of *eerkkil* needed?

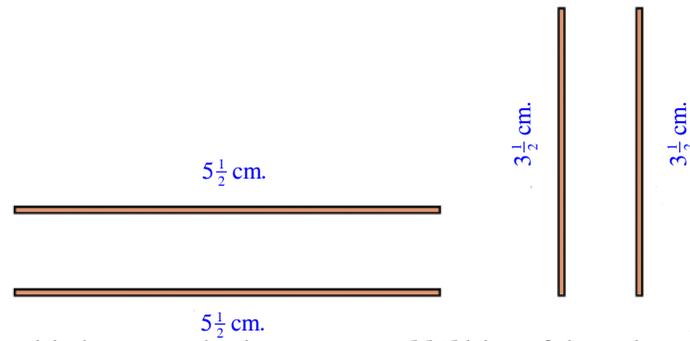


We can calculate the total length as

$$5\frac{1}{2} + 3\frac{1}{2} + 5\frac{1}{2} + 3\frac{1}{2} = 18$$

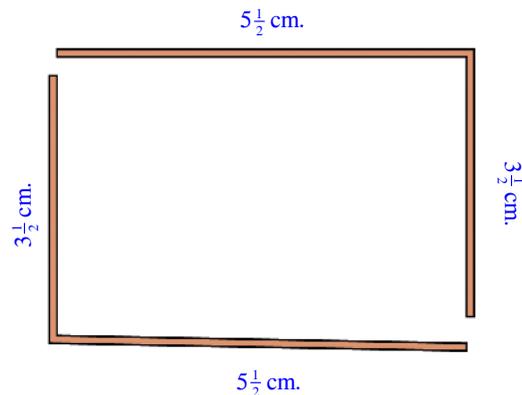
Or, we can calculate it as two *eerkkil* bits of length  $5\frac{1}{2}$  centimetres and two of length  $3\frac{1}{2}$  centimetres;

$$\left(2 \times 5\frac{1}{2}\right) + \left(2 \times 3\frac{1}{2}\right) = 11 + 7 = 18$$



There is a third way: take it as two *eerkkil* bits of length  $5\frac{1}{2} + 3\frac{1}{2}$  centimetres:

$$2 \times \left(5\frac{1}{2} + 3\frac{1}{2}\right) = 2 \times 9 = 18$$



Which is the easiest?

So if we take the length of a rectangle as  $l$ , breadth as  $b$  and perimeter as  $p$ , the relation between  $l$ ,  $b$  and  $p$  can be written in various ways as

$$p = l + b + l + b$$

$$p = 2l + 2b$$

$$p = 2(l + b)$$

Usually, the last one is the easiest to use.

For example, we can quickly calculate the perimeter of a rectangle of length 27 centimetres and breadth 43 centimetres as  $2 \times (27 + 43) = 140$  centimetres.



1. There are 25 children in one room and 35 in another. 5 biscuits are to be given to each. How many biscuits are needed?

- i. What if the number of children are 20 and 40?
- ii. If we take the number of children in the first room as  $f$ , in the second room as  $s$  and the total number of biscuits as  $t$ , in what all ways can we write the relation between  $f$ ,  $s$  and  $t$ ? What if each is given 6 biscuits instead of 5?
- iii. If the number of biscuits given to each is taken as  $b$ , in what all ways can we write the relation between  $f$ ,  $s$ ,  $t$  and  $b$ ?

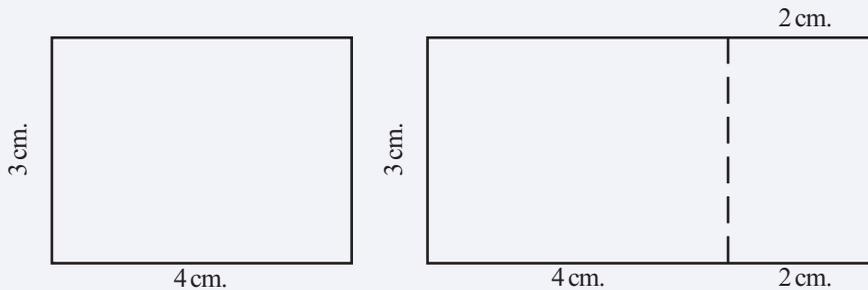
2. In the picture,  $M$  is the point right at the middle of  $AC$ .



What is the length of  $AM$ ?

- i. If a 5 centimetre long line is extended by 4 centimetres, at what distance from an end point of the longer line is the point exactly at its middle?

- ii. What if a  $7\frac{1}{2}$  centimetre long line is extended by  $2\frac{1}{2}$  centimetres?
- iii. A line of length  $l$  centimetres is extended by  $e$  centimetres. The mid point of the long line, is  $m$  centimetres away from one of its end points. What is the relation between  $l$ ,  $e$  and  $m$ ?
3. The length of a rectangle is 4 centimetres and its breadth is 3 centimetres. The length is increased by 2 centimetres to make a large rectangle.



- i. What is the area of the large rectangle? If the length is increased by 3 centimetres, what is the area of the large rectangle?
- ii. Taking the length and breadth of the original rectangle as  $l$  centimetres and  $b$  centimetres, the increase in length as  $i$  centimetres and the area of the large rectangle as  $a$  square centimetres, in what all ways can we write the relation between  $l$ ,  $b$ ,  $i$  and  $a$ ?



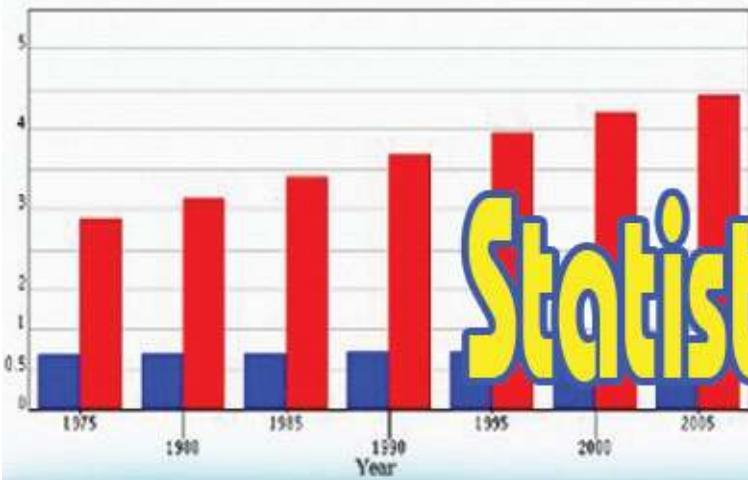
Looking back



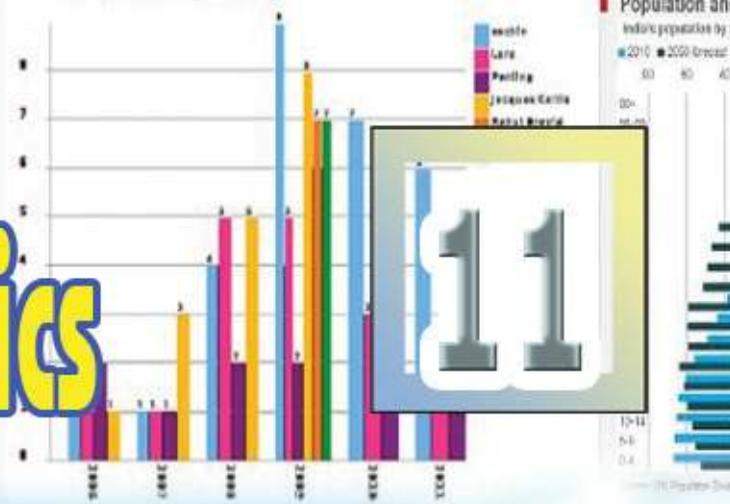
Learning outcomes	What I can	With teacher's help	Must improve
<ul style="list-style-type: none"> <li>Forming conclusion about the relation between various measurements and interpreting them in different ways.</li> </ul>			
<ul style="list-style-type: none"> <li>Explaining such conclusions in one's own language with conceptual clarity.</li> </ul>			
<ul style="list-style-type: none"> <li>Expressing relations between measurements using letters.</li> </ul>			
<ul style="list-style-type: none"> <li>Interpreting and explaining relations expressed using letters.</li> </ul>			



Population of Europe and Asia in millions



Rateman & Centuries (2000-2010)

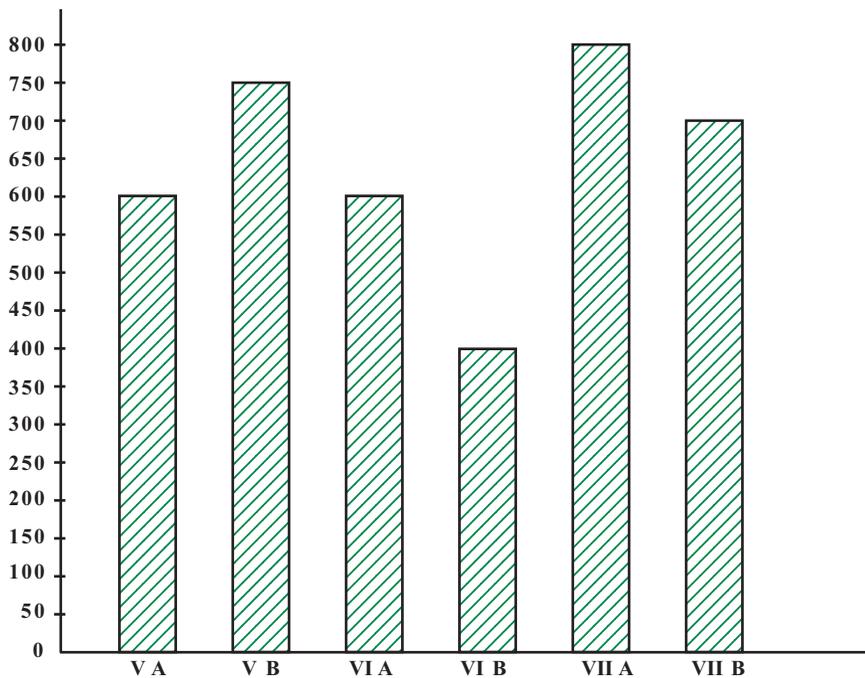


## Bar graphs

Remember how we drew bar graphs to show numerical information?

See the bar graph below.

It shows the amount of money each class in a school donated to the *Snehasparsham* medical aid fund.



- What is the total amount donated?
- Which class gave the most?
- And the least?

What other things should we get from this table?

The table below shows the number of children in each class in a school.

Class	Number of children
VA	25
VB	30
VIA	30
VIB	20
VIA	40
VIB	35
<b>Total</b>	<b>180</b>

Let's draw a bar graph of this.

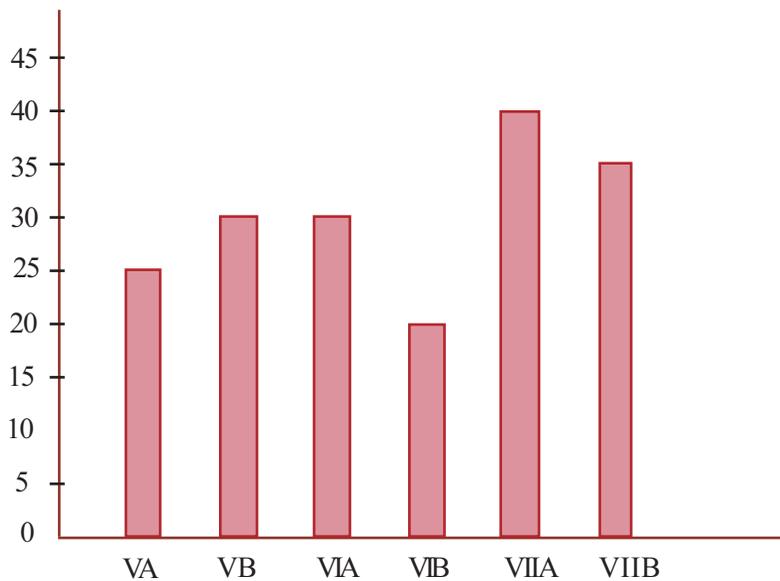
The height of each bar should be according to the number of children.

If we take it as 1 centimetre per child, what would be the heights?

So, what length per child would be a convenient scale?

What other things should we decide to draw the graph?

- The width of a bar
- Distance between bars



Now draw a graph in your notebook.

We get the number of children in each class from this graph and we get the amount each class donated from the first graph.

For example, in class VA, there are 25 children and they donated 600 rupees. So how much did each child of this class give on average?

Calculate the average amount for other classes also.

- Which class has the highest average?
- And the lowest?

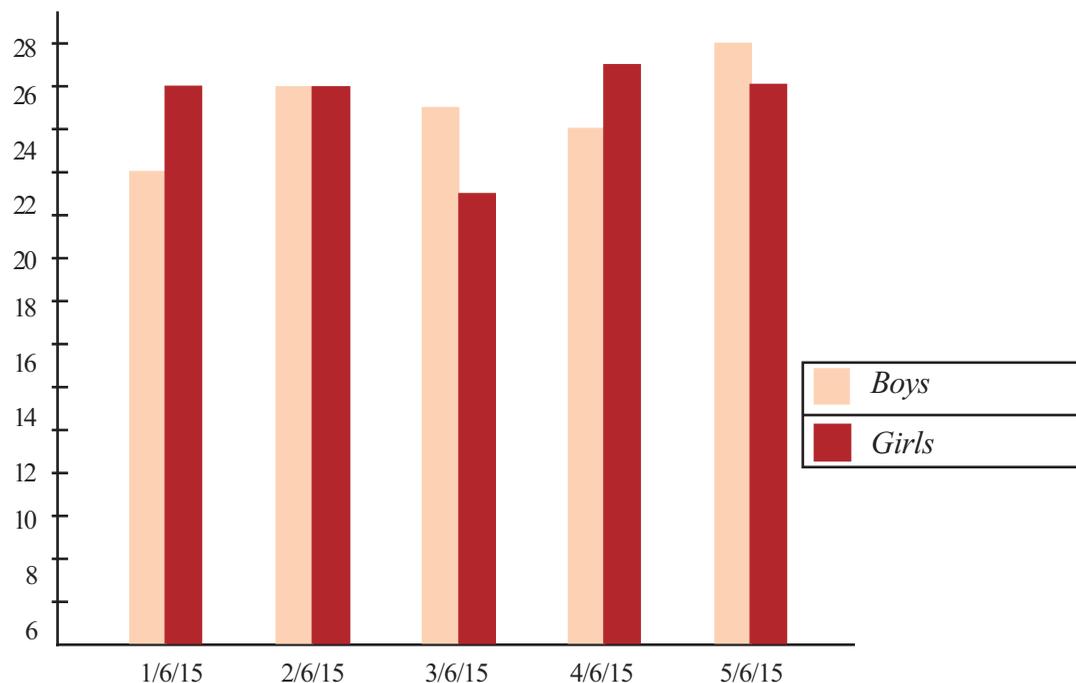
Draw a bar graph showing these averages.

In class VI, 20 children got A grade, 50 got B grade, 20 got C grade, 15 got D grade and 5 got E grade. Draw a bar graph showing this.



## Double bar

The bar graph below shows the number of boys and girls present in class 5 of a school, from 1<sup>st</sup> to 5<sup>th</sup> of June.



Complete the table, based on this.

Date	Number of children present		
	Boys	Girls	Total
1/6/15			
2/6/15			
3/6/15			
4/6/15			
5/6/15			

- On which day was the least number of children present?
- On which day was the most number of boys present? And the least?
- What about girls?
- On which day was the difference in number between boys and girls the most?

100 grams of rice is taken per child for lunch. How much rice was used each day during this week? Draw a bar graph showing this.



1. The table shows the number of notebooks sold at the school store during six months.

Month	June	July	August	September	October	November
Number	140	130	150	160	120	150

Draw a bar graph of this.

2. The table shows the various expenses of George's family for the last month.

Item	Expense
Food	2000
Dress	900
Travel	400
Education	700
Medicine	600
Others	800

Draw a bar graphs of this. Write down some facts we get from the graph.

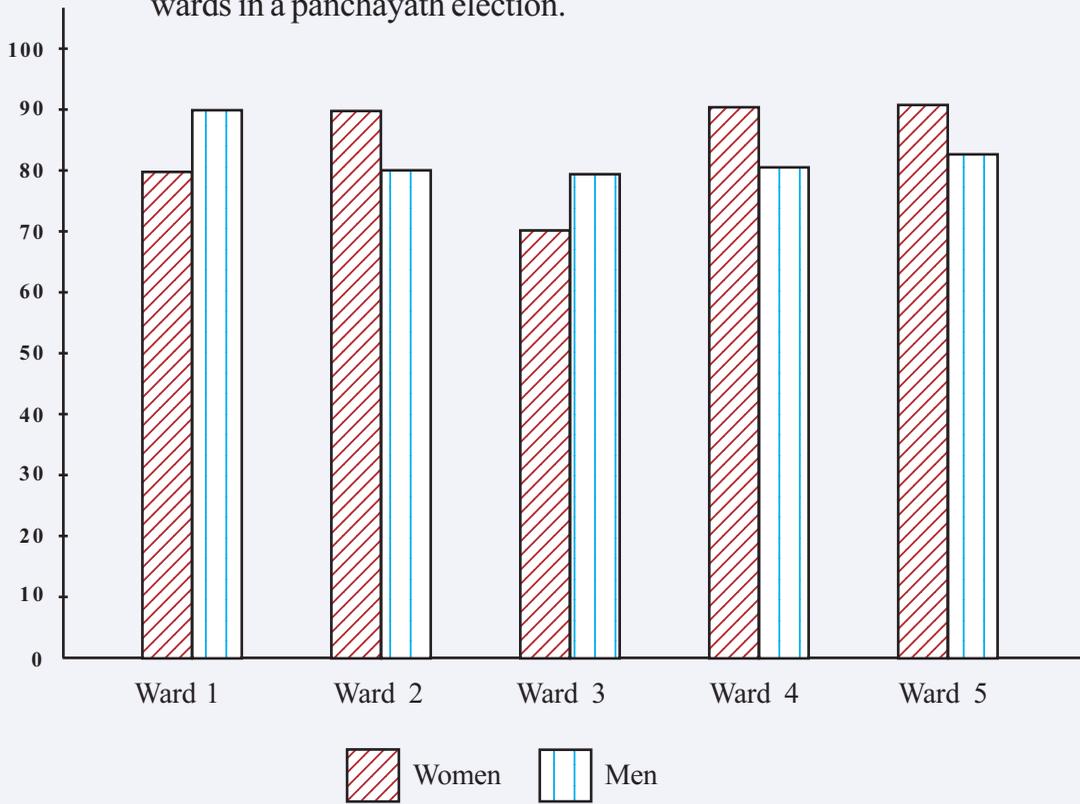
3. The table below shows the amount of electricity used at Soumya's home during last year.

Months	January, February	March, April	May, June	July, August	September, October	November, December
Unit (KW)	340	440	410	290	300	320

Draw a bar graph of this.

- How many units were used in all last year?
- What is the average use every two months?
- During which two months was the use closest to the average?

4. The bar graph shows the percent of those who voted in some wards in a panchayath election.



The table shows the total number of voters.

Ward	Women	Men	Total
1	570	620	1190
2	840	790	1630
3	760	800	1560
4	900	850	1750
5	740	720	1460

Calculate the actual number of men and women who voted in each ward.



## Looking back

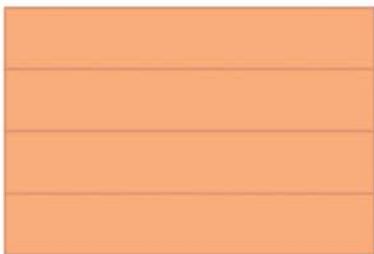
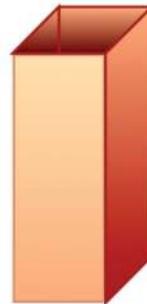
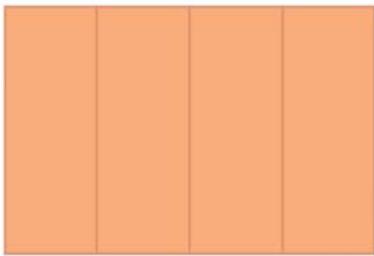


Learning outcomes	What I can	With teacher's help	Must improve
• Drawing bar graph using available information.			
• Interpreting various types of bar graphs.			
• Making tables showing information from a bar graph.			



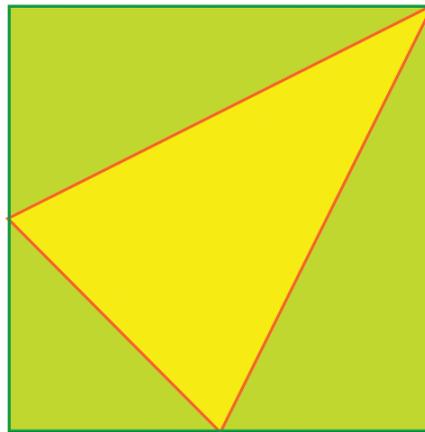
**Think a bit!**

- Two rectangular pieces of paper, 6 centimeters long and 4 centimeters wide, are folded four times, one horizontally and the other vertically to make two tubes:



Which of the tubes has more volume? How much more?

2. In the picture below, the yellow rectangle is drawn joining one vertex of the green square and the mid-points of its two sides.



What fraction of the area of the square is the area of the triangle?

3. Look at the pattern below:

$$\frac{1}{2} + \frac{1}{2} = 1$$

$$2 + 2 = 4 = 2 \times 2$$

$$\frac{1}{3} + \frac{2}{3} = 1$$

$$3 + \frac{3}{2} = \frac{9}{2} = 3 \times \frac{3}{2}$$

$$\frac{1}{4} + \frac{3}{4} = 1$$

$$4 + \frac{4}{3} = \frac{16}{3} = 4 \times \frac{4}{3}$$

$$\frac{1}{5} + \frac{4}{5} = 1$$

$$5 + \frac{5}{4} = \frac{25}{4} = 5 \times \frac{5}{4}$$

$$\frac{2}{5} + \frac{3}{5} = 1$$

$$\frac{5}{2} + \frac{5}{3} = \frac{25}{6} = \frac{5}{2} \times \frac{5}{3}$$

Can you find other pairs of numbers with their sum and product equal?  
What is the general method to find such pairs?

4. The product of the natural numbers from 1 to 10 can be factorized as a product of primes like this:

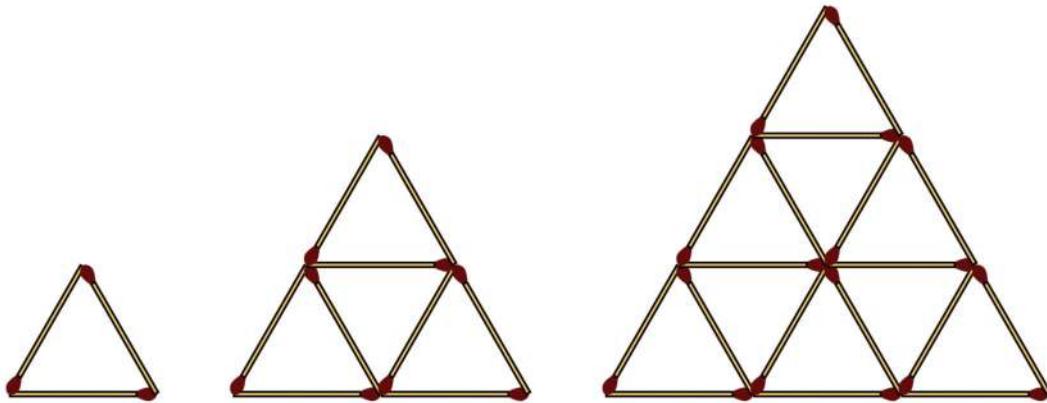
$$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10$$

$$= (2 \times 2 \times 2) \times (3 \times 3 \times 3 \times 3) \times (5 \times 5) \times 7$$

How many factors does the product have? How many zeros does this number end with?

If the product of natural numbers from 1 to 20 is factorized as a product of primes like this, which of the primes would be in it? How many of each?

How many factors would the product have? How many zeros would it end with.



First one triangle, then four triangles in two rows, next nine triangles in three rows.

How many matchsticks are used to make each?

Let's write as a table:

Rows	Triangles	Matchsticks
1	1	3
2	4	9
3	9	18
4		
5		

Can you fill up the table? How many triangles would be there if we make 10 rows like this? How many matchsticks would we need to make them?

6. Each shape in the sums and products below stands for one of the numbers 0, 1, 2, 3, 4, 5. Can you find out what number each shape stands for?

$$\bullet + \star = \bullet$$

$$\blacksquare \times \bullet = \blacksquare$$

$$\blacksquare \times \blacksquare = \blacklozenge$$

$$\blacksquare + \blacktriangle = \bullet$$

$$\star = \quad \bullet = \quad \blacksquare =$$

$$\blacklozenge = \quad \blacktriangle = \quad \bullet =$$