MATHEMATICS

Part - 2

Standard

V

Government of Kerala
Department of General Education

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 my parents, teachers and all elders, respect and treat everyone with courtesy.

To my country and my people, I pledge my devotion. In their well-being and prosperity alone, lies my happiness.

5

Dear Students,

We have learnt a lot about mathematical concepts like numbers, shapes and patterns. We have also had a better understanding of these concepts and acquired necessary skills related to them.

We have grasped the logic of mathematics too.

We are now able to find the relations between numbers, complete patterns, draw figures, analyse equations and find different ways of solving problems.

But we need to acquire more knowledge.

We have to grasp the idea of larger numbers, the relation among numbers and their more complex computations, harder and trickier solutions, deeper and more profound exercises involving mathematical concepts.

Let us freely, joyfully and confidently move forward together.

With regards,

Dr. Jayaprakash R.K.
Director
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The icon below is used in this textbook for convenience

Let's do the problems

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a [1][SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC] and to secure to all its citizens :

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the [2][unity and integrity of the Nation];

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949 do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.**
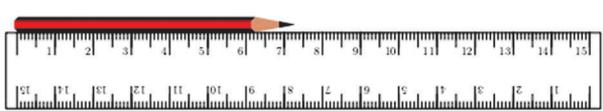
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1. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Unity of the Nation" (w.e.f. 3.1.1977)
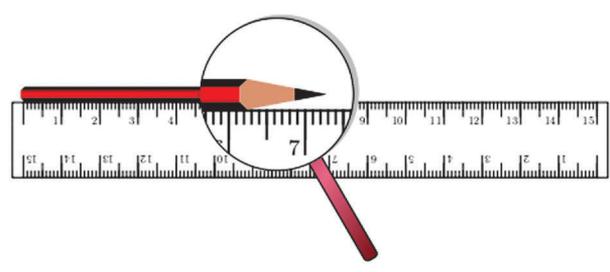
MEASURE MATH

Fractional Lengths

What's the length of this pencil?

A little more than 7 centimetres; but not close to 8 centimetres either.

Let's have a closer look:

7 centimetres and 3 millimetres, isn't it?

Can we say this in terms of centimetres alone?

As we know, 1 centimetre is 10 millimetres:

$$1 \text{ centimetre} = 10 \text{ millimetres}$$

This means that a millimetre is one part of a centimetre divided into ten equal parts.

In other words, 1 millimetre is $\frac{1}{10}$ of 1 centimetre:

$$1 \text{ millimetre } = \frac{1}{10} \text{ centimetre}$$

So, what about 3 millimetres?

3 parts of a centimetre divided into 10 equal parts:

3 millimetres $= \frac{3}{10}$ centimetre

So we can say that the length of the pencil is $7\frac{3}{10}$ centimetres.

There's a shorter way of writing this:

We write $7\frac{3}{10}$ centimetres as 7.3 centimetres.

7.3 is called the decimal form of $7\frac{3}{10}$ (read it as 7 point 3).

Similarly, we can write 8 centimetres and 7 millimetres (that is $8\frac{7}{10}$ centimetres) as 8.7 centimetres.

Do we measure centipedes in centimetres and millipedes in millimetres ?

Length of pencils				
	Measurement		**Fractional form**	**Decimal form**
	cm	**mm**	**cm**	**cm**
1				
2				
3				
4				
5				

Did you get the length of any pencil in exact centimetres without having to measure in millimetres?

For example, is there an 8 centimetre long pencil?

How do we write it in decimal form?

Just write 8 centimetres.

Since it has no fractional (that is, decimal) part, we can also write it as 8.0 centimetres (though there's no need to do so now).

A pencil cannot be less than one centimetre long; but there are certain things having such lengths (a very small bit of wire, small screws in toys and so on).

How do we write the length of such things in decimal form?

For example, 6 millimetres means $\frac{6}{10}$ centimetres. It has no whole number part and is just a fraction. So, we can write it as 0.6 centimetres.

Like this, we can write 4 millimetres as 0.4 centimetres and 1 millimetre as 0.1 centimetre.

Different Measures

We measure length of pencils or geometry boxes using centimetres and millimetres. But to measure the lengths of a bench or a room, it's more convenient to use a metre scale or tape. (How do we measure the distance jumped in sports events?)

The length of a bench was found to be 2 metres and 13 centimetres upon measuring. How do we write this in terms of metre alone?

One metre means 100 centimetres. In other words, one centimetre is $\frac{1}{100}$ of a metre, that is $\frac{1}{100}$ metre.

13 centimetres means $\frac{13}{100}$ metre.

So, 2 metres and 13 centimetres means $2\frac{13}{100}$ metres.

This is written in decimal form as 2.13 metres.

So, 4 metres and 78 centimetres can be written in metre in two ways:

$4\frac{78}{100}$ metres in fractional form and 4.78 metres in decimal form.

The length of a table was found to be 1metre, 25 centimetres and a little more; when this bit was measured in millimetres, it was found to be four.

Hence it is 1 metre, 25 centimetres and 4 millimetres.

How do we say this in metre ?

First, let's convert everything less than a metre into millimetres. Instead of 25 centimetres and 4 millimetres, we can say 254 millimetres, isn't it?

$$1 \text{ metre } = 1000 \text{ millimetres}$$

$$1 \text{ millimetre } = \frac{1}{1000} \text{ metre}$$

So, 254 millimetres is $\frac{254}{1000}$ metre.

And we can write 1 metre and 254 millimetres as $1\frac{254}{1000}$ metres in fractional form.

We write this in decimal form as 1.254 metres.

What is the decimal form of 1metre, 20 centimetres and 4 millimetres?

First we write it as 1 metre and 204 millimetres. This we can write in fractional form as $1\frac{204}{1000}$ metres; and then in decimal form as 1.204 metres.

This can be done for other measurements also.

For example, how do we write 2 litres and 125 millilitres in decimal form?

How many millilitres make a litre?

$$1 \text{ litre } = 1000 \text{ millilitres}$$

$$1 \text{ millilitre } = \frac{1}{1000} \text{ litre}$$

So we can write 2 litres and 125 millilitres as $2\frac{125}{1000}$ litres in fractional form and 2.125 litres in decimal form.

In the same way, what is the relation between kilogram and gram?

$$1 \text{ kilogram } = 1000 \text{ grams}$$

$$1 \text{ gram } = \frac{1}{1000} \text{ kilogram}$$

Thus the fractional form of 5 kilograms and 375 grams is $5\frac{375}{1000}$ kilograms and the decimal form is 5.375 kilograms.

Now, can you write the measurements in this table in fractional and decimal forms?

Measure	Fractional form	Decimal form
2 centimetres 3 millimetres	.... centimetres	.... centimetres
5 millimetres	.... centimetres	.... centimetres
8 metres 35 millimetres	.... metres	.... metres
6 kilograms, 125 grams	.... kilograms	.... kilograms
12 litres, 275 millilitres	.... litres	.... litres
325 millilitres	.... litres	.... litres

The Reverse Process

How many centimetres is 1.25 metres ?

As seen earlier,

$$1.25 \text{ metres} = 1\frac{25}{100} \text{ metres}$$

Using centimetres, we can say this without fractions:

$$\frac{1}{100} \text{ metre} = 1 \text{ centimetre}$$

$$\frac{25}{100} \text{ metre} = 25 \text{ centimetres}$$

Thus 1.25 metres means 1 metre and 25 centimetres.

In terms of centimetre alone, 125 centimetres.

Length for sugarcane and weight for sugar!

Can it be measured when it dissolves into sweetness, ?

Now try these problems

- How do we write 1.75 metres in fractional form? How may metres and centimetres is this? How much is it in centimetres alone?

- How do we write 0.38 metres in fractional form? How many centimetres is this?

- (i) How do we write 3.275 kilograms in fractional form?

  (ii) How do we write this in kilograms and grams?

  (iii) How do we write this in grams alone?

- Complete the table below:

Decimal form	Using fractions	Without fractions
7.3 centimetres	$7\frac{3}{10}$ centimetres	7 centimetres, 3 millimetres = 73 millimetres
3.5 centimetres	.... centimetres	.... centimetres, ... millimetres = ... millimetres
.... centimetres	.... centimetres	.... centimetres .... millimetres = 7 millimetres
5.42 metres	.... metres	.... metres, ... centimetres = ... centimetres
.... metres	$10\frac{27}{100}$ metres	.... metres, ... centimetres = ... centimetres
6.875 kilograms	.... kilograms	.... kilograms, ... grams = ... grams
.... kilograms	.... kilograms	.... kilogram, ... grams = 432 grams
3.425 litres	.... litres	.... litres, ... millilitres = ... millilitres
.... litres	.... litres	.... litres, ... millilitres = 5763 millilitres

FRACTIONS

Fractional share

If four cakes are divided between two persons, how many cakes would each of them get?

What if it's two cakes?

What if there's only one cake?

Each one gets half a cake, isn't it?

That is, $\frac{1}{2}$ of a cake.

What if one cake is divided equally among three persons?

Now, suppose two cakes are to be shared equally among three persons.

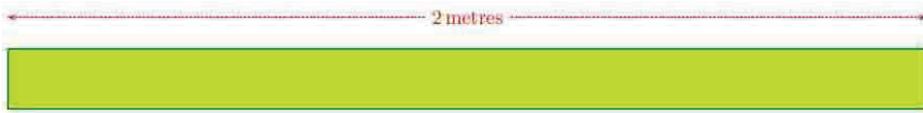First cut one cake into three equal pieces:

And give one piece to each person.

Now, we cut the other cake too and give one piece to each person.

So, each person gets $\frac{2}{3}$ of a whole cake.

Let's look at another problem.

How do we divide a 2 metre long ribbon among three kids?

First we fold it into two and mark 1metre.
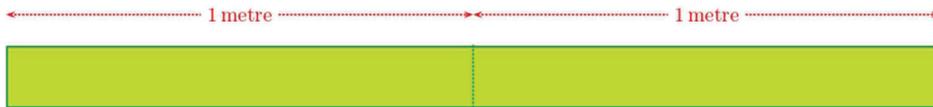
Next fold each metre into three and mark the folds.
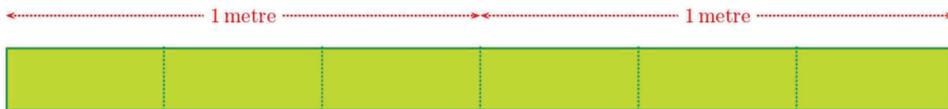
Now, if we cut off pairs of these parts, don't we get three equal pieces?

What is the length of each piece?

Each is two parts of 1metre divided into three equal pieces, isn't it?
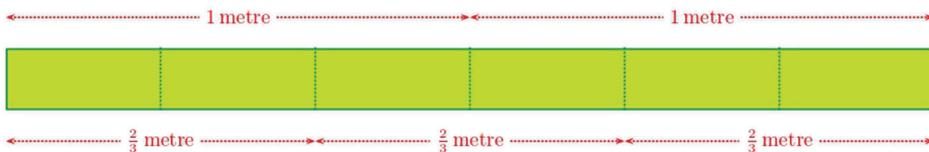
What did we see in both these problems?

Dividing one into three equal parts and taking two of them, and dividing two into three equal parts and taking one of them, both are $\frac{2}{3}$.

🧠 **Now solve these problems:**

(1)   i.   If 3 cakes are divided equally among 4 persons, what fraction of a cake would each one get?

     ii.   If a 3 metre long ribbon is cut into four equal pieces, what would be the length of a piece in metres?

     iii.   If 3 litres of milk is divided equally among 4 persons, how much milk would each get, in litres?

(2) If a 2 metre long rope is cut into 5 equal pieces, what would be the length of each piece in metres?

(3) 4 kilograms of sugar is divided into 5 packets of the same weight. How much sugar, in kilograms, is there in each packet?

New Fractions

We have seen that if two cakes are divided equally among three persons, each one would get two third of it.

How do we divide three cakes equally between two children?

First, we can give one whole cake to each:

Now, we can cut the other cake into halves and give a piece to each:

Thus each gets one and a half cake.

Let's look at another problem.

If a three metre long ribbon is cut into two equal pieces, what would be the length of each piece?

We can think like this:

- Three metres means two metres and one metre more.

- So, half of three metres is half of two metres and half of one metre together.

- That is, one and a half metres.

We can also think like this:

3 metre

1 metre ——— 1 metre ——— 1 metre

3 metre

1 metre ——— $\frac{1}{2}$ metre ——— $\frac{1}{2}$ metre ——— 1 metre
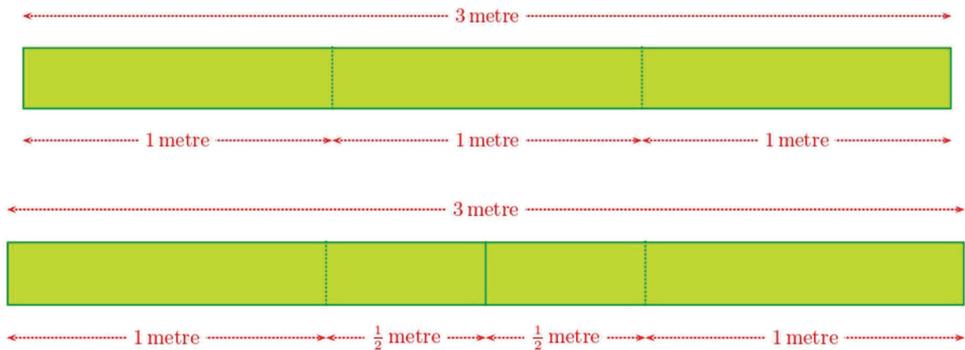
In general, one part of 3 divided into 2 equal parts is $1\frac{1}{2}$.

We saw that one part of 2 divided into 3 equal parts is $\frac{2}{3}$.

So, we can denote one part of 3 divided into 2 equal parts as $\frac{3}{2}$ (read it as 3 over 2).

That is,

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

Let's look at another problem.

If 9 litres of milk is divided equally among 4 kids, how much would each get, in litres?

We can calculate like this:

- If we give 2 litres to each, 1 litre would be left
- If we divide this 1 litre equally among the 4, each would get $\frac{1}{4}$ litre more.
- Each gets $2\frac{1}{4}$ litres.

We can write one part of 9 divided into 4 equal parts as $\frac{9}{4}$.

That is,

$$\frac{9}{4} = 2\frac{1}{4}$$

For each of the problems below, write the answer as a single fraction and as a whole number and a fraction.

1. If an 8 metre long string is cut into 5 equal parts, what would be the length of each piece?

2. 15 litres of kerosene is divided equally into 4 cans. How much does each can contain, in litres?

3. If 25 kilograms of sugar is divided equally among 8 persons, how much would each get, in kilograms?

Fraction and Division

If six litres of milk is divided equally among three persons, how much would each get?

We usually write the answer to this problem as a division:

$$6 \div 3 = 2$$

We've also seen that if it is 2 litres that is divided like this, then what each gets is $\frac{2}{3}$ litre. We can write this also as a division:

$$2 \div 3 = \frac{2}{3}$$

Like this, any fraction can be seen as a division also. For example, we have seen that if a three metre long ribbon is cut into four equal pieces, each piece would be $\frac{3}{4}$ metre long. Here, we divided three into four. So, this can also be written as a division:

$$3 \div 4 = \frac{3}{4}$$

On the other hand, any division can be written as a fraction also.

For example, if we divide six cakes equally among two kids, each would get three cakes.

Written as a division

$$6 \div 2 = 3$$

We can write $6 \div 2$ as $\frac{6}{2}$ also. Thus

$$\frac{6}{2} = 6 \div 2 = 3$$

What if there's a remainder on division?

For example, look at this problem:

If seven litres of milk is divided equally among two kids, how much would each get, in litres?

Remember what mother said! Some milk must be left in the pot after sharing

Don't worry! I'll take the pot also along with my share

If we give three litres to each, there would be one litre left.

In terms of division of numbers, this means;

7 divided into 2 gives quotient 3 and remainder 1.

In our problem related to milk, the one litre left can also be shared by giving half a litre to each. Thus each gets three and a half litres.

Writing this as a division

$$7 \div 2 = 3\frac{1}{2}$$

We can write it as $\frac{7}{2}$ also. That is,

$$7 \div 2 = 3\frac{1}{2} = \frac{7}{2}$$

What happened? Didn't you divide the rupees and paise?

Yeah! He gave me all the paise and took all the rupees himself!

Now look at this problem:

If 7 pens are divided between two persons, how many pens would each get?

Here, we can only say that each gets three pens and one pen will be left over, right?

For each of the problems, write the answer either as a whole number and fraction or as quotient and remainder, according to the situation.

(1) If 15metres of cloth is divided equally among 4 persons, how many metres of cloth would each one get?

(2) If 250 rupees is equally shared by 8 persons, how much money would each one get? Write this in rupees and paise.

(3) How many boxes are required to pack 100 eggs with 12 in each box?

(4) If 15 litres of milk is divided equally among 4 persons, how much would each get, in litres?

(5) Among how many persons can 15 litres of milk be shared, if each is to get 4 litres?
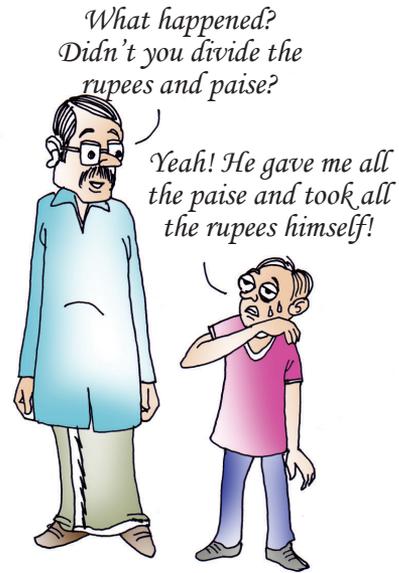
Number Relations

Addition, Subtraction and Multiplication

A simple problem:

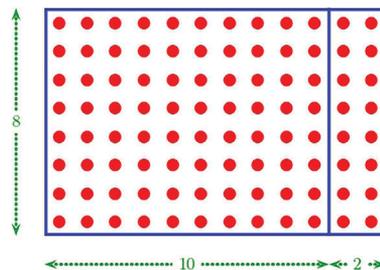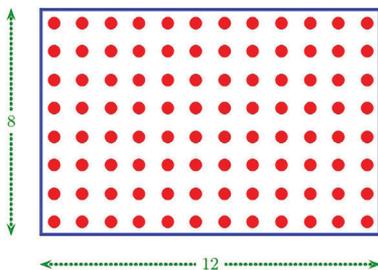How much money is needed to buy 12 pens at 8 rupees each?

How did you calculate it?

Did you do it mentally as 80 rupees for 10 pens, 16 rupees for two more and altogether 96 rupees?

How do we write these calculations in math?

$$
\begin{aligned}
12 \times 8 \; &= \; (10 + 2) \times 8 \\
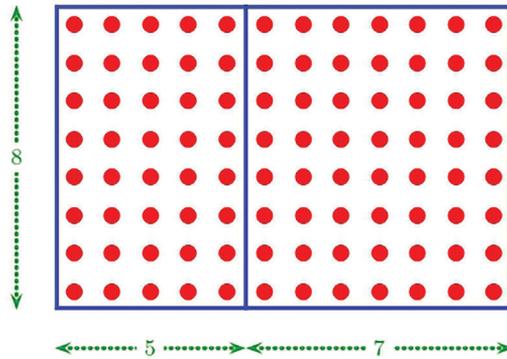&= \; (10 \times 8) + (2 \times 8) \\
&= \; 80 + 16 \\
&= \; 96
\end{aligned}
$$

We can also draw pictures to show this:

We can also do like this:

$$12 \times 8 \ = \ (5 + 7) \times 8$$
$$= \ (5 \times 8) + (7 \times 8)$$
$$= \ 40 + 56$$
$$= \ 96$$

What is the general principle used here?

> To multiply the sum of two numbers by a number, we need to multiply each number in the sum and add them together.

This can be shortened:

> The product of a sum is the sum of the products.

Lets us change the pen problem like this:

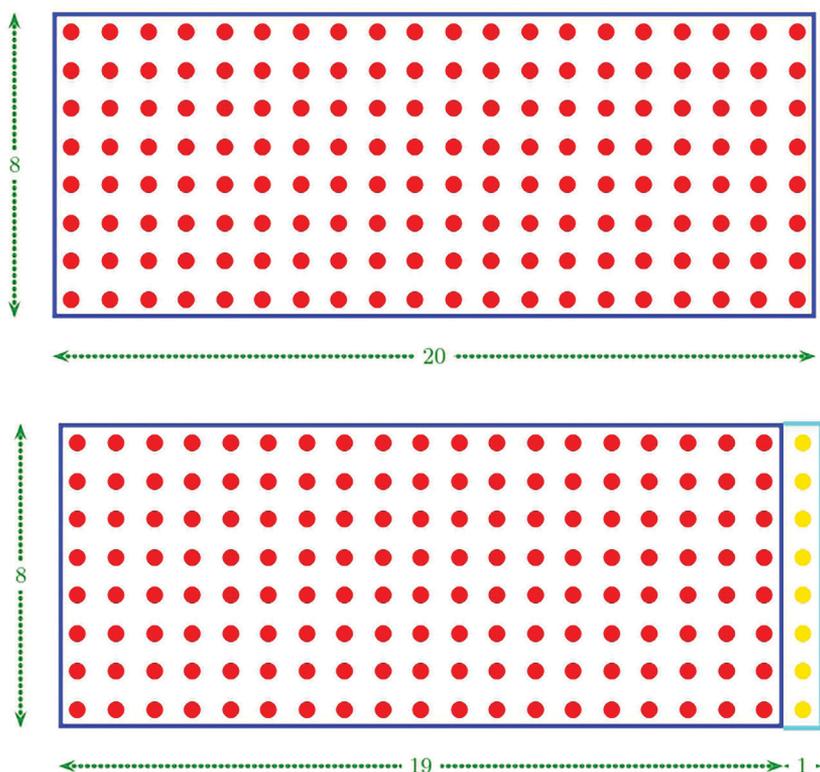How much money is needed to buy 19 pens at 8 rupees each?

We can compute like this as before:

80 rupees for 10 pens, $9 \times 8 = 72$ rupees for 9 more; altogether $80 + 72 = 152$ rupees.

There's another way:

160 rupees for 20 pens, 8 rupees for 1 pen; so $160 - 8 = 152$ rupees for 19 pens.

That is,

$$19 \times 8 = (20 - 1) \times 8$$
$$= (20 \times 8) - (1 \times 8)$$
$$= 160 - 8$$
$$= 152$$

So, as in the case of the product of a sum, we can write the product of a difference also as a general principle:

> The product of a difference is the difference of the products

Now, see whether you can do these problems in your head.

    (i) 15×6 (ii) 18×7 (iii) 24×9 (iv) 29×8 (v) 99×6

Addition, Subtraction and Division

How about turning our pen problem around?

    How many pens at 6 rupees each can be bought with 78 rupees?

We can think like this

- With 60 rupees, 10 pens can be bought.

- With the remaining 18 rupees, 3 more pens can be bought.

- Altogether we have 13 pens.

Mathematically speaking, what we computed here is the number which gives 78 on multiplication by 6

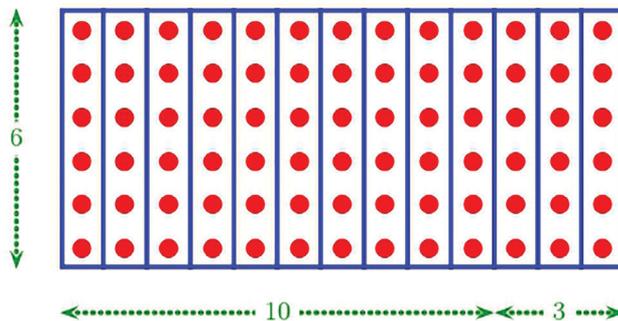In other words, we calculated how much we would get by dividing 78 by 6.

Let us write our method of computation also in terms of division:

- $60 \div 6 = 10$

- $18 \div 6 = 3$

- $78 \div 6 = 10 + 3 = 13$

We can also describe this using pictures. First we split 60 into 10 parts of 6 each:
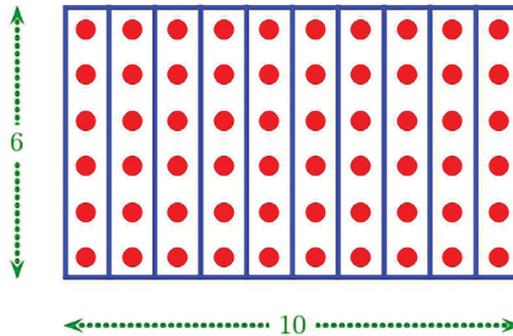
Then we split the remaining 18 into 3 parts of 6 each and add to the first picture.

Thus we can split 78 into 13 parts of 6 each

So, to divide the sum of two numbers, we can divide each and add.

Let's write this as a general principle:

> If two numbers can be divided without remainder by a number, then their sum can also be divided without remainder; and the quotient is the sum of the quotients.

We can also shorten this:

> In division without remainder, the quotient of a sum is the sum of the quotients.

Note that this doesn't work when there are remainders. For example,

- 7 divided by 3 gives quotient 2 and remainder 1.

- 17 divided by 3 gives quotient 5 and remainder 2.

- 7 + 17 = 24 divided by 3 gives quotient 8 and remainder 0.

Differences can also be divided like this. For example, let us change the pen problem like this.

How many pens at 6 rupees each can be bought with 108 rupees?

We can think like this:

- With 120 rupees, 20 pens can be bought.

- We have 120 − 108 = 12 rupees less.

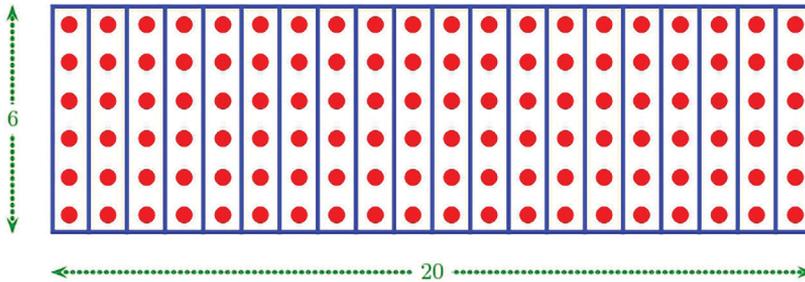- So, the number of pens is 2 less.

- Thus 20 − 2 = 18 pens can be bought.

Written in terms of division

- 108 = 120 − 12

- 120 ÷ 6 = 20

- 12 ÷ 6 = 2

- 108 ÷ 6 = 20 − 2 = 18
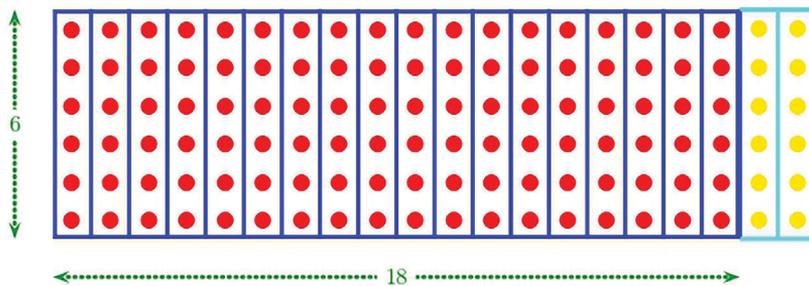

What did you get when three pens were divided among four?
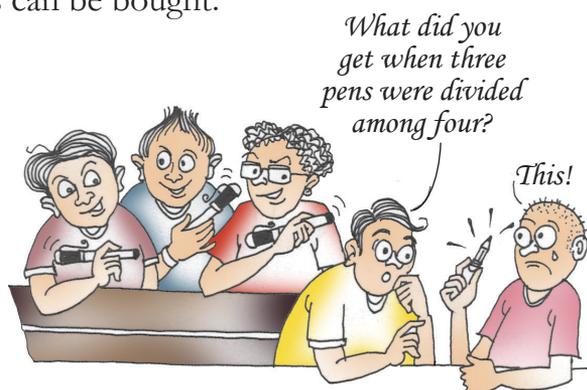
This!

We can also draw pictures to show this. First 120 can be split into 20 parts of 6 each:

If we remove two of these parts, the total is reduced by 12 to become $120 − 12 = 108$; and the number of parts is reduced to 18:

Now can't you do these problems mentally?

     (i) $39 ÷ 3$ (ii) $52 ÷ 4$ (iii) $125 ÷ 5$

     (iv) $396 ÷ 4$ (v) $135 ÷ 15$

Remainders

We have seen how we can write a number as certain times another number together with a remainder, in the lesson **Division Methods.**

For example, taking 17 and 5,

$$17 = (3 × 5) + 2$$

That is, 17 is 3 times 5 and 2 more.

When we split a two-digit number as tens and ones, we are actually writing it as certain times 10 and a remainder.

For example, 37 is 3 tens and 7 ones; that is 3 times 10 and remainder 7:

$$37 = (3 × 10) + 7$$

Thus the last digit 7 is the remainder on dividing 37 by 10.

Is this true for three-digit numbers also?

For example, 425 is 4 hundreds, 2 tens and 5 ones. We can also say, it is 42 tens and 5 ones.

That is 42 times 10 and remainder 5:

$$425 = (42 \times 10) + 5$$

Thus on dividing 425 by 10 also, we get the last digit 5 as the remainder.

In general,

> The remainder on dividing any number by 10 is the last digit of the number.

From this, we also see that numbers ending in 0 can be divided by 10 without remainder.

This can be stated in another way: numbers ending in 0 are *divisible* by 10.

Now since $10 = 2 \times 5$, it's easy to split a number into fives and ones. For example, taking the number 34,

$$\begin{aligned} 34 &= (3 \times 10) + 4 \\ &= (3 \times 2 \times 5) + 4 \\ &= (6 \times 5) + 4 \end{aligned}$$

So, 34 divided by 4 gives remainder 4.

Does dividing any number by 5 give the last digit as remainder?

How about 35?

If we split 35 as in the case of 34, we get

$$\begin{aligned} 35 &= (3 \times 10) + 5 \\ &= (3 \times 2 \times 5) + 5 \\ &= (6 \times 5) + 5 \end{aligned}$$

But we can't say the remainder is 5 from this, can we? This five added to the first six fives make seven fives, right?

$$35 = (6 \times 5) + 5$$
$$= 7 \times 5$$

So, the remainder is 0.

If we look at the next numbers 36, 37, 38, 39, the remainders are 1, 2, 3, 4. At 40, the quotient increases by 1 to become 8 and the remainder becomes 0 again.

So, what can we say in general about the remainder on dividing by 5?

> If the last digit of a number is less than 5, the remainder on dividing the number by 5 is the last digit itself. If the last digit is greater than or equal to 5, the remainder is 5 subtracted from the last digit.

From this, we can also see that numbers ending in 0 or 5 are divisible by 5 (that is, they can be divided without remainder by 5).

By writing $10 = 5 \times 2$, we can split any number into twos and ones:

$$37 = (3 \times 10) + 7$$
$$= (3 \times 5 \times 2) + 7$$
$$= (15 \times 2) + 7$$

Now to get the remainder on division by 2, we must split 7 also as 2 times a number and remainder:

$$7 = (3 \times 2) + 1$$

These 3 twos and the first 15 twos together make 18 twos:

$$37 = (15 \times 2) + (3 \times 2) + 1$$
$$= (18 \times 2) + 1$$

So, the remainder is 1.

What if we take 38 instead of 37?

$$38 = (3 \times 10) + 8$$
$$= (3 \times 5 \times 2) + 8$$
$$= (15 \times 2) + (4 \times 2)$$
$$= 19 \times 2$$

Remainder is 0; that is, 38 can be divided by 2 without remainder.

So, what can we say in general about the remainder on dividing a number by 2?

> If the last digit of a number is divisible by 2, then the number itself is divisible by 2; if the last digit is not divisible by 2, the remainder is 1 on division by 2.

Next note that any three-digit number is a sum of hundreds, tens and ones. For example, 429 is four hundreds, two tens and nine ones.

We can also say that it is four hundreds and twenty-nine ones; that is

$$429 = (4 \times 100) + 29$$

From this we can see that 29 is the remainder on dividing 429 by 100.

This is true for numbers with more digits also, isn't it?

$$7654 = (76 \times 100) + 54$$

$$82647 = (826 \times 100) + 47$$

So, what can we say in general?

> For any number with three or more digits, the remainder on dividing it by 100 is the number formed by the last two digits.

Now, since $100 = 25 \times 4$, we can write hundreds in terms of fours. For example,

$$329 = (100 \times 3) + 29$$
$$= (3 \times 25 \times 4) + 29$$
$$= (75 \times 4) + 29$$

To find the remainder on division by 4, we must split 29 also as fours and a remainder:

$$29 = (7 \times 4) + 1$$

Then we can write

$$329 = (75 \times 4) + 29$$
$$= (75 \times 4) + (7 \times 4) + 1$$
$$= (82 \times 4) + 1$$

The remainder on division by 4 is 1.

Try such calculations with other numbers. What can we say in general?

> For any number with two or more digits, the remainder on dividing it by 4 is the remainder on dividing the last two digits of the number by 4.

From this we can also see that for any number with two or more digits, if the number formed by the last two digits is divisible by 4, the number itself is divisible by 4.
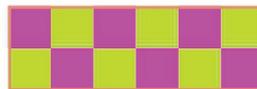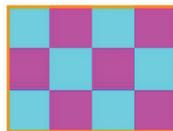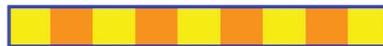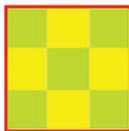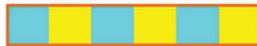
(1) Find which of the numbers below are divisible by 2, 4, 5 or 10. For the others, find the remainder on division by each of these:

(i) 3624   (ii) 3625   (iii) 3626   (iv) 3630

(2) In any five consecutive natural numbers, one of them will be divisible by 5. Explain why this is so.

(3) For any number with three or more digits, the remainder on division by 8 is the remainder on dividing the number by the last 3 digits of the number by 8. Explain why this is so.
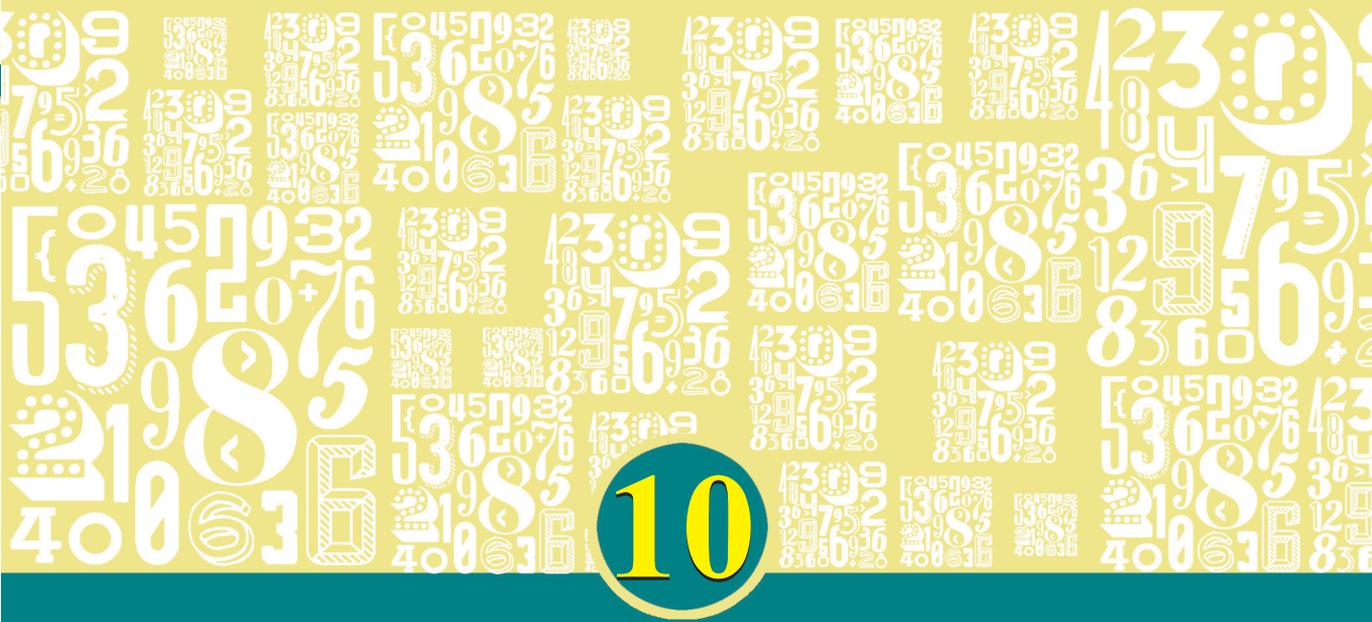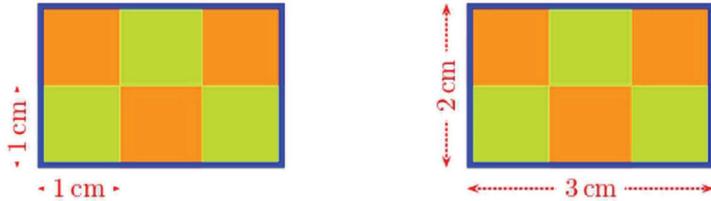
RECTANGLE MATH

Squares and Rectangles

Some children are making rectangles by joining small squares.

All small squares have sides of 1 centimetre. Can you write the width and height of all the rectangles in the picture?

For example, look at this rectangle:

The width of this rectangle is 3 centimetres and the height is 2 centimetres.

Find the widths and heights of all rectangles like this.

Rectangle	Width (cm)	Height (cm)
	3	2

Measuring Boundaries

The children have also pasted coloured threads along the edges of each rectangle they have made.

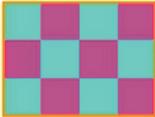What is the length of the thread required to paste around the first rectangle?

6 centimetres for each of the top and bottom edges, and 1 centimetre for each of the left and right edges is required.

Altogether 6 + 6 + 1 + 1 = 14 centimetres.

This length, taken around the rectangle, is called its perimeter.
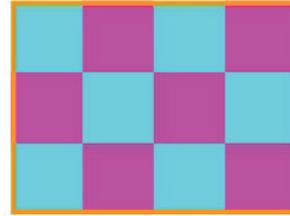
Thus, the perimeter of the rectangle given above is 14 centimetres.

Now we can write the perimeters of the rectangles also in our table:
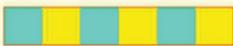
| Rectangle	Width (cm)	Height (cm)	Perimeter (cm)
	6	1	14
	3	2	
	3	3	
	9	1	
	4	3	
	6	2	
	12	1	

Measuring Insides

Now, look at the first and the fifth rectangles in our table.

The perimeter of both rectangles is 14 centimetres, isn't it?

But the rectangle on the left is made with 6 small squares and the rectangle on the right is made with 12 small squares.

This shows that if two 14 centimetre long strings are cut in two different ways to make the edges of rectangles, the measure of the space inside the rectangles will not be the same:
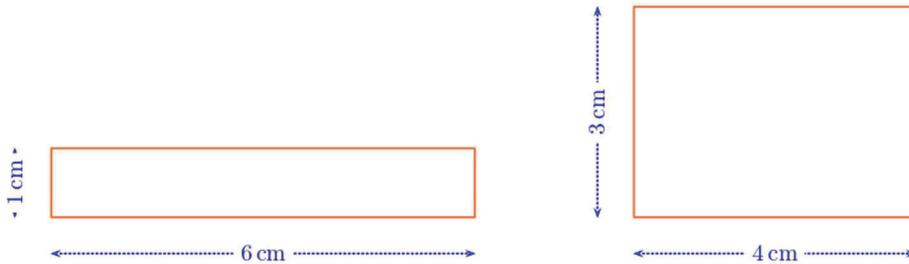
In other words, the rectangle on the right is more spread out. The measure of the spread is called **area.**

Just as we measure lengths using fixed lengths such as centimetre and metre, we measure areas using predetermined squares.

For example

> The area of a square of sides 1 centimetre is said to be 1 square centimetre.

Two such squares joined together is said to have area 2 square centimetres, three of them joined together is said to have area 3 square centimetres and so on.

Area 1 square centimetre

Area 2 square centimetres

Area 3 square centimetres

Area 4 square centimetres
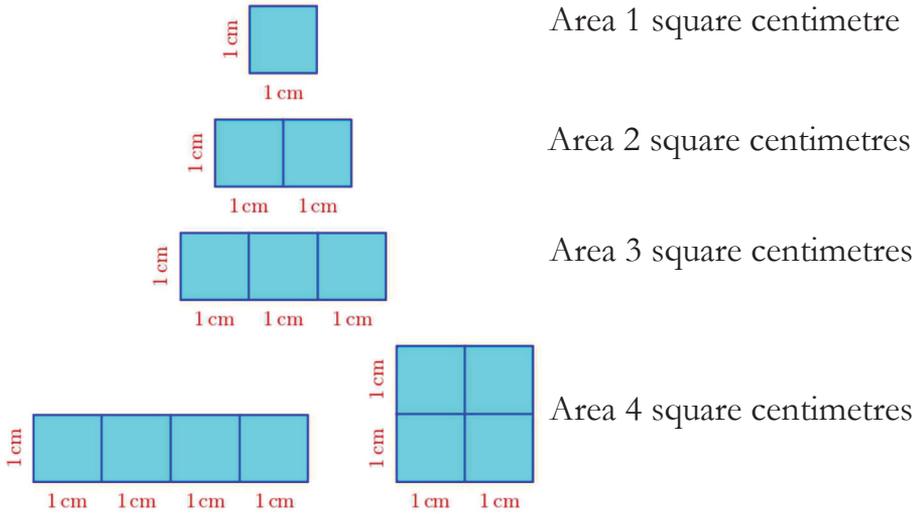
Now we can add areas also in our table:

| Rectangle	Width (cm)	Height (cm)	Perimeter (cm)	Area (sq.cm)
	6	1	14	6
	3	2		
	3	3		
	9	1		
	4	3		
	6	2		
	12	1		

The sides of large rectangles (playgrounds, rooms in a building etc.) are measured in metres, right? The areas of such rectangles are measured in terms of a square of side 1 metre.

> The area of a square of sides 1metre is said to be 1 square metre.

As in the case of small rectangles, two such squares joined together is said to have area 2 square metres, three of them joined together is said to have area 3 square metres and so on.

Calculations

Take a look at this rectangle:

3 cm

5 cm
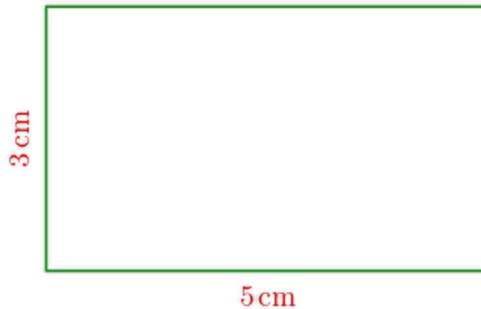
What is its perimeter?

Adding the lengths of sides one by one, we get:

$$5 + 3 + 5 + 3 = 16$$

Thus the perimeter can be calculated as 16 centimetres.

Or we can take sides of the same lengths together, and calculate the perimeter as twice 5 and twice 3.

$$(5 \times 2) + (3 \times 2) = 10 + 6 = 16$$

Is there any other way?

No need of big squares to measure the playground? How so?

This little has everything squared away

SQUARE ROUTE

Twice 5 and twice 3 is twice 8, isn't it?

$$
\begin{aligned}
(5 \times 2) + (3 \times 2) &= (5 + 3) \times 2 \\
&= 8 \times 2 \\
&= 16
\end{aligned}
$$
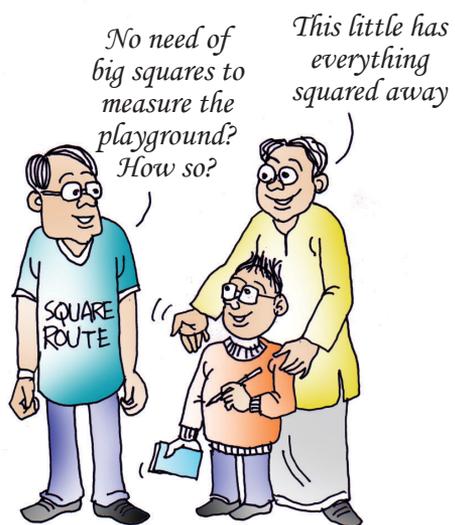
Can you calculate, the perimeter of a rectangle of sides 10 centimetres and 5 centimetres in a similar way?

In general,

The perimeter of a rectangle is twice the sum of its sides.

Using this, can't you mentally calculate the perimeters of the rectangles with lengths of sides as below?

(i)   6 centimetres, 3 centimetres

(ii) 13 centimetres, 7 centimetres

(iii) 6 centimetres, 6 centimetres

(iv) 25 metres, 15 metres
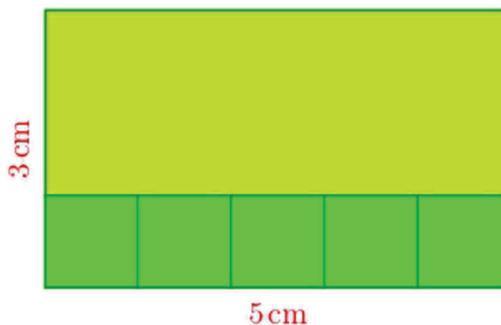
(v) 34 metres, 16 metres

Now how do we compute the area of the rectangle seen earlier?
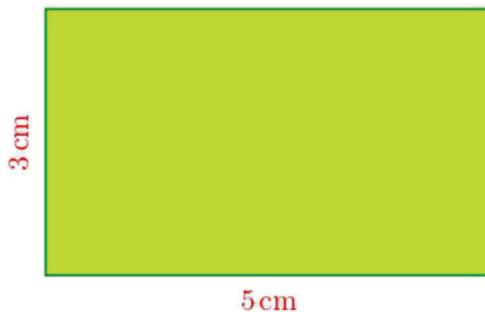
For that, we'll have to calculate the number of small squares of side 1 centimetre that can fit inside it.
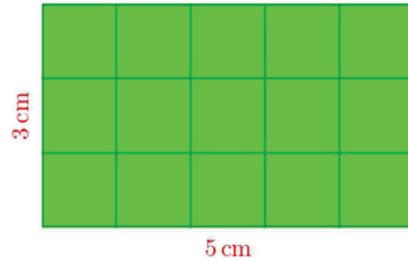
First let's put one row of such squares along the bottom side.

How many?

How many such rows can we stack inside the rectangle?
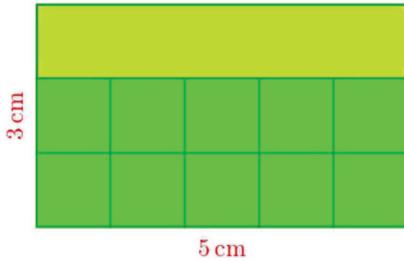
So, what's the area of the rectangle?

3 rows of 5 squares each.

$3 \times 5 = 15$ squares in all.

The area is 15 square centimetres.

Can you now calculate the area of the rectangle given below?
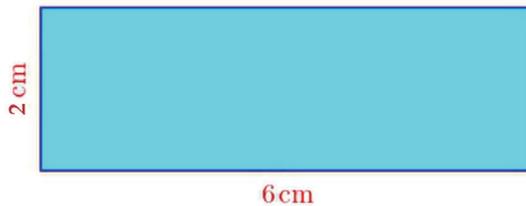
How many squares of side 1 centimeter can we arrange along the bottom side?

How many such rows can be stacked inside the rectangle?

How many squares in all?

Now, how do we state the general method to calculate the area of a rectangle?

> The area of a rectangle is the product of the lengths of its sides.

Note that if the lengths of the sides are in centimetres, the area is in square centimetres, and if the lengths of the sides are in metres, then the area is in square metres.

Now try these problems:

(1) Calculate the areas of the rectangles with lengths of sides as below:

(i) 6 centimetres, 3 centimetres   (ii) 12 centimetres, 5 centimetres

(iii) 10 centimetres, 10 centimetres (iv) 8 metres, 5 metres

(v) 11 metres, 7 metres

(2) Draw rectangles of area and perimeter as below:

(i) 12 square centimetres, 14 centimetres

(ii) 12 square centimetres, 16 centimetres

(iii) 12 square centimetres, 26 centimetres

(iv) 5 square centimetres, 12 centimetres

(v) 8 square centimetres, 12 centimetres

(vi) 9 square centimetres, 12 centimetres

Some Other Shapes

Take a look at this figure made with *eerkkil* bits:
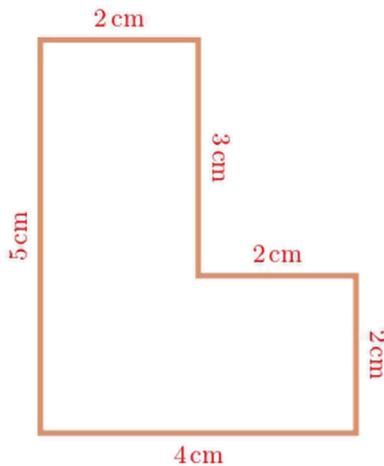
How many pieces of *eerkkil* are needed to make this?

And the length of each is also given, isn't it?

Adding up all these,

$$4 + 5 + 2 + 3 + 2 + 2 = 18$$

Thus to make this, we can first cut out a piece of *eerkkil* 18 centimetres long and then cut it into six pieces with the lengths as above.

There's another way to make this figure. First make a rectangle like this:
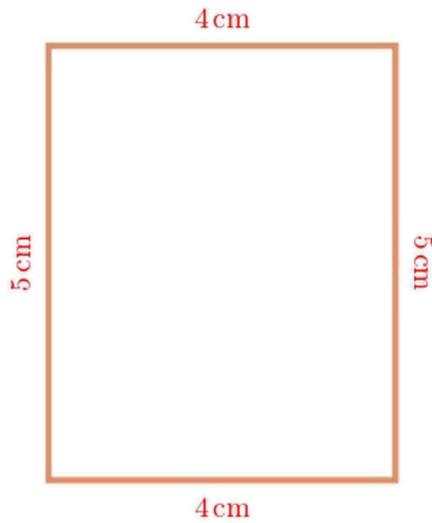
Mark lengths on the top and the right as shown below and cut out the pieces:
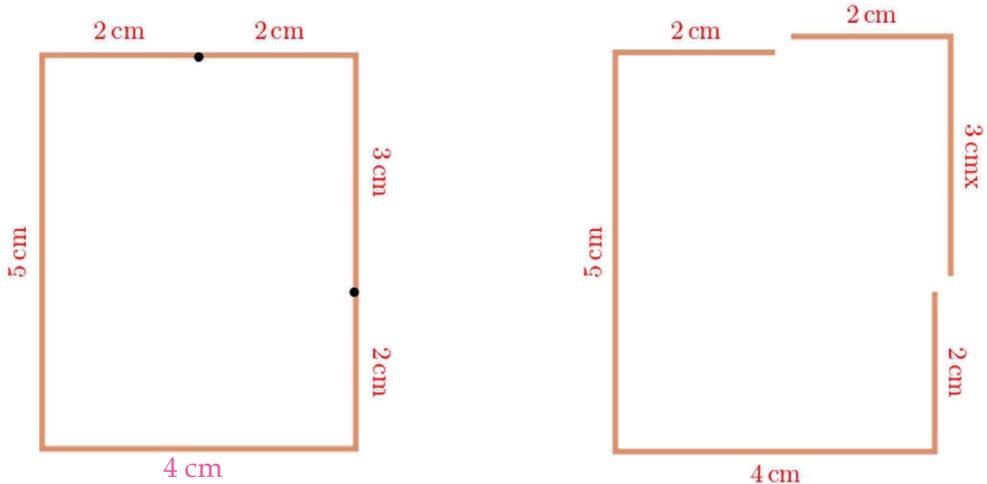
Now if we replace the removed bits as below, we get the earlier figure right?
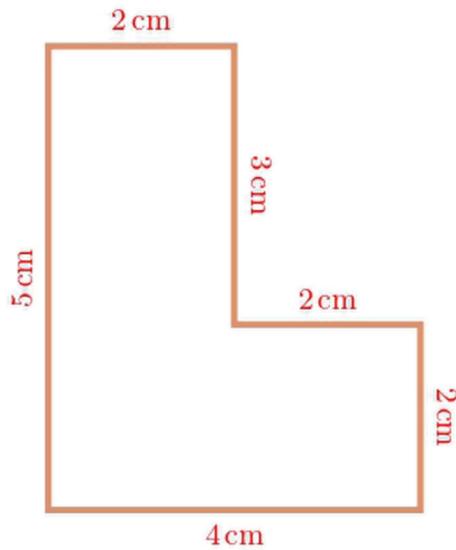
All the *eerkkil* used to make the rectangle are used in this figure also.

In the language of mathematics, the rectangle and this figure have the same perimeter.

Now let's cut out this figure from a sheet of paper:
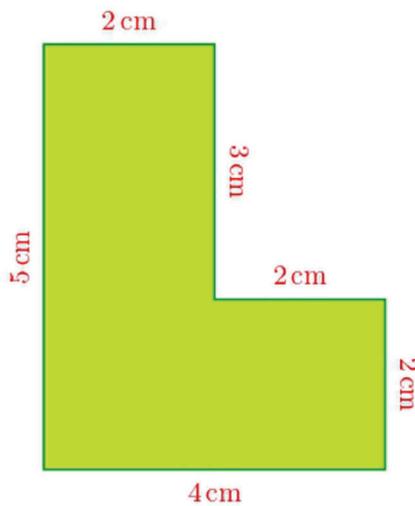
What is its area?

We can consider it as two rectangles joined together:
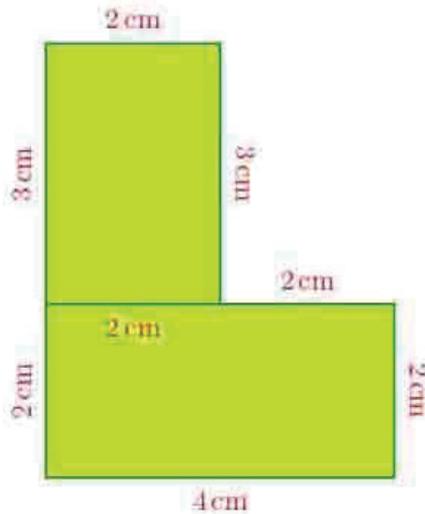
So to compute the area, we add the areas of these two rectangles:

$$(4 \times 2) + (2 \times 3) = 8 + 6 = 14$$

The area of this figure is 14 square centimetres.

This can be done in another way. We can make this figure by first cutting out a big rectangle and then cutting off a smaller rectangle from it:
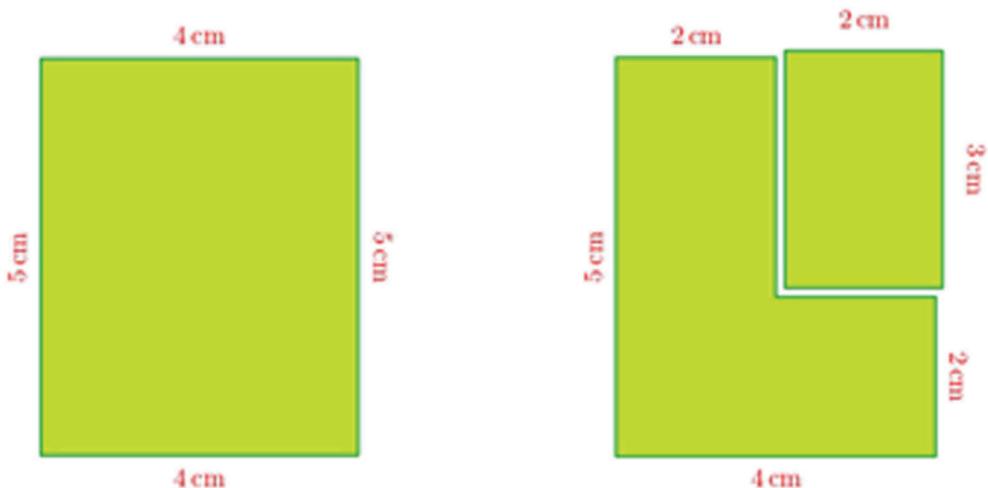
So, we get the area of the figure by subtracting the area of the smaller rectangle from the area of the larger rectangle:

$$(4 \times 5) - (2 \times 3) = 20 - 6 = 14$$

Did you notice something here? When we removed the small rectangle from the larger one, the area was reduced, but there was no change in the perimeter.

Can we cut off a small rectangle from a larger one in such a way that the area is decreased, but the perimeter is increased? Try!

Now compute the perimeter and area of each of the shapes below:

5 cm

1 cm

5 cm

1 cm

5 cm

3 cm

1 cm

5 cm

4 cm

5 cm

2 cm

2 cm

2 cm

2 cm

2 cm

2 cm

2 cm

2 cm
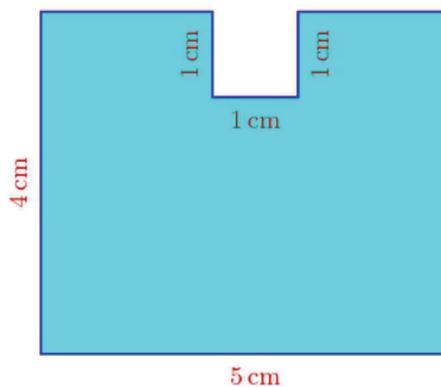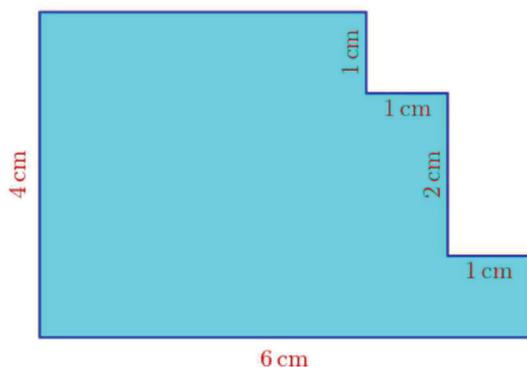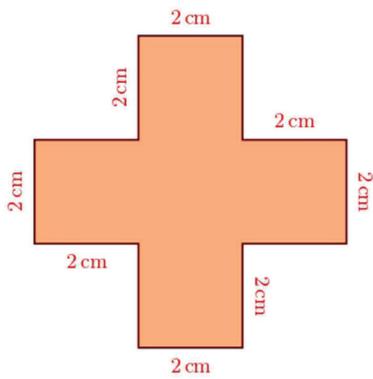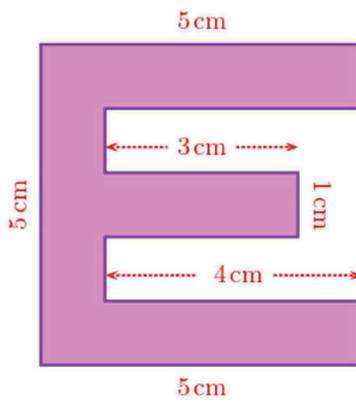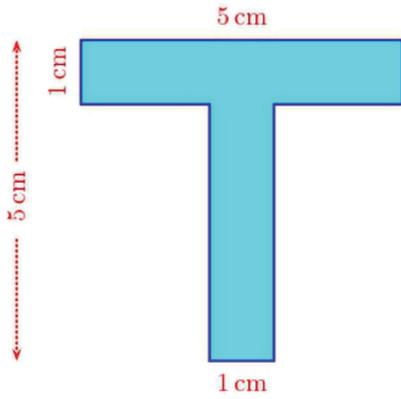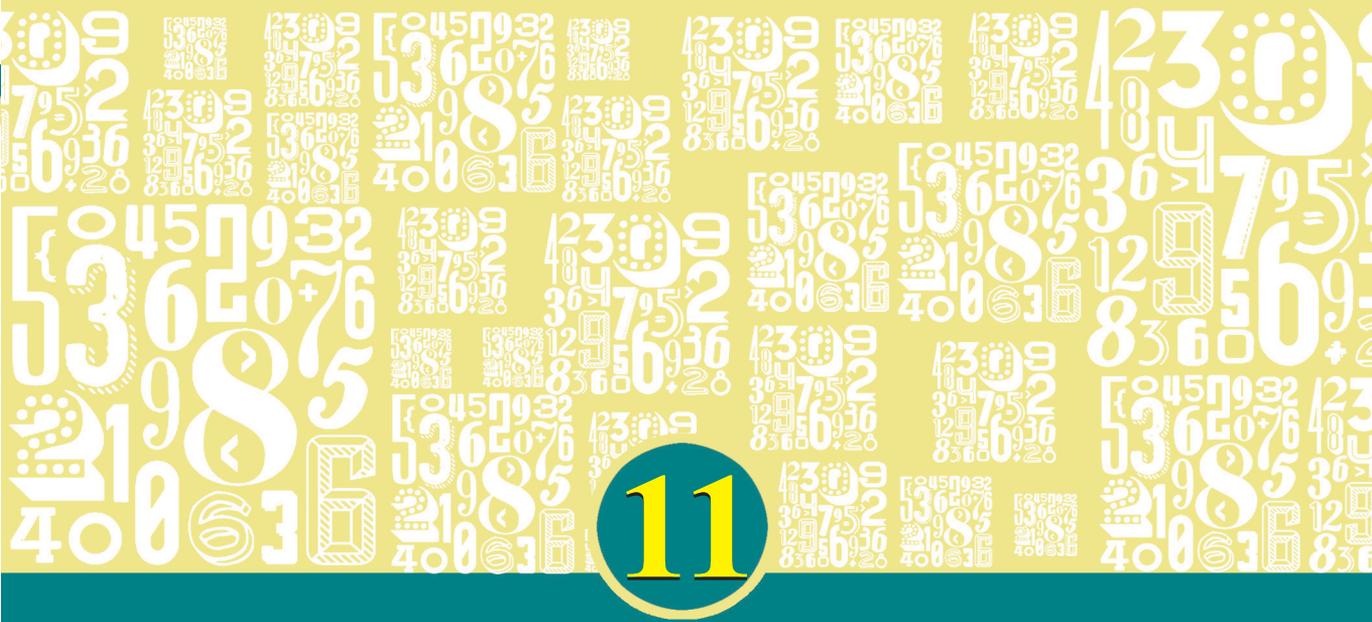
WITHIN NUMBERS

Multiplication and Multiples

See this table:

1	2	3	4	5	6	7	8	9	$\cdots$	$\cdots$
2	4	6	8	10	12	14	16	18	$\cdots$	$\cdots$
3	6	9	12	15	18	21	24	27	$\cdots$	$\cdots$
4	8	12	16	20	24	28	32	36	$\cdots$	$\cdots$
5	10	15	20	25	30	35	40	35	$\cdots$	$\cdots$
6	12	18	24	30	36	42	48	54	$\cdots$	$\cdots$
7	14	21	28	35	42	49	56	63	$\cdots$	$\cdots$
8	16	24	32	40	48	56	64	72	$\cdots$	$\cdots$
9	18	27	36	45	54	63	72	81	$\cdots$	$\cdots$
$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$
$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$

How are the rows and columns written?

The first row and column has just the natural numbers.

What about the second row and column?

1	2	3	4	5	6	7	8	9	$\cdots$	$\cdots$
2	4	6	8	10	12	14	16	18	$\cdots$	$\cdots$
3	6	9	12	15	18	21	24	27	$\cdots$	$\cdots$
4	8	12	16	20	24	28	32	36	$\cdots$	$\cdots$
5	10	15	20	25	30	35	40	35	$\cdots$	$\cdots$
6	12	18	24	30	36	42	48	54	$\cdots$	$\cdots$
7	14	21	28	35	42	49	56	63	$\cdots$	$\cdots$
8	16	24	32	40	48	56	64	72	$\cdots$	$\cdots$
9	18	27	36	45	54	63	72	81	$\cdots$	$\cdots$
$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$
$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$

Twice the natural numbers.

In the language of mathematics, we get the numbers by multiplying the numbers 1, 2, 3, . . . by 2.

We can shorten this as *multiples* of 2.

So, what about the third row and column?

In general,

> By the multiples of a natural number, we mean the numbers got by multiplying 1, 2, 3, . . . by that number.

Thus we can say that in our table, numbers in the 2nd row are multiples of 2.

numbers in the 3rd row are multiples of 3.

. . . .

What about the 1st row?

Any natural number is a multiple of 1, isn't it?

Is 48 a multiple of 6?

The 8th number in the 6th row is 48; which gives

$$8 \times 6 = 48$$

How about a bigger number?

For example, is 102 a multiple of 6?

We can find this by extending the table. Is there any other way?

The question is whether 6 multiplied by any number gives 102.

To see this, we need only divide 102 by 6, right?

	6	
	102−	
10	60	$10 \times 6 = 60$
	42−	
5	30	$5 \times 6 = 30$
	12−	
8	12	$2 \times 6 = 12$
$102 \div 6 = 17$	0	$17 \times 6 = 102$

This shows

$$102 = 17 \times 6$$

So, 102 is indeed a multiple of 6.

We observe another fact from this computation. Since $102 = 6 \times 17$, the number 102 is also a multiple of 17.

How about 268?

	6	
	268−	
20	120	$20 \times 6 = 120$
	148−	
20	120	$20 \times 6 = 120$
	28−	
4	24	$4 \times 6 = 24$
Times 44	4	$(44 \times 6) + 4 = 268$

Remainder

This shows that

$$268 = (44 \times 6) + 4$$

That is, 268 is larger than 44×6 and smaller than 45×6 (how?).

So, 268 is not a multiple of 6.

Thus what's the general method of checking whether a number is a multiple of another number?

> If a number is divisible by another number, the first number is a multiple of the second number; if there is a remainder on division, it is not a multiple.

Recall from the lesson **Number Relations** that divisible by a number means division by that number leaves no remainder.

> Now in each pair of numbers given below, check whether the first is a multiple of the second:

(i) 7, 91   (ii) 9, 127   (iii) 12, 136   (iv) 15, 225

Division and Factors

We've seen that we can check whether one number is a multiple of another by division.

For example, since

$$72 \div 4 = 18$$

72 is a multiple of 4.

The fact that 72 is divisible by 4 can be put in another form:

4 is a *factor* of 72

In general

> By the factors of a number, we mean those numbers by which this number is divisible.

In the lesson **Division Methods**, we've seen how the same relation between numbers can be stated either using multiplication or using division. For example

Numbers	Multiplication	Division
6, 54	$54 = 6 \times 9$	$54 \div 6 = 9$ $54 \div 9 = 6$

Now this can be stated also in terms of multiples or factors.

Numbers	Multiplication		Division	
6, 54	$54 = 6 \times 9$	54 is a multiple of 6 54 is a multiple of 9	$54 \div 6 = 9$ $54 \div 9 = 6$	6 is a factor of 54 9 is a factor of 54

Now write the relation between each pair of numbers below like this, as multiplication-multiple and division-factor.

(i) 9, 72　　(ii) 12, 156　(iii) 13, 169　(iv) 25, 375

Factors in Multiplication and Division

Splitting a number into products of factors will make some computations easier.

For example, let's calculate 12×15

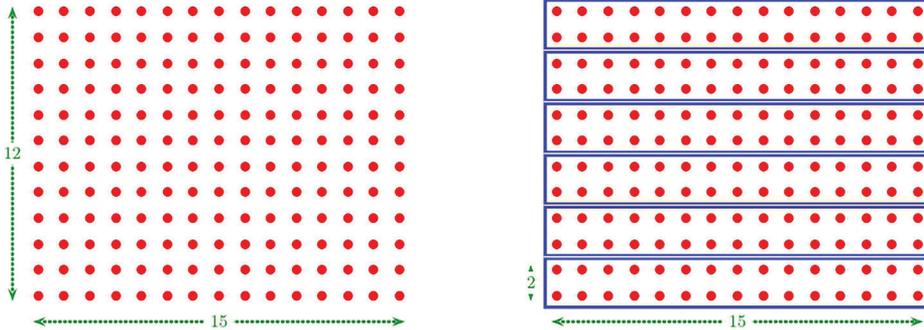Writing $12 = 2 \times 6$ as a product of factors,

$$12 \times 15 = 6 \times 2 \times 15$$

In this, we can mentally calculate $2 \times 15 = 30$; also using the fact that $6 \times 3 = 18$, we can do the entire multiplication in head as follows:

$$12 \times 15 = 6 \times (2 \times 15) = 6 \times 30 = 180$$

This computation can also be described using pictures:

Next consider 16×18. If we split 16 as $2 \times 2 \times 2 \times 2$, then

$$18 \times 16 = 18 \times 2 \times 2 \times 2 \times 2$$

Noting that each multiplication by 2 doubles the number, the multiplications above can be done quickly as

$$36, 72, 144, 288$$

That is,

$$18 \times 16 = 288$$

See if you can mentally calculate the products below:

(i) 12×25 (ii) 35×18 (iii) 125×8 (iv) 125×24

Now let's take a look at an example of how division can be simplified using factors.

> 75 biscuits are to be distributed among 15 kids. If the shares are to be equal, how many should be given to each?

To find this, we have to divide 75 by 15, right?

Instead of directly dividing, let's think like this: Since $15 = 3 \times 5$, we first split the kids into 3 groups of 5 each.

Seems your computations are wrong. Need more biscuits to distribute

Now we need only give 75 ÷ 3 = 25 biscuits to each group.

And when these are equally shared within each group, each kid will get 25 ÷ 5 = 5 biscuits.

What did we do here?

Instead of dividing 75 by 15, we first divided it by 3, and then divided the quotient by 5.

Let's look at another problem.

60 sweets are to be split equally into 12 packets. How many should be put in each packet?

Here we have to split 60 into 12 equal parts; that is divide 60 by 12.

We can write 12 = 3 × 4, as a product of factors. First let's split 60 sweets into 3 equal parts.
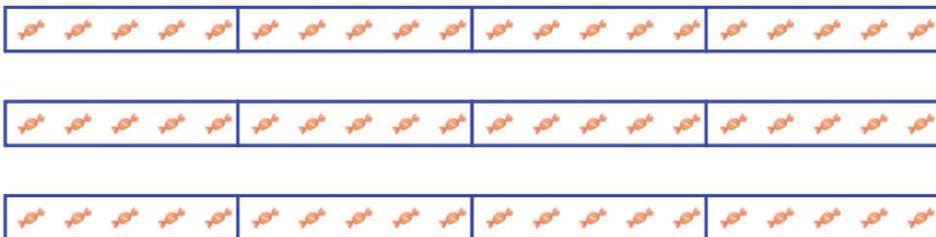
We can mentally calculate that each part will have 20 sweets (just by recalling 6 = 3 × 2)

$$60 \div 3 = 20$$

Next if we split each of these 3 parts into 4 equal parts, we will have 3 × 4 = 12 equal parts, isn't it?

And we can see that each of these parts has 20 ÷ 4 = 5 sweets. Thus each packet must have 5 sweets.

$$60 \div 12 = 5$$

So to divide by 12, we can first divide it by 3, and then divide the quotient by 4 (or the other way round).

As another example, let's do 288 ÷ 16

Writing 16 = 2 × 2 × 2 × 2, we can see that we need only divide by 2 four times. If we also recall that dividing by 2 is just halving, we can compute the quotients easily as

$$144, 72, 36, 18$$

That is;

$$288 ÷ 16 = 18$$

Now try these problems:

    (i) 90 ÷ 15   (ii) 900 ÷ 18 (iii) 160 ÷ 32

    (iv) 168 ÷ 24 (v) 210 ÷ 42

Common Factors

How did you do the last problem of the previous section?

We can think like this:

210 ÷ 42	
42 = 2 × 21	210 ÷ 2 = 105
105 ÷ 21	
21 = 3 × 7	105 ÷ 3 = 35
35 ÷ 7	
35 = 7 × 5	35 ÷ 7 = 5
210 ÷ 42 = 5	

What did we do here?

(1) To divide 210 by 42,

    (i) First divide 210 by the factor 2 of 42.

    (ii) Since 2 is a factor of 210 also, we got the quotient 105 with no remainder.

(2) Now remove the 2 which is a factor of both 210 and 42, and divide 105 by 21.

    (i) For this, first divide 105 by the factor 3 of 21.

    (ii) Since 3 is a factor of 105 also, we got the quotient 35 with no remainder.

(3) Now remove the 3 which is a factor of both 105 and 21, and divide 35 by 7.

(4) This gives quotient 5.

All this can be condensed into just one sentence:

Remove one by one, the numbers 2, 3, 7 which are the factors of both 210 and 42.

Let's now write the earlier problem in another way:

$168 \div 24$	
$24 = 2 \times 12$	$168 \div 2 = 84$
$84 \div 12$	
$12 = 3 \times 4$	$84 \div 3 = 28$
$28 \div 4$	
$28 = 4 \times 7$	$28 \div 4 = 7$
$168 \div 24 = 7$	

What did we do in this problem also?

We removed one by one, the numbers 2, 3, 4 which are the factors of both 168 and 24.

> Numbers which are the factors of both the numbers are called *common factors* of these two numbers.

So, the technique used in these examples can be stated like this:

In dividing one number by another, common factors of both can be removed.

For example, to divide 90 by 18, we note that

$$90 = 9 \times 5 \times 2 \qquad\qquad 18 = 9 \times 2$$

and then remove the common factors 9 and 2 to get the quotient as 5.

Now find the quotients below by removing common factors:

(i) $600 \div 150$ (ii) $900 \div 180$ (iii) $225 \div 75$

(iv) $420 \div 105$

TABLES AND GRAPHS

Tables

The table below shows the number of students in Class 5, grouped according to their grades in the math exam:

Grade	Number of students
A	9
B	10
C	9
D	6
E	1
Total	**35**

This is a shortened form of a larger table giving the grade of each of the 35 students separately. We won't get all the information in the larger table from this shorter one. But still, we can get some general information about the performance of the class from this.

For example:

- B is the grade that most students got.

- E is the grade that the least number of students got.

- The number of students who got A or B is more than the number of students who got C, D or E.

- The number of students who got A, B or C is four times the number of students who got D or E.

What other information can you get from this table?

The grades of Class 6 and Class 7 students are given in the tables below:

Class 6	
Grade	**Number of students**
A	10
B	12
C	8
D	2
E	2
Total	34

Class 7	
Grade	**Number of students**
A	12
B	9
C	7
D	4
E	1
Total	33

We can combine all three tables into one:

Class Grade	5	6	7
A	9	10	12
B	10		
C			
D			
E			

What information can we get from the completed table?

🧠 Now try these problems.

(1) The population of the various districts of our state, according to the 2011 census, is given in the table below:

District	Population
Kasaragod	1307375
Kannur	2523003
Wayanad	817420
Kozhikode	3086293
Malappuram	4112920
Palakkad	2809934
Thrissur	3121200

District	Population
Ernakulam	3282388
Idukki	1108974
Kottayam	1974551
Alappuzha	2127789
Pathanamthitta	1197412
Kollam	2635375
Thiruvananthapuram	3301427

Rewrite the table with populations in the ascending order.

(2) The runs scored by a team in the first ten overs of a one-day match is given below:

Over \ Ball	1	2	3	4	5	6
1	2	0	0	2	0	0
2	1	4	0	2	0	0
3	0	0	4	0	1	1
4	4	0	2	0	1	0
5	0	0	4	1	0	3
6	2	0	2	2	0	0
7	1	0	4	0	2	1
8	2	0	2	0	3	0
9	0	0	6	2	2	0
10	6	0	0	4	0	2

Calculate the totals runs secured in each over and shorten the table like this:

| Over	1	2	3	4	5	6	7	8	9	10
Runs										

(i)   How many runs were scored in the first ten overs?

(ii) In how many overs were more than 6 runs scored?

(iii) In how many overs were less than 6 runs scored?

(iv) What other information can we get from this shortened table?

Data Pictures

England batted first in a T20 match against India. The runs they scored in each over is given in this table:

Over	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Runs	11	9	8	16	6	3	6	7	6	5	18	5	6	3	3	5	20	11	3	8

We can show this as a picture:
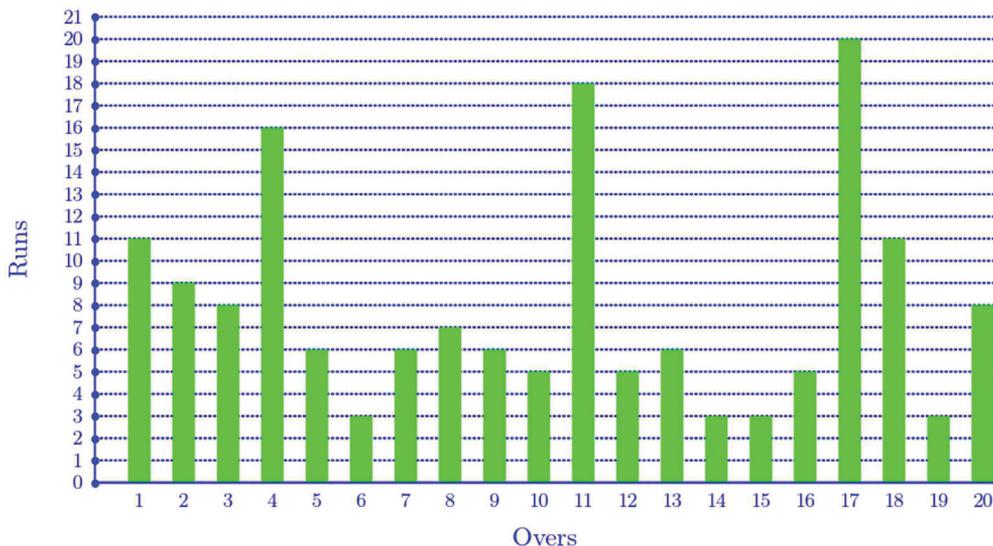

How is this drawn?

Along a horizontal line at the bottom, numbers from 1 to 20 are marked at the same distance apart. This is to show the number of overs.

Along a vertical line on the left, numbers from 1 to 21 are marked at the same distance apart. This is to show the number of runs scored.

Then at the position showing each over, rectangles are drawn with heights up to the number on the vertical line showing the number of runs scored in that over. All these rectangles are of the same width.

All the information we get from the table can be found in the picture also. Moreover, we can see the ups and downs of scores at one glance. Such a picture is called a *bar graph*.

Now let's see the specific graph of the performance of India batting second:
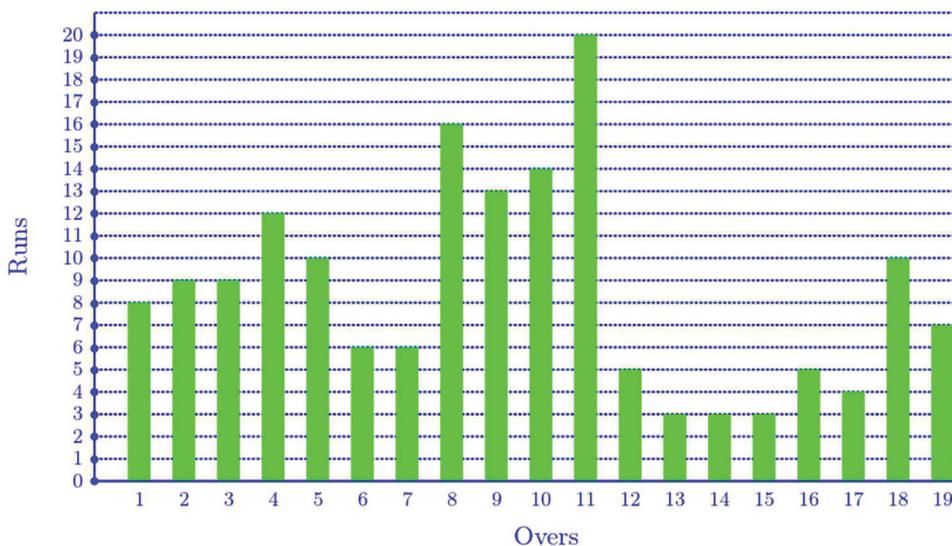
It doesn't show the 20th over, since India won in the 19th over.

We can get a lot of information from this graph itself.

- In which over was the most runs scored?

    * How many runs were scored?

- In which over was the least runs scored?

    * How many runs were scored?

- In how many overs were more than 10 runs scored?

    * Which are those overs?

- In how many overs were less than 6 runs scored?

    * Which are those overs?

Now make a table showing the runs India scored in each over.

We can also compare the batting performance of the teams by drawing the graphs in different colours and combining them.
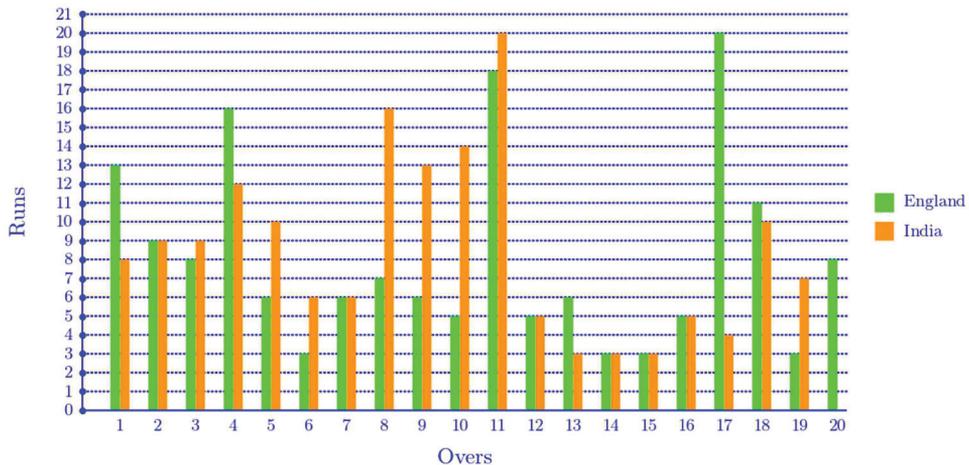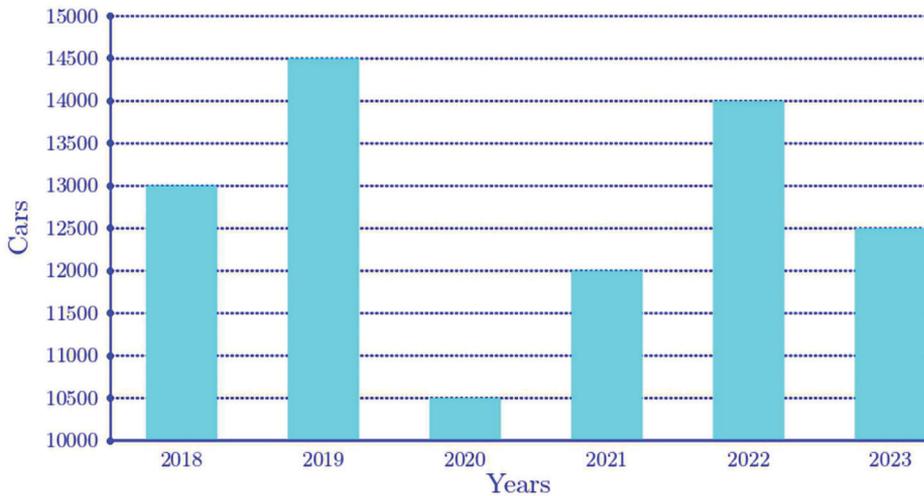

Can you answer these questions using the above graph?

- In which overs did India score more runs than England?

- In which overs did both teams score the same number of runs?

- Which team scored more at the end of the first ten overs?

Now try these problems

1. The graph below shows the number of cars a company manufactured in the past few years:


(i) In which year was the most number of cars made? How many cars were manufactured?

(ii) And in which year was the least number of cars manufactured? How many cars were manufactured?

(iii) How many cars less than those made in 2018 were made in 2023?

2. The graph below shows the units of electricity consumed during various months of a year:
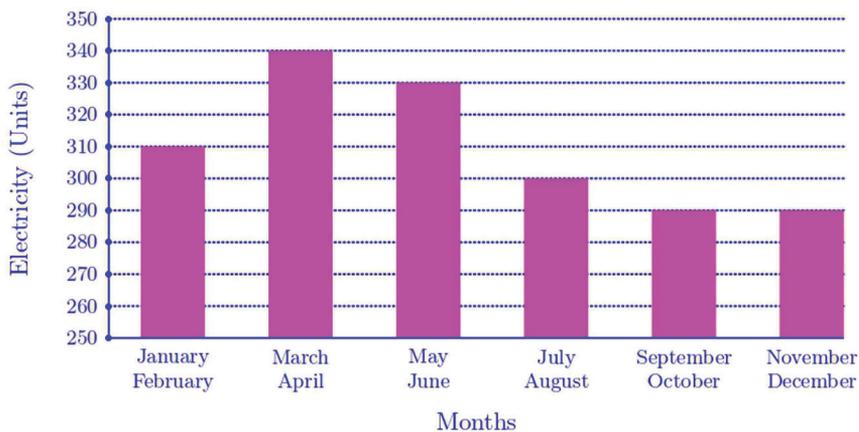
(i)   In which months was the maximum electricity used?

(ii) In which months was it the minimum?

(iii) What is the difference between the maximum and minimum?

(iv) Are there any months in which the same units of electricity was used?

(v) What is the total number of units used in this whole year?

3. The graph below shows the number of girls and boys in classes 1 to 7 in a school:
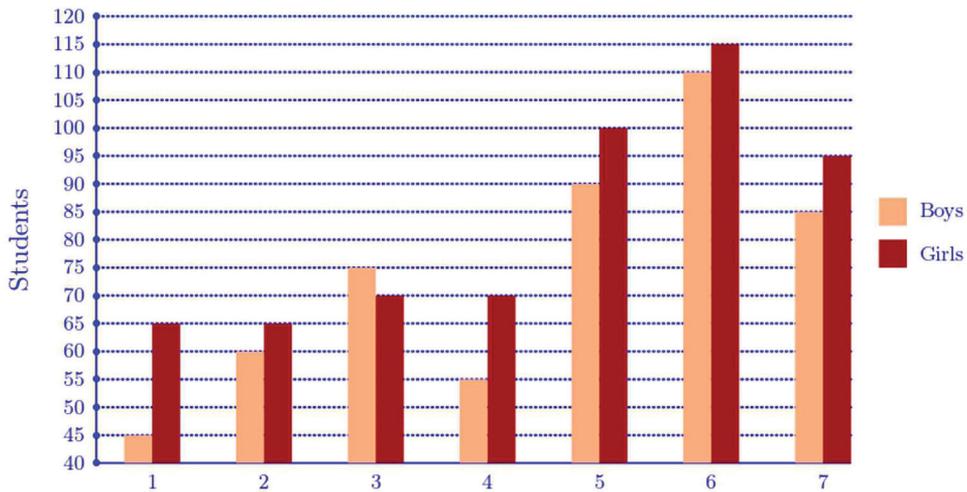
(i)   Which class has more boys than girls? What is the difference?

(ii) In which class is the difference between the number of girls and boys the most? In which class is this the least?

(iii) How many girls are there in all these classes together?

(iv) What is the total number of students?

CONSTITUTION OF INDIA
Part IV A

FUNDAMENTAL DUTIES OF CITIZENS

ARTICLE 51 A

Fundamental Duties- It shall be the duty of every citizen of India:

(a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;

(b) to cherish and follow the noble ideals which inspired our national struggle for freedom;

(c) to uphold and protect the sovereignty, unity and integrity of India;

(d) to defend the country and render national service when called upon to do so;

(e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;

(f) to value and preserve the rich heritage of our composite culture;

(g) to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures;

(h) to develop the scientific temper, humanism and the spirit of inquiry and reform;

(i) to safeguard public property and to abjure violence;

(j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievements;

(k) who is a parent or guardian to provide opportunities for education to his child or, as the case may be, ward between age of six and fourteen years.

CHILDREN'S RIGHTS

Dear Children,

Wouldn't you like to know about your rights? Awareness about your rights will inspire and motivate you to ensure your protection and participation, thereby making social justice a reality. You may know that a commission for child rights is functioning in our state called the **Kerala State Commission for Protection of Child Rights.**

Let's see what your rights are:

- Right to freedom of speech and expression.
- Right to life and liberty.
- Right to maximum survival and development.
- Right to be respected and accepted regardless of caste, creed and colour.
- Right to protection and care against physical, mental and sexual abuse.
- Right to participation.
- Protection from child labour and hazardous work.
- Protection against child marriage.
- Right to know one's culture and live accordingly.

- Protection against neglect.
- Right to free and compulsory education.
- Right to learn, rest and leisure.
- Right to parental and societal care, and protection.

Major Responsibilities

- Protect school and public facilities.
- Observe punctuality in learning and activities of the school.
- Accept and respect school authorities, teachers, parents and fellow students.
- Readiness to accept and respect others regardless of caste, creed or colour.