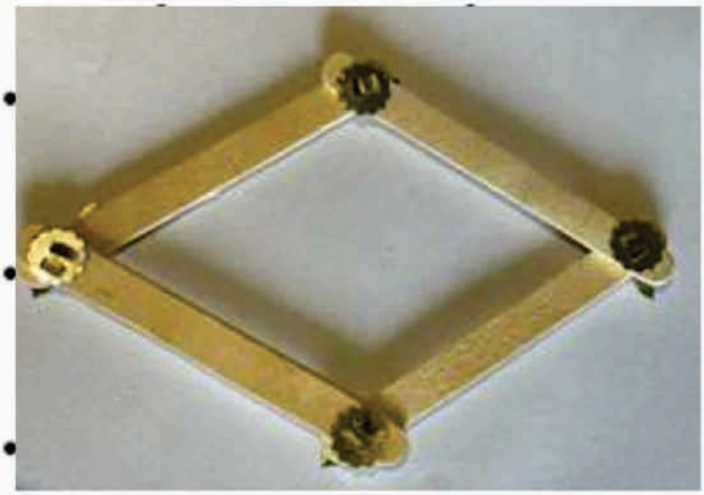
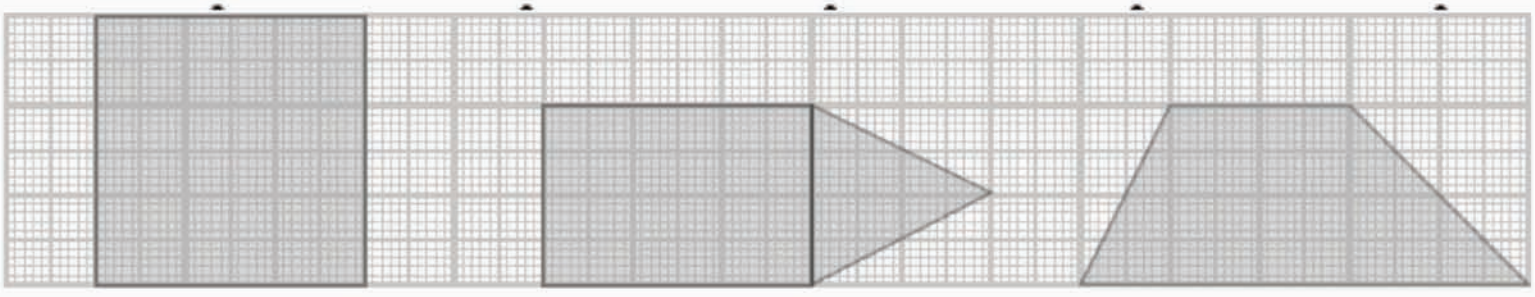
MATH DELIGHT 8





Universal Active Math
Math Delight - 8

Conceived and Written by
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NAVNIRMITI LEARNING FOUNDATION

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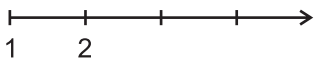
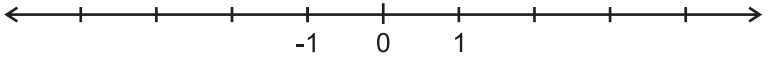
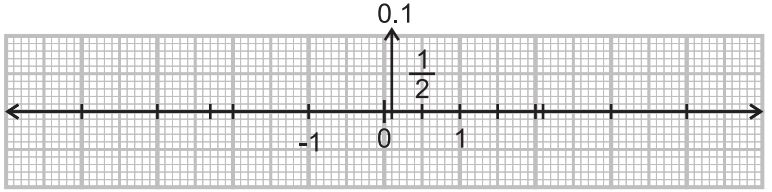
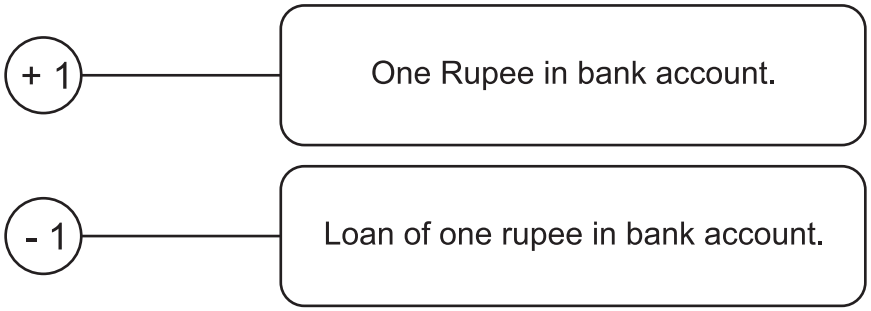
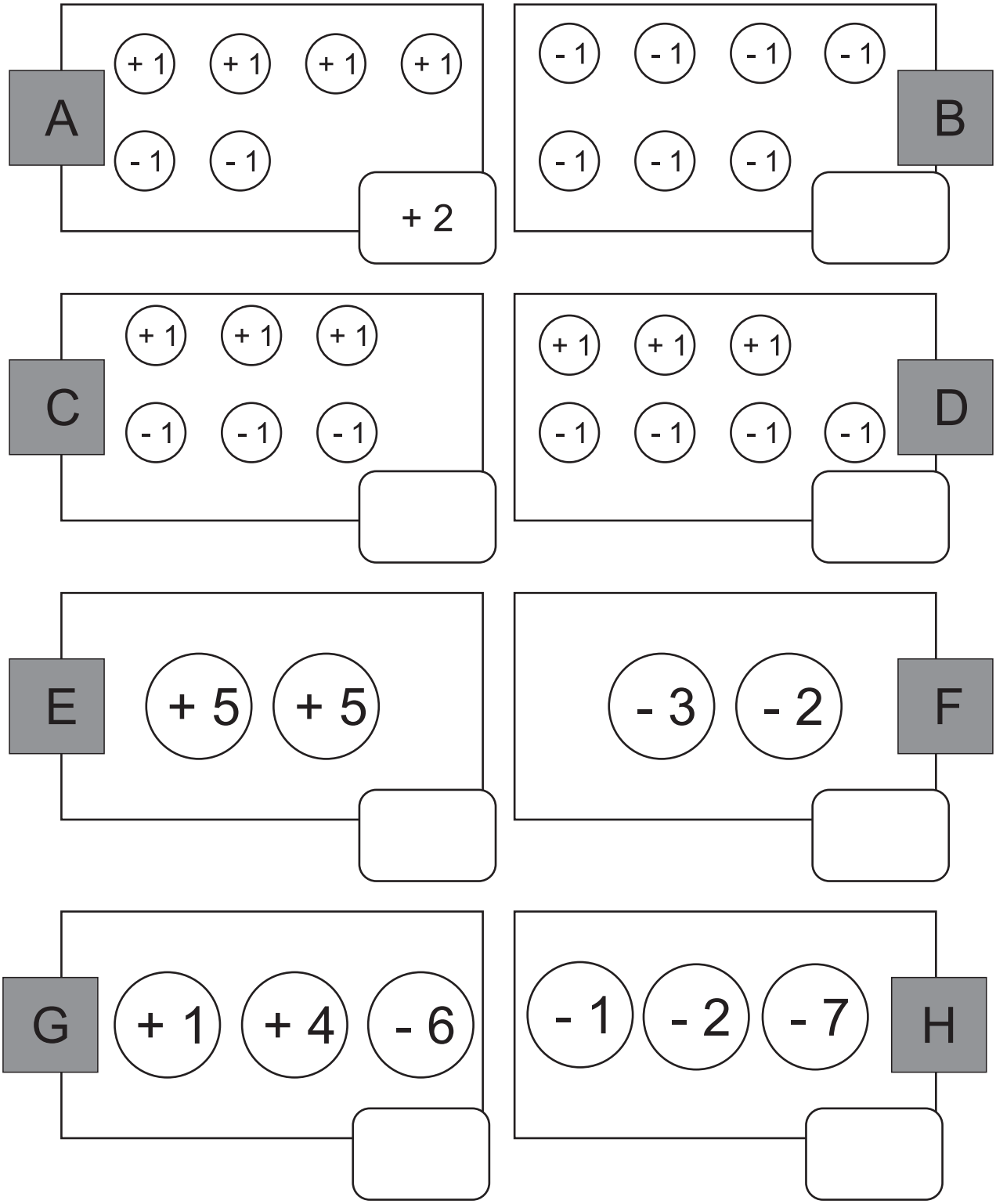
Let's refresh the basics of number system

Name of the set of numbers	How is it formed?	How is it shown?	Showing on the number line Write the values of all points marked.
Natural numbers	Counting numbers	N = { 1, 2, 3, ...}	
Whole numbers	Natural numbers + zero	W = { 0, 1, 2, ...}	
Integers	Natural numbers +their opposites + zero	I = { ..., -2, -1, 0, 1, 2, ...}	
Rational Numbers	Integers+ fractions	R = { p/q where p and q are integers and q is not zero}	



A to F are six bank accounts. Write the values of these accounts.



Which account is the richest? _____

Which account is the Poorest? _____

Which account has zero value? _____

Who is richer, A or B? _____

Whose account has less value, D or B? _____

Compare using the signs <, =, >

0	<	+2		-3	0	+5
- 2		- 6		+10	-8	-10

Write appropriate numbers considering the signs <, =, >

- 4	<			+ 2	<		<	
- 4	>			+ 2	>		>	

In class 6, you had discovered rules of adding positive and negative numbers. Revise it from Math Delight 6 (Page numbers 95 to 103).

1) + and + ⟶ + Total

2) – and – ⟶ - Total

3) + and – ⟶ (sign of the bigger number)
and (difference)

-1 +1 = 0
-4 +4 = 0
} We show this as cancellation in addition. $\cancel{-4} + \cancel{4} = 0$

Use appropriate rule and solve.

1) + 5 + 7

2) - 5 – 7

3) – 7 + 5

4) + 5 – 10

5) – 200 + 10

6) – 300 - 10

7) +3a – 10a

8) $-5x - 3x$

9) + 5 + 3 – 2

10) – 6 – 2 + 4

11) – 3 - 2 - 1

12) – 5a + 5a – 2a

13) – 4 + 4 – 2 – 1

14) + 3 – 2 – 3 + 2

While adding, when you remove the brackets, signs of insiders remain unchanged.

$(+2) + (+3) = +2 +3 =$ $+5$

$(-5) + (-1) = -5 -1 =$ ☐

$(-3) + (+2) =$ ..... $=$ ☐

$(+6) + (-2) =$ ..... $=$ ☐

$(+2-3) - (-2-3) =$ ..... $=$ ☐

$(-3+5) - (-5-2) =$ ..... $=$ ☐

Subtracting a positive number is like adding a negative number.
Subtracting a negative number is like adding a positive number.
Therefore while removing a bracket after a minus sign, signs of all insiders get reversed.

$(+3) - (+1) = +3 -1 =$ $+2$

$(-5) - (-2) = -5 + 2 =$ ☐

$(+6) - (+6) =$ ..... $=$ ☐

$(+10) - (+2) =$ ..... $=$ ☐

$(-8) - (-8) =$ ..... $=$ ☐

$(+2-3) - (-2-3) =$ ..... $=$ ☐

$(-3+5) - (-5-2) =$ ..... $=$ ☐

Note that we are using two rules. Rule for removing the brackets, the rule for adding positive and negative numbers.

Fill in the blanks.

(+ 2) + ( ) = + 6 (+ 2) + ( ) = - 4 6 - ( ) = 4

6 - ( ) = 8 (- 4) + ( ) = - 6 - 4 + ( ) = - 2

(- 4) - ( ) = - 6 (- 4) - ( ) = - 2 ( ) + (- 2) = 0

( ) - (- 2) = 0 ( ) - (+ 2) = 0 ( ) + (- 3) = - 6

( ) + (+ 3) = - 3 ( ) + ( ) = 0 ( ) + ( ) = + 5

( ) + ( ) = - 3 ( ) + ( ) = - 10 ( ) + ( ) = -100

($5a$) + ($-2a$) = ... ($5a$) - ($-2a$) = ...

($10x$) - (x) = ... ($-3xy$) - ($-5xy$) = ...

($3a$) + ($-4a$) - ($-a$) = ...

($-7p$) - ($+3p$) - ($-p$) = ...

Use one positive and one negative number :

( ) + ( ) = + 6

Use two negative numbers :

( ) + ( ) = - 6

Use two negative numbers :

( ) - ( ) = + 4

Use one positive and one negative number :

( ) - ( ) = - 6

Use two numbers with the same sign :

( ) + ( ) = 2

( ) - ( ) = 2

Revise pages 10 to 15 of Math Delight 7 to discover the rules for multiplication of integers :

(+) x (+) = + product
(-) x (+) = - product
(+) x (-) = - product
(-) x (-) = + product

Use the rule and solve.

(+6) x (+3) = ☐	(+4) x (- 4) = ☐
(- 6) x (+3) = ☐	(- 4) x (- 4) = ☐
(+ 6) x (- 3) = ☐	(- 4) x (+ 4) = ☐
(- 6) x (- 3) = ☐	(+4) x (+4) = ☐
(+7) x ( ) = +21	( ) x ( ) = - 20
(- 7) x ( ) = + 21	( ) x ( ) = +20

(+ 2) x (+ 3) x (- 4) = ☐

(- 2) x (- 3) x (+ 4) = ☐

(+ 2) x (- 3) x (0) = ☐

(+ 2) x (- 3) x (+ 4) = ☐

(- 2) x (- 3) x (- 4) = ☐

(- 1) x (- 1) = ☐

(- 1) x (- 1) x (- 1) = ☐

(- 1) x (- 1) x (- 1) x (- 1) = ☐

(- 1) x (- 1) x (- 1) x (- 1) x (- 1) = ☐

(- 1) x (- 1) x (- 1) x (- 1) x (- 1) x (- 1) = ☐

Write the missing numbers and signs.

(- 3) X (+ 8) = (☐ 24)

(- ☐) X (☐ ☐) = (+ 25)

(- 6) X (☐ ☐) = (- 6)

(☐ ☐) X (+ ☐) = (+ 14)

(☐ 3) X (☐ ☐) = (- 27)

(+ 9) X (☐ ☐) = (☐ 54)

(☐ 2) X (☐ 2) X (☐ 2) = (- 8)

(☐ ☐) X (- 2) X (- 3) = (- 6)

(☐ 2) X (+ ☐) X (+ 5) = (+ 20)

(☐ 1) X (☐ ☐) X (☐ 6) = (☐ 0)

Write division statements and discover the rules for division.

+5			
+2	+10	$\frac{+10}{+2} = +5$	$\frac{+10}{+5} =$ ☐
-5			
+2	-10	$\frac{-10}{+2} =$ ☐	$\frac{-10}{-5} =$ ☐
-5			
-2	+10	$\frac{+10}{-2} =$ ☐	$\frac{+10}{-5} =$ ☐

Rules for division of integers

$\frac{+}{+} = +$ division

$\frac{-}{+} = -$ division

$\frac{+}{-} = -$ division

$\frac{-}{-} = +$ division

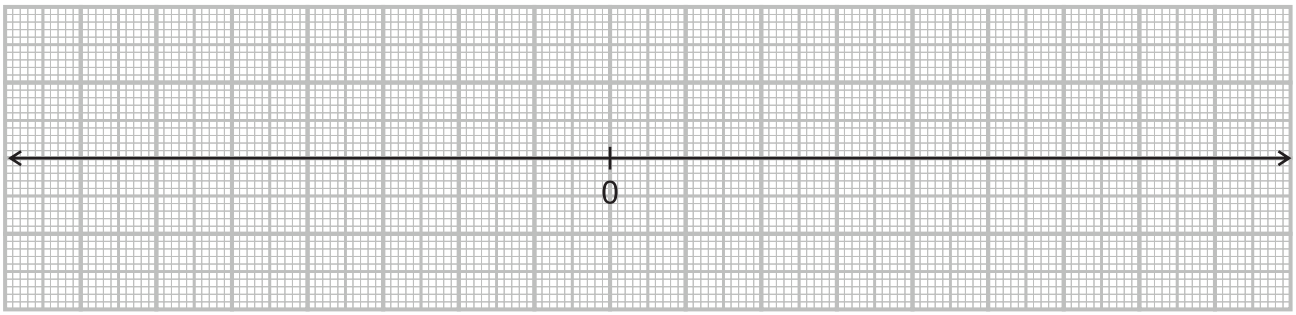
Rational numbers

A number that can be expressed in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$ is called a Rational number. E. g. 0.5 is equal to 1/2.

Number	in $\frac{p}{q}$ form	Some equivalent rational numbers	In standard form
3	$\frac{3}{1}$	$\frac{6}{2}$ $\frac{9}{3}$ $\frac{30}{10}$	$\frac{3}{1}$
1			
1.2			
1.25			
0			
$\frac{3}{2}$			
$\frac{-36}{-24}$			
$\frac{3}{-15}$			

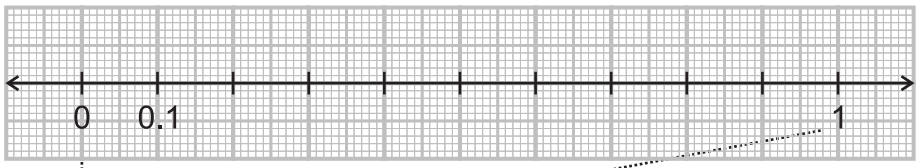
Decide the types of each of these numbers and put the tick marks or crosses in each columns. Also show these numbers on the number line given below.

Number	Natural	Whole	Integer	Rational
5	✓	✓	✓	✓
$\frac{3}{1} = 3$	✓	✓	✓	✓
- 4	X	X	✓	✓
$\frac{1}{2}$				
0				
$\frac{20}{10}$				
$\frac{-40}{20}$				
3.4				
- 6.8				
$\frac{-5}{2}$				
1				

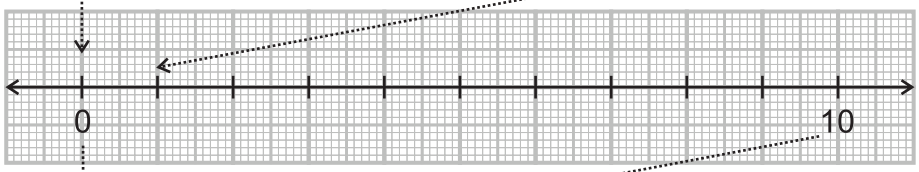


Observe the two given numbers. Write appropriate numbers at each marked point.

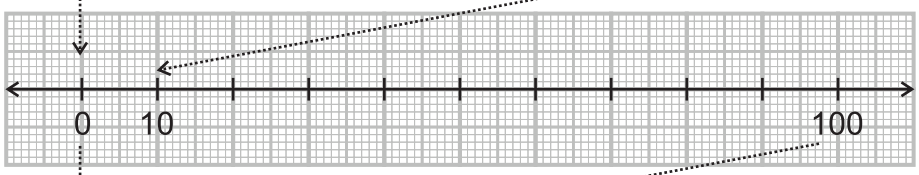
1) 0 to 1



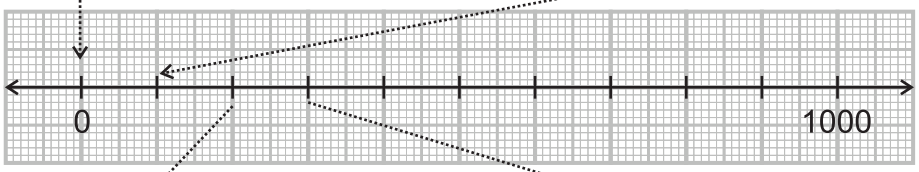
2) 0 to 10



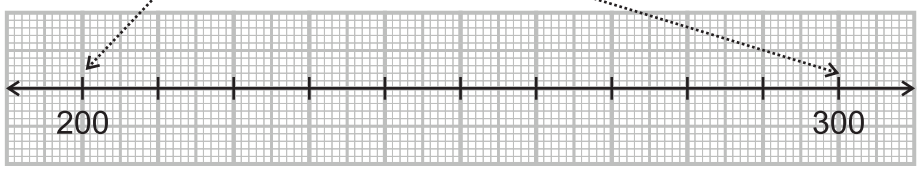
3) 0 to 100



4) 0 to 1000



5) 200 to 300



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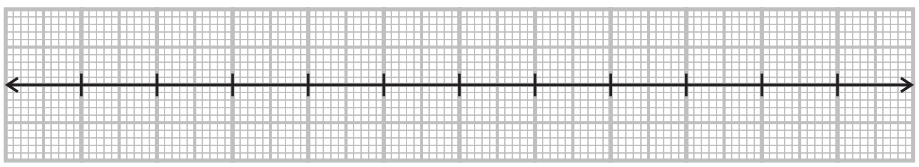
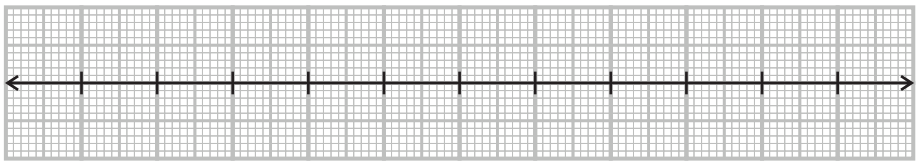
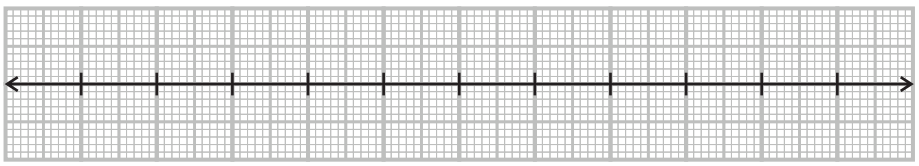
6) 20 to 30



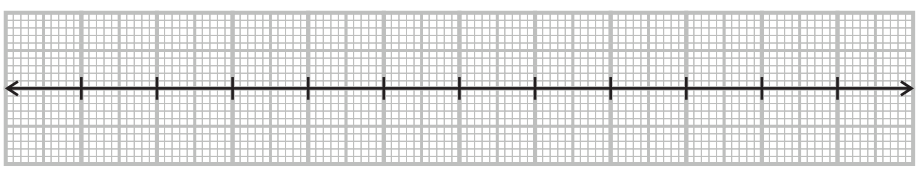
7) 2 to 3



8) 2.1 to 2.2

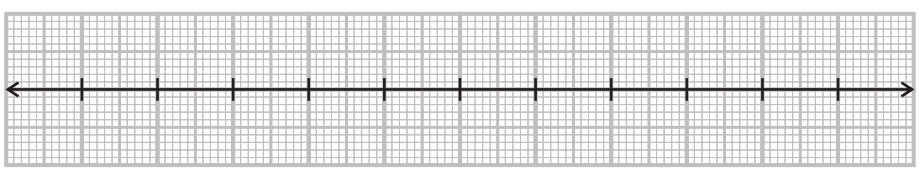


9) 0 to 500

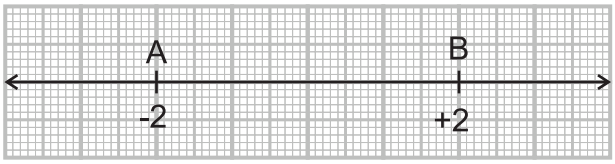


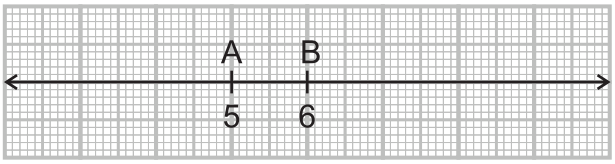
10) 0 to 0.5

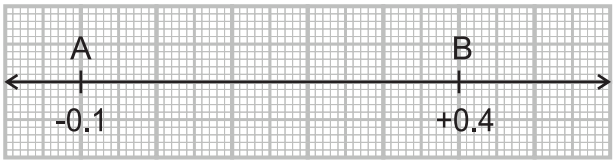
Clue- find 0.1 first.

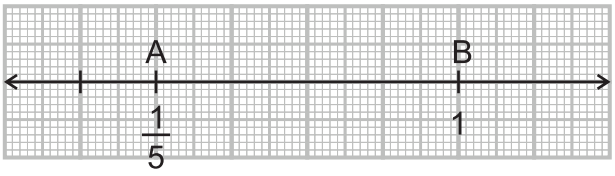


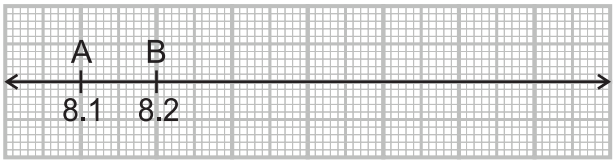
Observe the two given numbers A and B. Also observe the scale of the number line. Mark and write any three numbers between A and B.

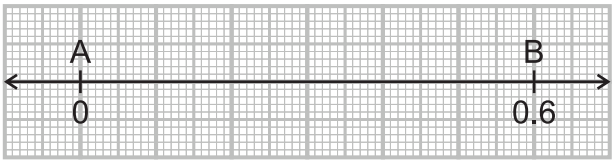


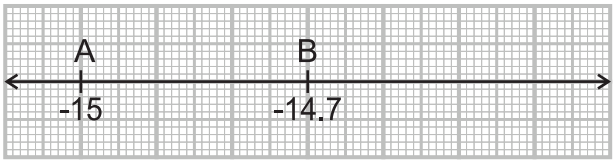


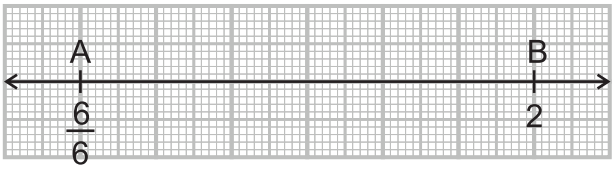


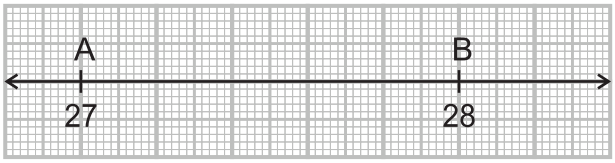


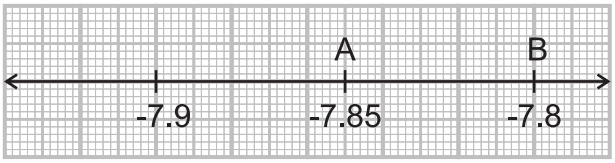


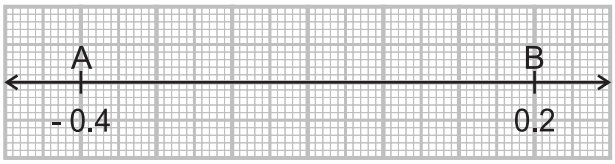


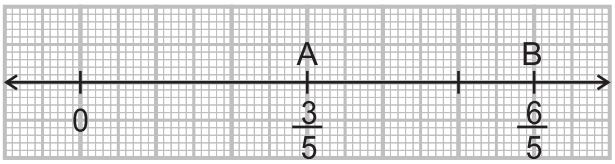


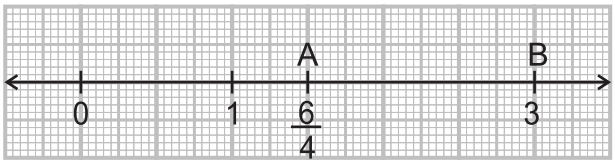


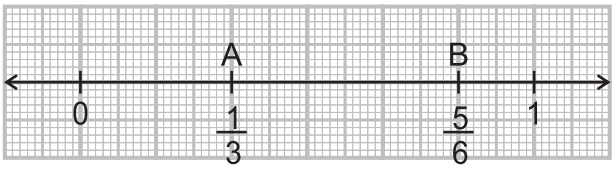


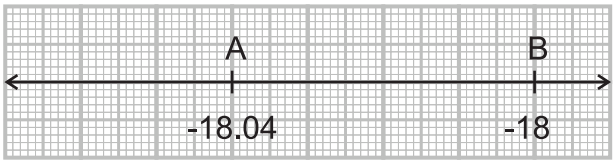


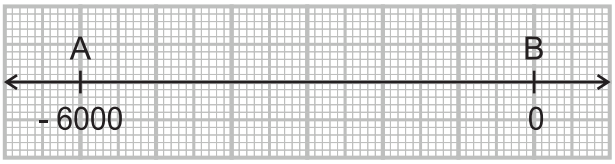




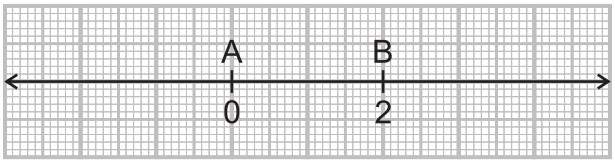
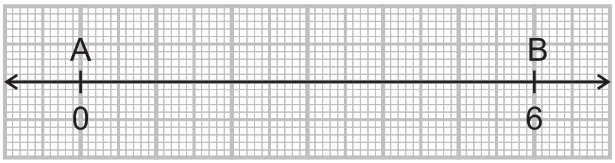
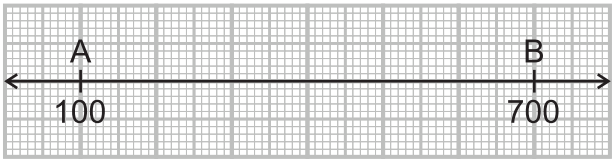
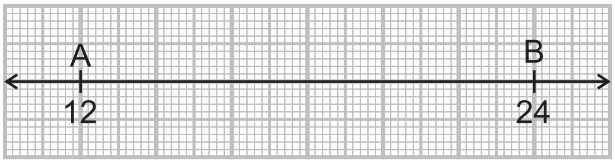
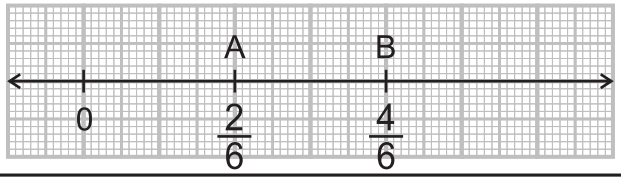
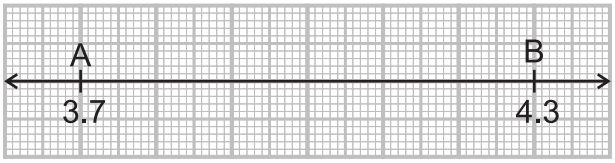








Find the midpoint of line segment AB. Write its coordinate(value). Fill in the table.

On number line	Point A	Point B	Midpoint
	0	2	1
			
			
			
			
			

Observe the points A, B and the midpoint in above table.
Guess and fill in the missing coordinates of midpoint, point A or point B in the table below.

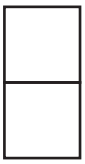
Point A	1	0	21	2	5		a-1	x-5	a
Point B	3	4	23			9	a+1		b
Midpoint				4	7	5		x	

Is your last midpoint $\frac{a+b}{2}$?

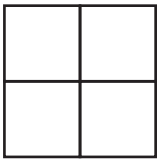
Did you discover that we can find number between any two rational numbers by taking average of those two numbers?

What is an expression with 'n'

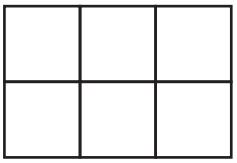
Make a rectangle with groups of 2 cubes. Write it as a multiplication.

1 group of 2 

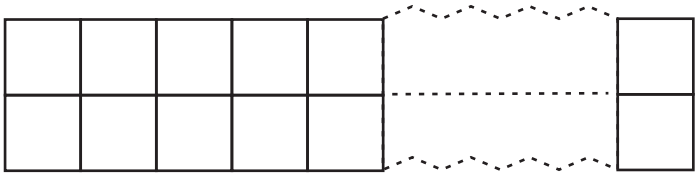
2 x 1 two taken one time

2 groups of 2 

2 x 2 two taken two times

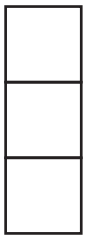
3 groups of 2 

2 x 3 two taken three times

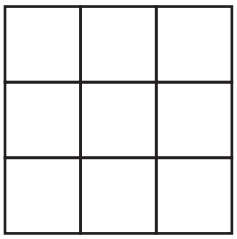
n groups of 2 

2 x ▢ two taken n times

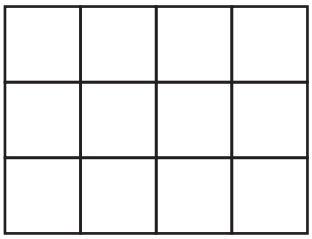
Make a rectangle with groups of 3 cubes. Write the multiplication



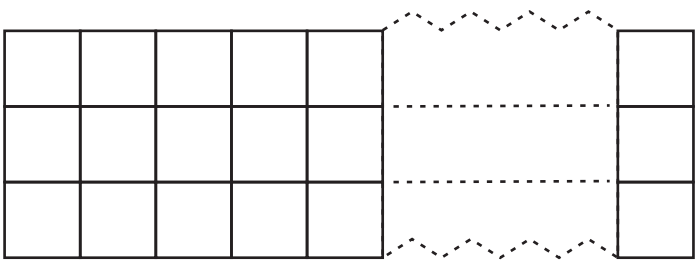
3 x 1



▢ x ▢



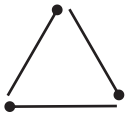
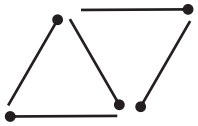
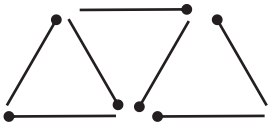
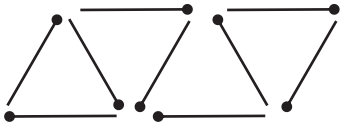
▢ x ▢



▢ x ▢

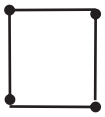
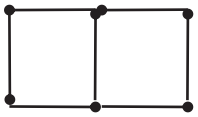
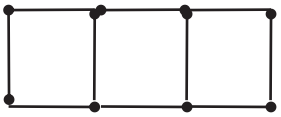
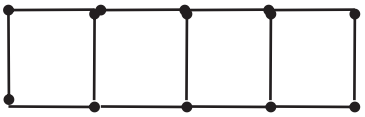
3 taken n times

Look at the following matchstick pattern of triangles. Find the general rule that gives the number of matchsticks in terms of the number of triangles.

				
No. of Triangles	1	2		
No. of matchsticks	3			

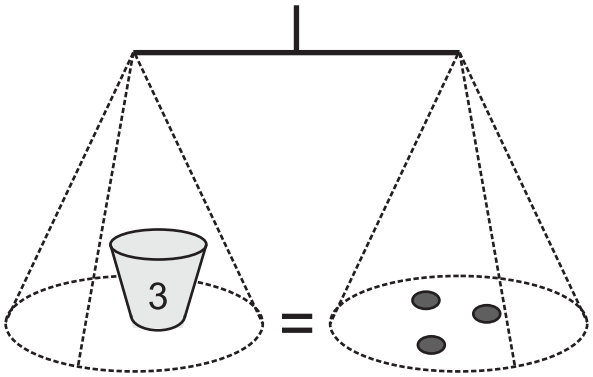
Rule :

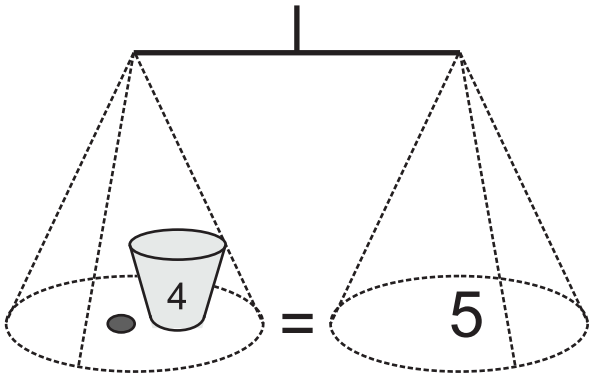
Look at the following matchstick pattern of squares. Find the general rule that gives the number of matchsticks in terms of the number of squares.

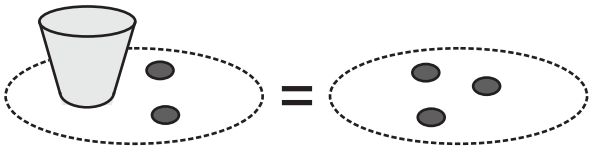
				
No. of Squares	1	2	3	
No. of matchsticks	4			

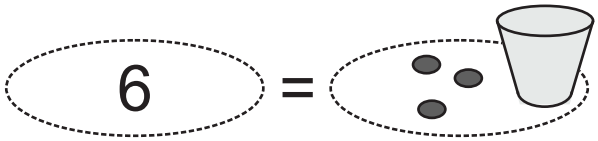
Rule :

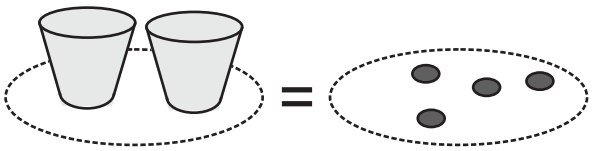
Left pan and right pan of a balance are equal. Some beads are kept in a cup in each of these statements. How many beads are there in the cup? Write on the cup.

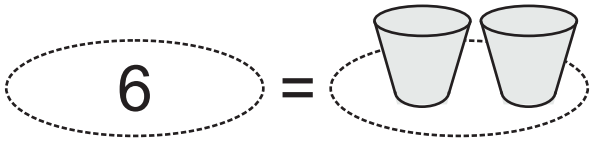






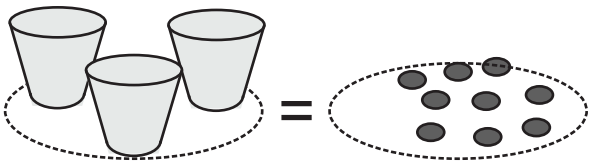


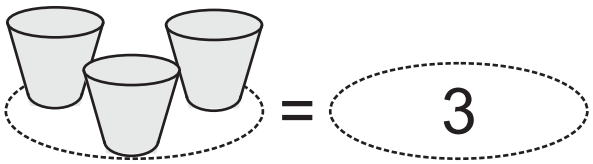


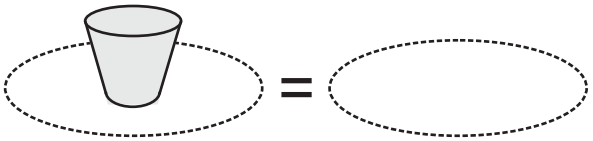


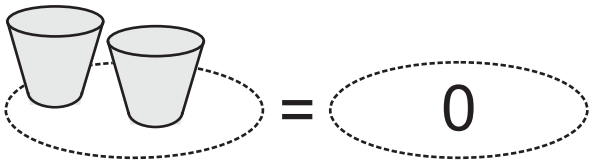
Cups that look alike have the same number.

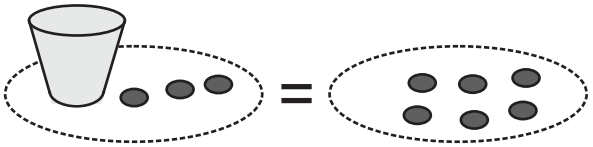
Cups that look alike have the same number.

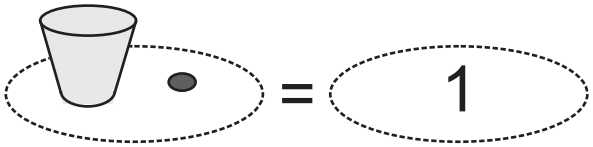


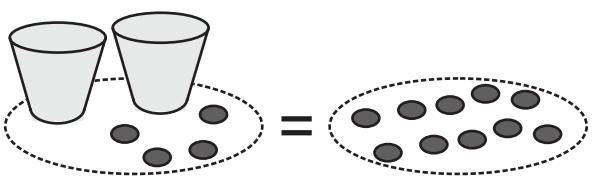


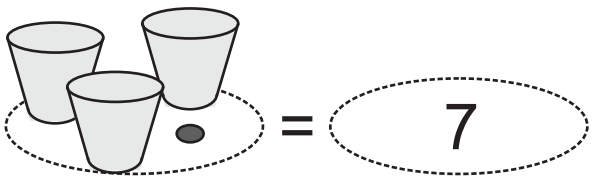




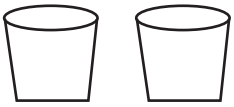
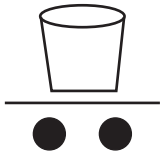
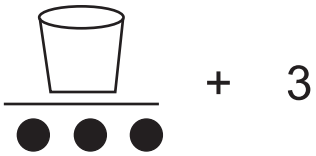
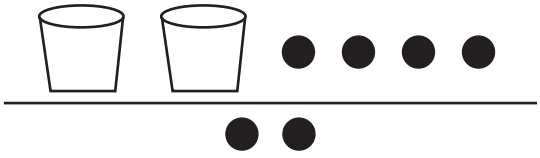
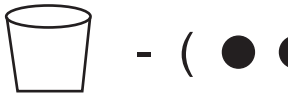
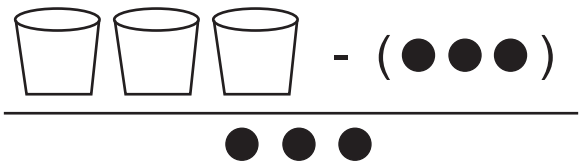
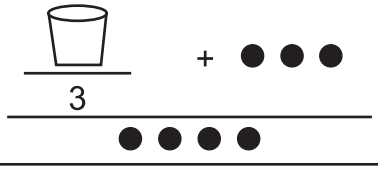






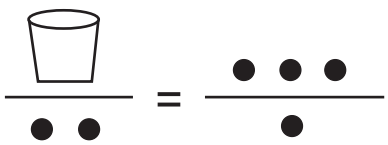


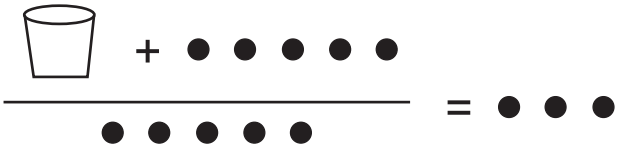
Equations - Preparations.

Picture (x is an unknown)	Expression
	x
	$2x$
	$3x + 4$
	$4x + 1$
	
	
	
	
	
	

We have kept an unknown number in cup.
Let;s call is as x. Write the following equations in the language of x.

$x = 3$





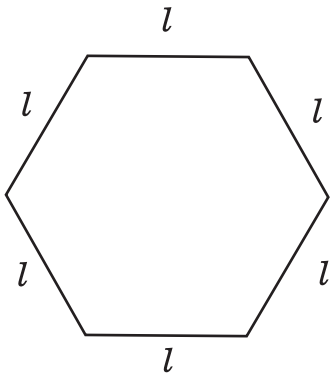
The side of a regular hexagon is l. Express the perimeter of the hexagon using l.

Perimeter = _____

समभुज षटकोनची बाजू l आहे.

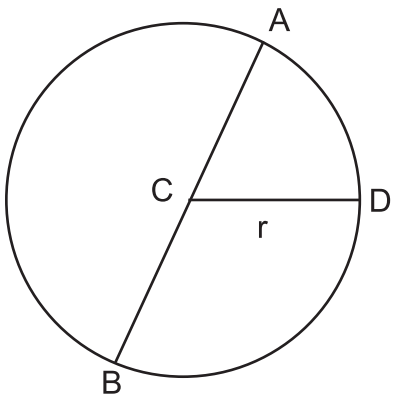
l चा वापर करून षटकोनाची परिमिती किती ?

परिमिती = _____



AB is the diameter of the circle with center C. Express the diameter (d) in terms of its radius (r).

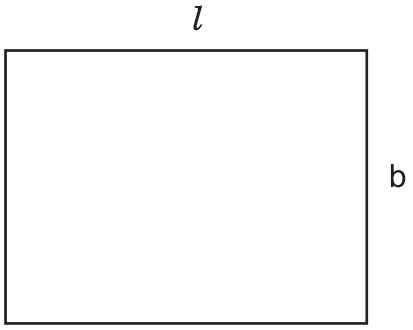
d = _____



Express the perimeter(P) and area(A) of the rectangle in terms of its length (l) and breadth (b)

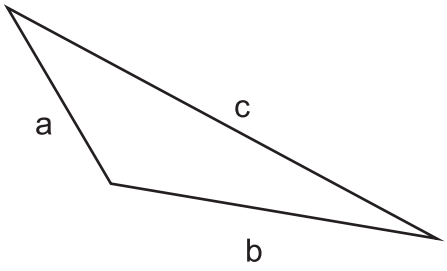
P = _____

A = _____



Express the perimeter of the given triangle in terms of its sides a, b and c.

Perimeter = _____



Expressions with variables.

Give expressions :

1) 7 added to P ⟶ P + 7

2) 7 subtracted from P ⟶

3) P multiplied by 7 ⟶

4) P divided by 7 ⟶

5) 3 more than P ⟶

6) 3 less than P ⟶

7) 5 times P ⟶

Take Sarita's present age to be y years.

1) What will be her age 5 years from now ?

2) What was her age three years back ?

3) Sarita's grandfather is 6 times her age. What is grandfather's age?

4) Grandmother is 2 years younger than grandfather. What is her age?

5) Sarita's friend is 2 years older than Sarita. What is her friend's age?

Description	Equation
A number is equal to 5	$x = 5$
4 added to a number is 7	
3 times a number is 15	
2 subtracted from a number given 3.	
A number divided by 3 is 4.	
Two times a number plus 5 is 8.	
Three times a number minus 2 given 10.	
Half of a number plus 1 is 5.	

Write the algebraic expressions :

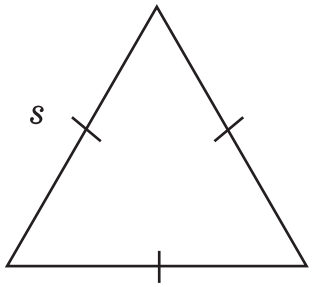
Description	Algebraic Expression
Sum of x and y	$x + y$
	xy
a and b both squared and added	
5 added to three times the product of m and n	
	$10 - yz$
	$\frac{1}{4}\ pq$
	$x^2 + 3x + 2$
	$2\ (3a + 6b)$
Your age is x. Your brother is 5 years elder than you. Sum of your and your brother's age.	

A number is called n. _____

What is the number after n? _____

What is the number before n? _____

Breadth of a rectangle is b.
Length is double of breadth.
Write length _____



Side of an equilateral triangle is s.
Its perimeter (sum of all three sides)
is _____

Riya was born when her mother was 25 years old.
Today Riya's age is r. Her mother's age is _____.

Grandmother's age is 10 times that of her grandson's age.
If grandson's age is m, grandmother's age is _____.
If grandmother's age is 50 years, grandson's age is _____ years.

Statement using expressions	Statement in ordinary language
Salim scores r runs and Nalin scores (r + 15) runs.	Nalin scores 15 runs more than Salim.
A notebook costs Rs.p. A book costs Rs.3p	
Our class has n students. The school has 20n students.	
Jaggu is z years old. His uncle is $4z$ years old and his aunt is $(4z - 3)$ years old.	

Evaluating the expressions

x	$x + 2$	$2x$	$2x+2$	x^2	x^2+2
3	3 + 2 = 5	2 x 3 = 6	2 x 3 = 6	3 x 3 = 9	9+2=11
5					
1					
0					

Find the value of given expressions if x = -2

$3x - 4$
= 3 x (-2) - 4
= -6 - 4
= -10

$- 4x + 6$

$5x^2$

$x^2 + 3x - 3$

Equation	Description
$x = 4$	
$2x = 6$	
$x + 2 = 6$	
$3x + 1 = 10$	
$4x - 2 = 2$	
$\frac{x}{2} = 5$	
$\frac{x}{3} - 4 = 1$	

Solve worksheets 174 to 179 of Math Delight 6.

Equation	To have only variable on left hand side	Solution
$x + 3 = 5$	Subtract 3 from both sides.	$x + 3 - 3 = 5 - 3$ $x = 2$
$x - 2 = 4$		
$3x = 12$		
$\frac{x}{2} = 5$		

Solve.

$x + 5 = 8$	$m + 4 = 3$	$2p = 20$
$\frac{x}{4} = 3$	$7 = y + 2$	$10 = 5t$

$2x - 4 = 2$

Added 4 on both sides.

$2x - 4 + 4 = 2 + 4$

$2x = 8$

Divided by 2 on both sides.

$\frac{2x}{2} = \frac{8}{2}$ 4

$x = 4$

$3x + 5 = 8$

$\frac{x}{2} - 3 = 2$

$4y - 3 = 13$

$\frac{m}{4} + 1 = 6$

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

Did you multiply by $\frac{3}{2}$ in second step?

$5t + 28 = 10$

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

$2y + \frac{5}{2} = \frac{17}{2}$

$\frac{5}{2}x = -10$

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

$\frac{2b}{3} - 5 = 3$

$7m + \frac{19}{2} = 13$

$6z + 10 = -2$

$2(x + 4) = 12$

$3(n - 5) = 21$

$-4(2 + x) = 8$

$4(2 - x) = 8$

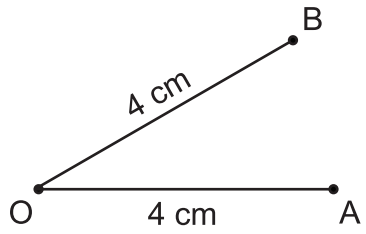
$4 = 5(p - 2)$

$-4 = 5(p - 2)$

$3(x + 1) = 0$

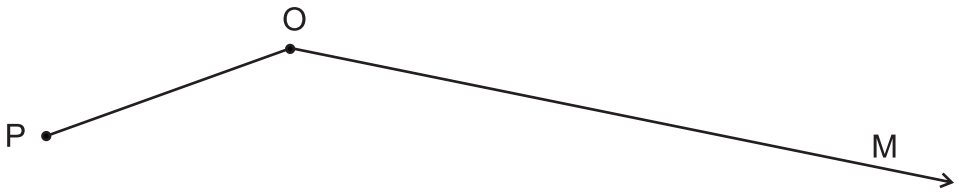
$4(5 - x) = 0$

OA = 4 cm. OB = 4cm. Draw points C, D and E which are at 4 cm from O.

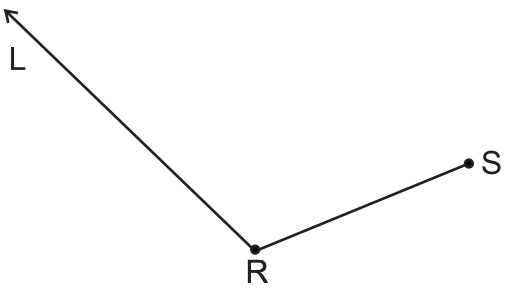


Which figure will you get if you draw all points that are at 4 cm from O? Can you use compass to draw it? Did you get a circle? We draw a circle with O as centre and OA as radius.

OP is a segment and OM is a ray.
On OM cut OQ equal to OP.



On ray RL cut RT equals RS.



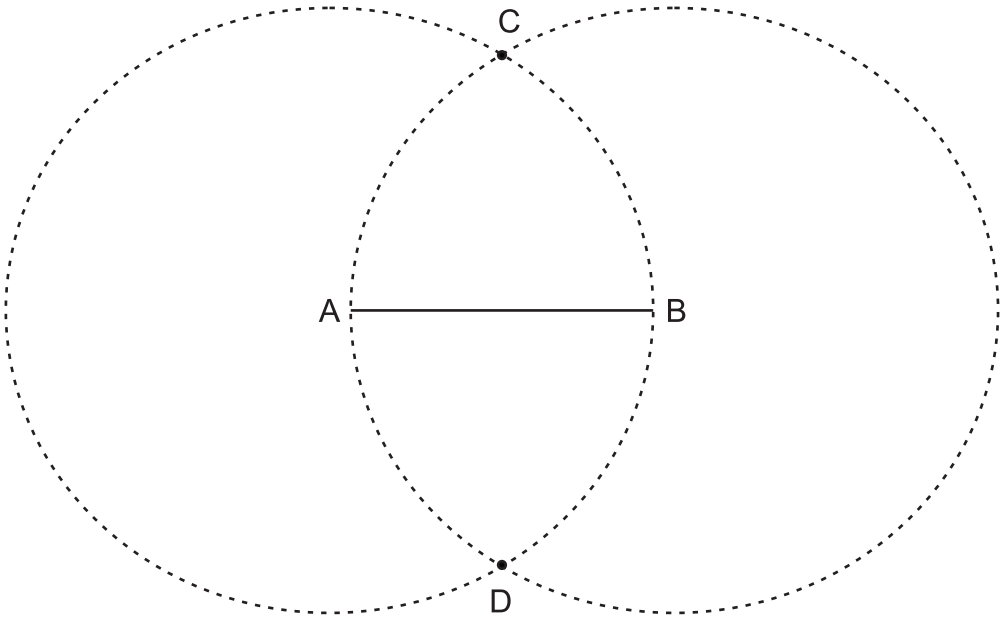
Segment AB = 4 cm

We have to find a point C such that

AC = BC = AB = 4 cm

Can you imagine where point C will be? What shape will you get? Draw a rough sketch.

Let me help you. If at A, we draw a circle with radius 4 and at B also we draw a circle with radius 4.... ? Try it.



For the circle on the left, any point on the circle is at the distance AB from A. For the circle on the right any point on the circle is at the distance AB from B. These circles meet in points C and D.

So, AB = CA = CB = 4 cm. Draw ABC.

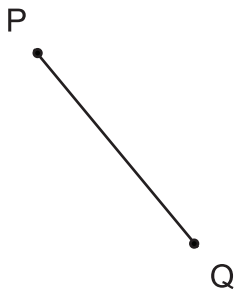
Can you tell the type of triangle ABC?

.....

Instead of drawing full circle we can draw an arc. The point we are searching for is somewhere on that arc. When we draw the other arc, we get a point of intersection. That is the exact point we are searching for.

Draw LM = 5 cm. Draw △ LMN such that LM = LN = MN.

PQ is given to you. Draw an equilateral triangle using PQ as a side.



AB is given to you. Draw an isosceles triangle such that AB is base and the other two sides are 9 cm each.

Use scale, protractor, compass and pencil to draw the following triangles on loose papers.
Write the names of vertices inside the triangle.
Cut out the triangle.
For each triangle check whether everyone's triangle is congruent (exactly identical)

Draw and cut this triangle	Everyone got the same triangle?	Test of congruency
Side 1 = 6 cm Side 2 = 8 cm Side 3 = 5 cm	Yes	SSS is the test of congruency
Angle 1 = 80^0 Angle 2 = 70^0 Angle 3 = 30^0	No	AAA is **NOT** the test of congruency
Side 1 = 8 cm Side 2 = 8 cm Side 3 = 11 cm		
Side 1 = 7 cm Side 2 = 9 cm Angle between these two sides = 50^0		
In triangle ABC, Side BC = 7 cm $\angle$ B = 60^0 $\angle$ C = 40^0		
In triangle PQR, Side QR = 11 cm Side PQ = 6 cm $\angle$ R = 30^0	You will get two different triangles	
In triangle LMN, $\angle$ L = 80^0 $\angle$ M = 60^0 $\angle$ N = 40^0		
Side 1 = 6 cm Side 2 = 8 cm Angle between these two sides = 90^0		
One angle = 90^0 Side 1 = 8 cm Hypotenuse = 13 cm		

Can you construct a specific triangle ABC with angles A = 50^0, B = 60^0 and C = 70^0?
Draw and check if all children have drawn the same.

Yes/No. All triangles (are / are not) the same.

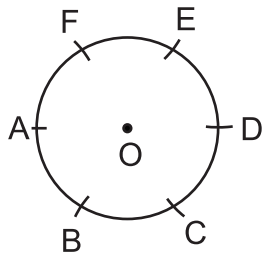
Can you construct a $\triangle$PQR with PQ = 4cm, angle P = 60^0 and angle Q = 40^0
Draw and check.

Construct $\triangle$DEF with DE = 3 cm, EF = 4 cm, angle DEF = 90^0

Draw any circle. With the same radius cut the circle into equal parts by drawing arcs as shown in the figure.

How many parts do you get? .....

Draw a circle with bigger radius next to this figure and repeat the same procedure.



Join OA and OB.
Measure the angles formed at the centre O using a protractor.

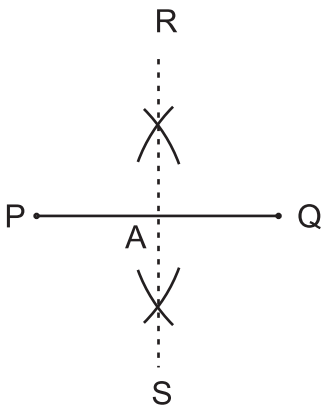
$\angle$ AOB = $\angle$ BOC =

You know that straight angle is 180^0
You also know that opposite angles are equal.
Can you find out all other angles using these theorems without actually measuring the angles?

$\angle$ COD = $\angle$ DOE = $\angle$ EOF = $\angle$ FOA =

Draw DE = 4 cm. Draw an angle of 60^0 at a point D, without using a protractor.

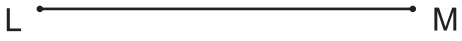
Example : Draw a perpendicular bisector RS of line segment PQ using compass :



RS ⊥ PQ

PA = AQ

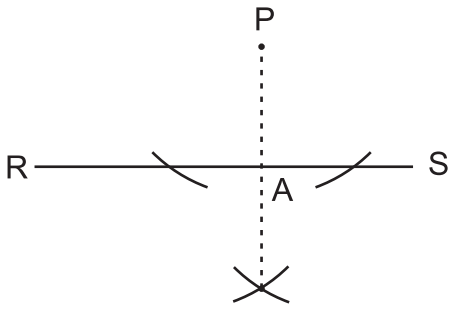
Draw a perpendicular bisector CD of line segment AB using compass :



..... ⊥ .....

..... = ...

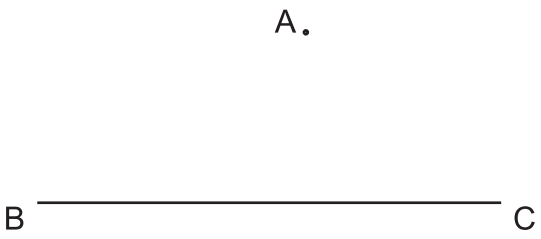
Example : Draw a perpendicular from an external point P to segment RS.



PA ⊥ RS

∠ PAR = ∠ PAS = 90^0

Draw a perpendicular from an external point A to segment BC.



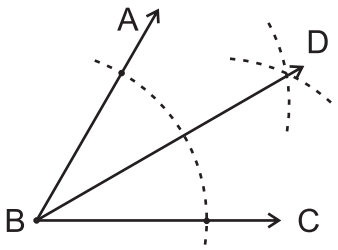
..... ⊥ .....

∠ ..... = ∠ ..... = ...^{0}

Draw 3 different line segments, Draw perpendicular bisectors of each of them.

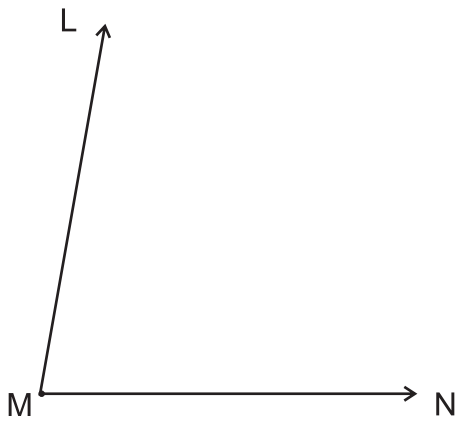
Draw 3 different line segments. Take point A such that it is outside of each of these segments. Draw a perpendicular to each of the line segments from point A.

Example : Draw an angle bisector BD of the angle ABC using compass :



$\angle ABD = \angle DBC$

Bisect angle LMN using compass :



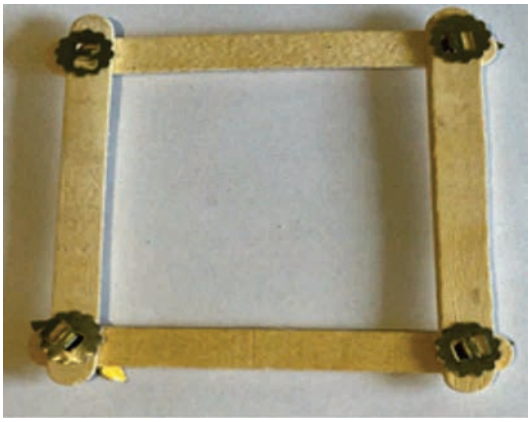
..... = ...

Draw PQ = 3.5 cm and angle P = 60^0
Mark point R to make PR = 4.2 cm
Complete $\triangle$ PQR.

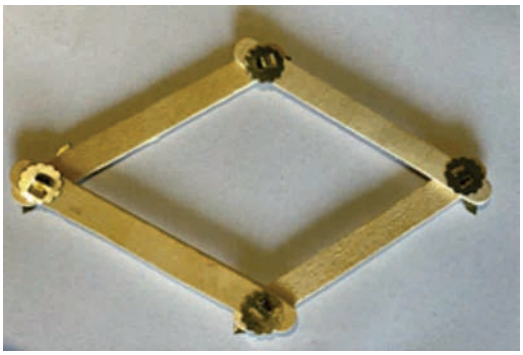
Draw CD = 5 cm. Can you draw an angle of 90^0 at C by using a compass ?

Activity with ice-cream sticks and split pins (or using Jodo Straw kit).

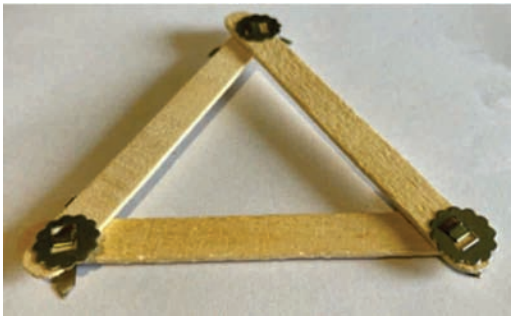
Make a square with ice cream sticks -
Take 4 ice cream sticks. Punch holes on both corners of the sticks with a large paper puncher.



Using split pins make a square.



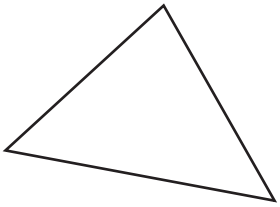
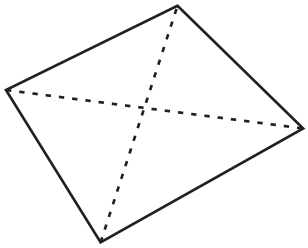
Push one side of the square to the right. It becomes rhombus.



Make a triangle and push out one side. Does it change shape?

What can we conclude?
That a triangle is a rigid, sturdy shape and hence used in building bridges and houses.

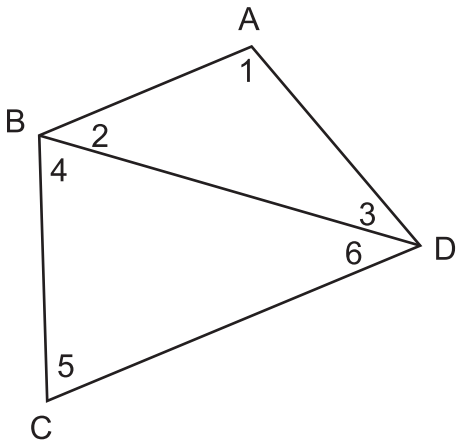
Polygon is a simple closed curve.
Diagonal connects to non-consecutive vertices.
Draw all diagonals for each figure.
Fill in the following table.

Draw rough figure	Number of sides, vertices and angles	Number of diagonals	Name
	3	0	Triangle
		2	Quadrilateral
			Pentagon
	6		
	7		Heptagon

Draw rough figure	Number of sides, vertices and angles	Number of diagonals	Name
	8		Octagon
			Nonagon
			Decagon
. . . . .	. . . . .	. . . . .	. . . . .
n - sided polygon	n	—	n-gon

The sum of interior angles of a triangle is 180^0

Find the sum of interior angles of a quadrilateral using the above property by filling in the blanks:



ABCD is a quadrilateral.

By drawing a diagonal BD, we get 2 traingles,

namely △ ---------- and △ ----------

Angles of a triangle add up to .....

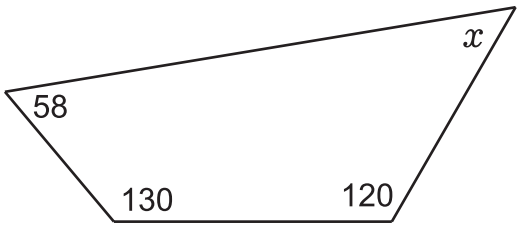
$\angle 1 + \angle 2 + \angle 3 =$ .....

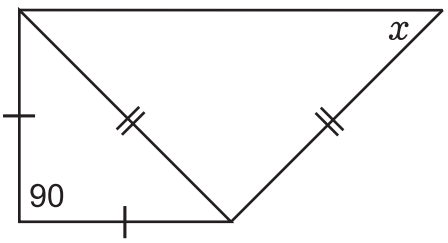
$\angle 4 + \angle 5 + \angle 6 =$ .....

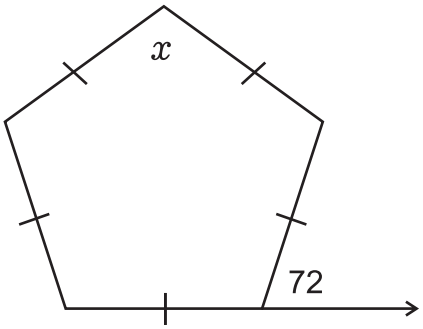
$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 =$ .....

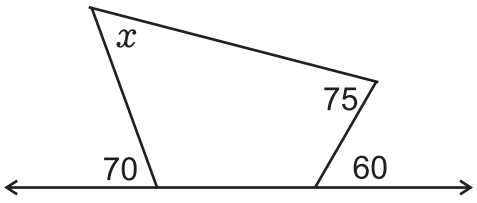
Angles of a quadrilateral add up to .....

Find the angle measure x in each of these figures :







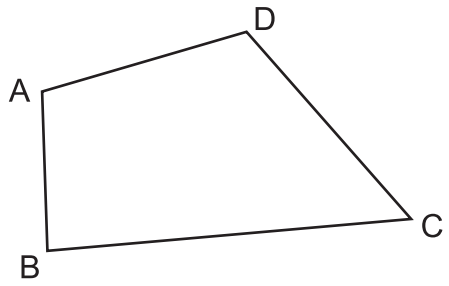


Draw two quadrilaterals.

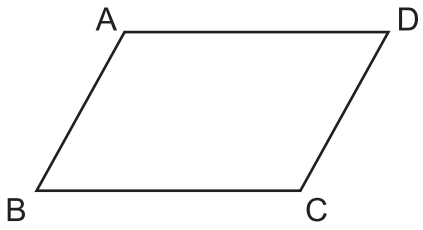
Measure all angles.

Verify that the sum is about 360^0

Here is a quadrilateral ABCD having all 4 sides different.



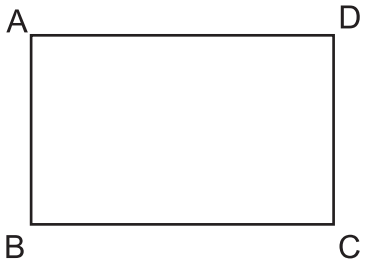
If we make opposite sides equal, they also become parallel, and we get a paralleogram.
Measure all angles and sides.



$\angle$ A = $\angle$ B = $\angle$ C = $\angle$ D =

Sides AB = BC = CD = AD =

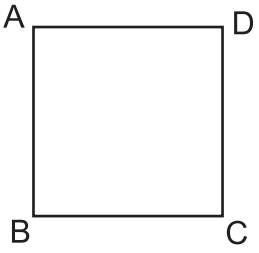
If we start with a parallelogram and all angles right angles we will get a rectangle.
Measure all sides.



$\angle$ A = $\angle$ B = $\angle$ C = $\angle$ D =

Sides AB = BC = CD = AD =

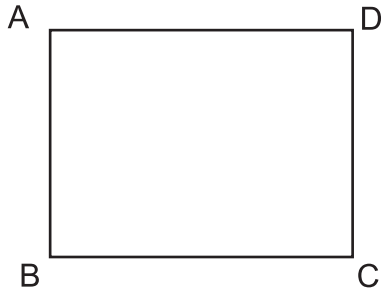
If we start with a rectangle and make all sides equal, we get a square.
Measure all sides.



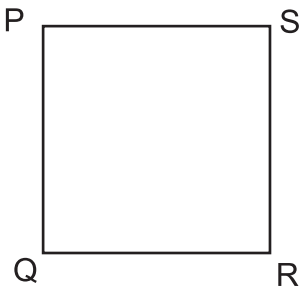
$\angle$ A = $\angle$ B = $\angle$ C = $\angle$ D =

Sides AB = BC = CD = AD =

Properties of rectangles and squares : Measure and write what you think it would be.



1) Is AB parallel to DC? .....
2) Is AD ∥ BC? .....
3) Is AB = DC?.....
4) Is AD = BC?.....
5) Are opposite sides parallel and equal?
6) Join the diagonal AC.
Join the diagonal BD. Label the point of intersection as P.
7) Is AC = BD? .....
8) Are diagonals equal?.....
9) Is AP = PC? .....
10) Is BP = PD? .....
11) Do diagonals bisect each other?.....
12) Do the diagonals bisect each other at right angles? .....
13) Are adjacent sides equal? .....



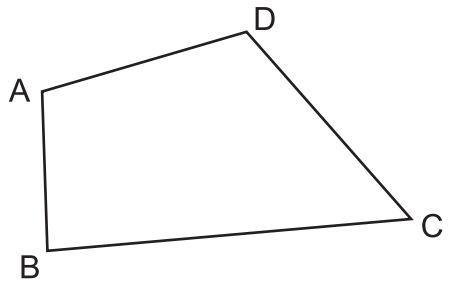
1) Is PQ parallel to SR? .....
2) Is PS ∥ QR? .....
3) Is PQ = QR = RS = SP?.....
4) Are opposite sides parallel?.....
5) Are all sides equal?.....
6) Join the diagonal PR.
Join the diagonal QS. Label the point of intersection as M.
7) Is PR = QS? .....
8) Are diagonals equal?.....
9) Is PM = MR = QM = MS? .....
10) Do diagonals bisect each other?.....
11) Do the diagonals bisect each other at right angles? .....
12) Are adjacent sides equal? .....

Write what you observe.
We will learn to prove them later.

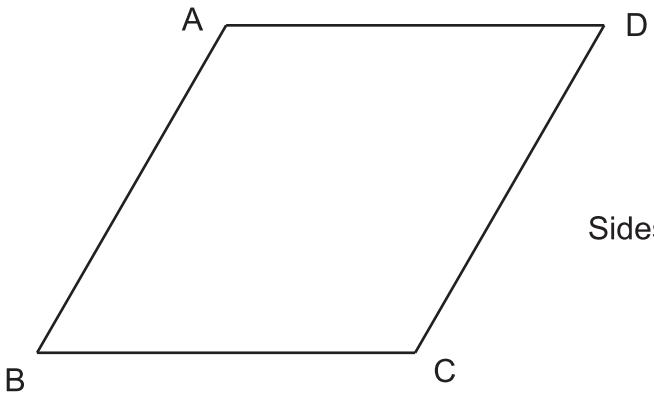
Shape	Sides (are they parallel?, are they equal?)	Angles (are they equal? are they right angles?)	Diagonals (are they equal? do they bisect each other?)
Rectangle			
Square			

All properties of rectangles are there in squares. Therefore square is also a rectangle. But it is a special type of rectangle. It also has all sides equal.
Thus, every square is a rectangle. But every rectangle is not a square.

We again start with a quadrilateral ABCD.



If we make all sides equal we get a rhombus.



$\angle A =$ $\angle B =$ $\angle C =$ $\angle D =$

Sides AB = BC = CD = AD =

Draw the diagonals of this rhombus. Label their point of intersection as P.

AC = BD =

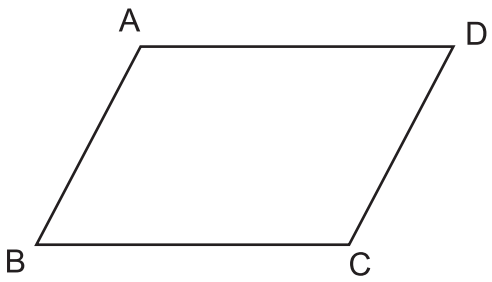
AP = PC = BP = PD =

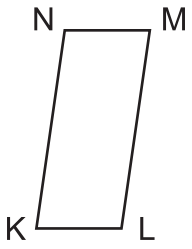
From the measures of AP, PC, BP and PD can we say that the diagonals of a rhombus bisect each other? Explain.

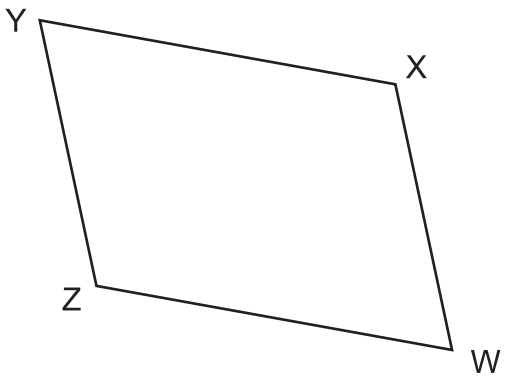
Measure all angles at P. Can we say that the diagonals of a rhombus bisect each other at right angles?

Properties of Parallelogram and rhombus : Measure and write what you think it would be.

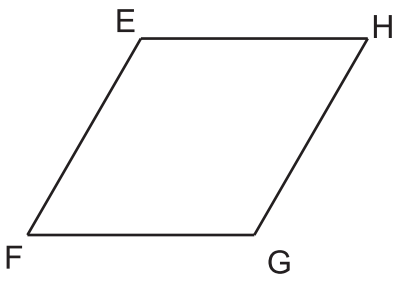
Paralleogram

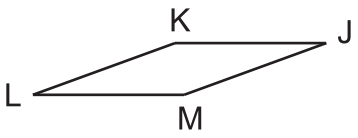


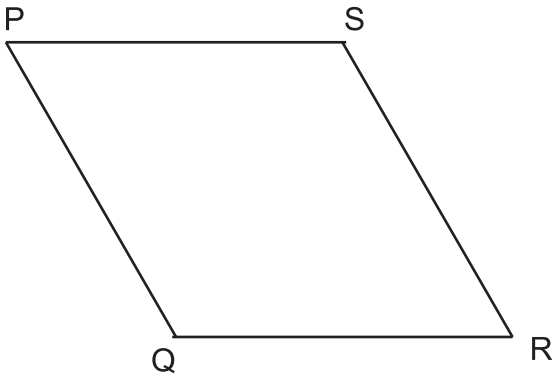




Rhombus





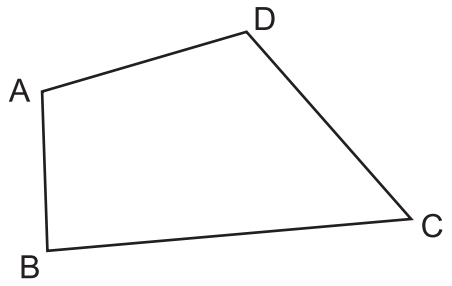


Write what you observe.
We will learn to prove them later.

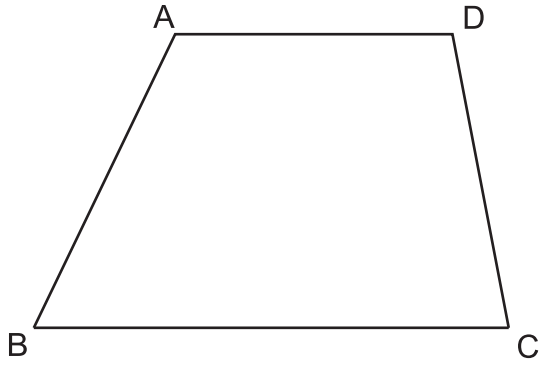
Shape	Sides (are they parallel?, are they equal?)	Angles (are they equal? are they right angles?)	Diagonals (are they equal? do they bisect each other?)
Parallelogram			
Rhombus			

All properties of a **parallelogram are there in a rhombus. Therefore rhombus is also a parallelogram.**
But it is a special type of Parallelogram. It also has all sides equal.
Thus, every rhombus is a parallelogram. But every parallelogram is not a rhombus.

We again start with a quadrilateral ABCD.



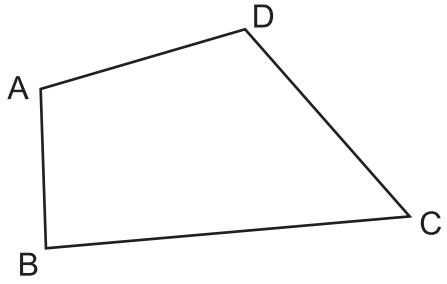
If we make one pair of opposite sides parallel, we get a trapezium.



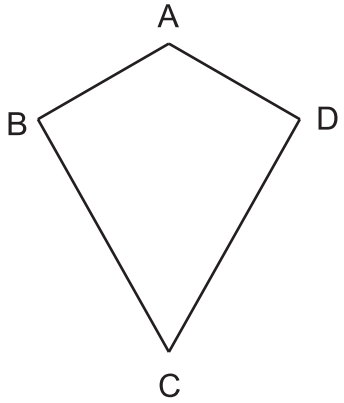
$\angle A =$ $\angle B =$ $\angle C =$ $\angle D =$

$\angle A + \angle B =$ $\angle C + \angle D =$

We again start with a quadrilateral ABCD.



If we make AB = AD and BC = DC we get a kite.



$\angle B =$ $\angle D =$ Is $\angle B = \angle D$?

Sides AB = BC = CD = AD =

Which sides are equal?

Discussion with whole class - How to construct a quadrilateral.

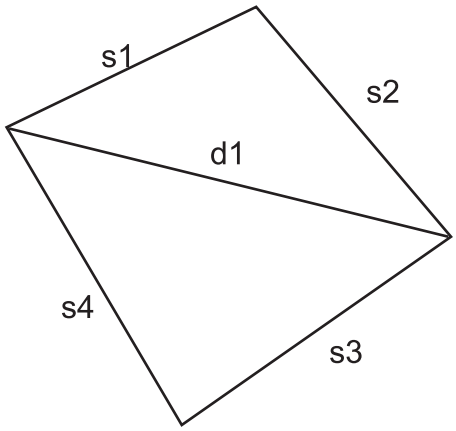
You know how to construct a triangle.
You can draw a unique triangle of SSS, SAS, ASA, AAS are given.
You cannot draw a unique triangle if AAA or SSA are given.

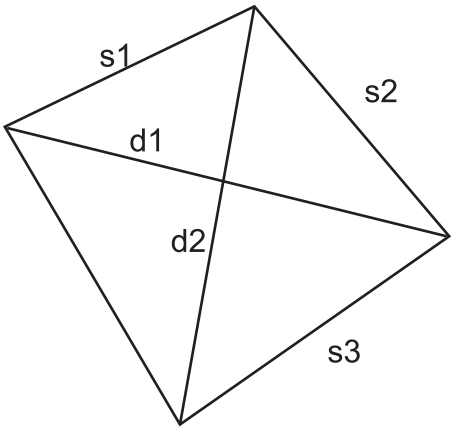
Any quadrilateral can be split into two triangles by drawing a diagonal.

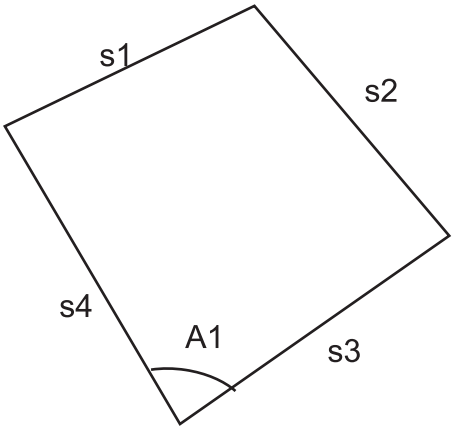
So, you can also draw a quadrilateral.

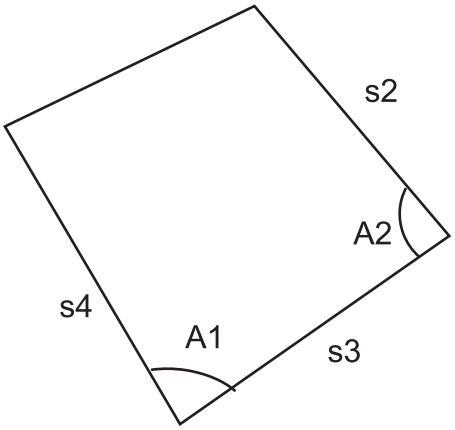
If an angle is given we draw a ray using protractor. We get the exact length by drawing an arc. To get a point of intersection of two known sides, we draw two arcs and take their point of intersection.

Discuss in your class how you will draw a quadrilateral if the labelled information is given in each of these figures. d1 and d2 are diagonals. Write the numbers in sequence of drawing them.







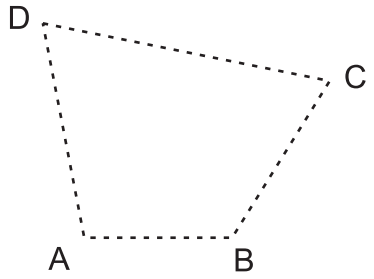


Learn how to construct a quadrilateral.

When you want to find point B at a distance of 4 cm from point A, you draw a circle using compass, keeping A as the centre and with radius 4 cm. Point B will be somewhere on that circle. You may also draw an arc instead of drawing full circle if you know where the point will be approximately.

Try to draw a quadrilateral ABCD having sides AB = 3 cm, BC = 4 cm, AD = 5cm, DC = 6 cm.

Rough sketch



Your quadrilateral

Will you get a unique (specific) quadrilateral? .....

Discuss why you didn't get a specific quadrilateral.

What if one diagonal is given? Will you get a specific quadrilateral?

Construct a quadrilateral having the same sides as above and having diagonal DB as 5.8 cm.

Construction activities : Discuss with your partner. work together to construct quadrilaterals.

Can you construct a rectangle given one side 4.3 cm and a diagonal 5.2 cm?
Take 4.3 cm as base. You know that all angles of right angles. Draw right angles at both ends of this base. How will you use the diagonal? Understand from the sketch. Complete the rectangle.

Rough sketch ⟶

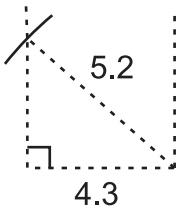


Figure ↓

Construct quadrilateral PQRS with sides PQ = 5.6 cm, QR = 4.2 cm, $\angle Q = 80^0$, RS = 5.5 cm and PS = 6.2 cm.

Think : $\angle Q$ is given.

1) Draw base, ..QR.....
2) Draw angle, which is .....
3) Draw arc from R with radius .....
4) Draw arc from Q with radius .....
5) Draw arc from S with radius .....

Rough sketch ⟶

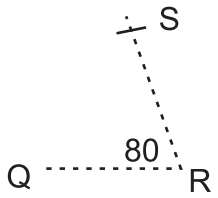


Figure ↓

Can you draw it by taking PQ as the base?.

Construct quadrilateral OLMN with
OL = 2 cm, LM = 5 cm, MN = 3.5 cm,
$\angle$ L = 120^0 and $\angle$ M = 105^0
hint : you know angles L and M.
Which side will you take as the base ?.....

Rough sketch ⟶

Figure ↓

If you know two adjacent sides can you construct a parallelogram?
If AB = 3 cm, BC = 5 cm, can you construct a parallelogram ABCD? Try to draw.

Are everyone's figure the same? .....

Why?.....
.....

Was your guess correct? .....

So we need another factor.

Remember : To construct a triangle, we need another side or another angle.

Construct a parallelogram ABCD, if AB = 3 cm, BC = 5 cm, AC (the diagonal) = 4.5 cm.

Draw a parallelogram DEFG with DE = 3.5 cm, EF = 4.5 cm and FD = 5.2 cm

Construct a parellelogram PQRS with sides 3.7 cm, 4.9 cm and angle between them as 45^0

Construct a parallelogram with sides 5 cm, 3.7 cm and angle between them 38^0. Label it.

Which sides are parallel and equal?

Measure the angles. Which angles are equal?

Write the properties of paralleograms :

Opposite sides are.....

Opposite angles are.....

What can you say about the adjacent angles?

.....

Discuss with the whole class -

Is every rectangle a parallelogram? Why?

Is every parallelogram a rectangle? Why?

Is every rhombus a parallelogram? Why?

Is every parallelogram a rhombus? Why?

Is every square a parallelogram? Why?

Is every parallelogram a square? Why?

Is every square a rhombus? Why?

Is every rhombus a square? Why?

Is every square a rectangle? Why?

Is every rectangle a square? Why?

Data Handling - Discuss together while working on each problem. Teacher will guide you.

Data helps us to understand and analyse the world around us. Our decisions and actions can be based on the analysis of this data.
You will experience this in the following worksheets (work together, help each other, use calculator).

Example :

The current population of world is more than 7 billion

7 billion = 7,00,00,00,000 = 700 crore

Out of 100 :
21 are over-nourished
63 can eat full
15 are under-nourished
1 ate the last meal but did not make it to the next meal.

Do you think the world has enough resources to feed everyone? Justify your answer.

We use different ways to represent the data pictorially.

1) Pictograph
2) Bar graph
3) Double bar graph
4) Histogram
5) Pie chart of circle graph
6) Line graph etc.

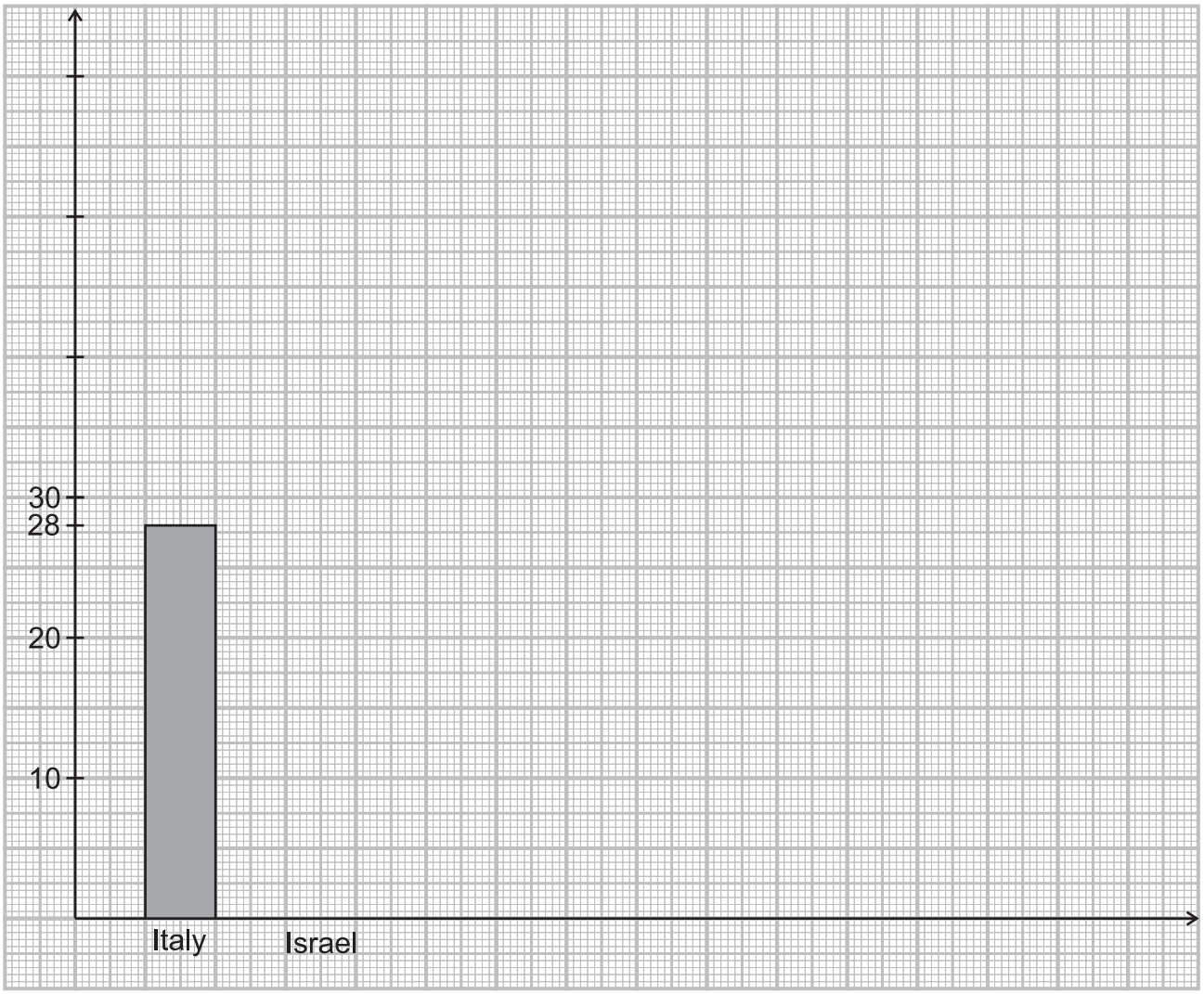
The choice of graph depends on how we want to compare, how we want to use the information.

Bar Graph

By June 23, 2021, population percentage fully vaccinated in some countries is as follows :

Country	Population % fully vaccinated (Numbers rounded off)
Italy	28%
Israel	60%
United States	45%
India	4%
Brazil	12%
Germany	33%

Draw the bar graph. Observe the scale. Mark the numbers. Draw bar for each country.

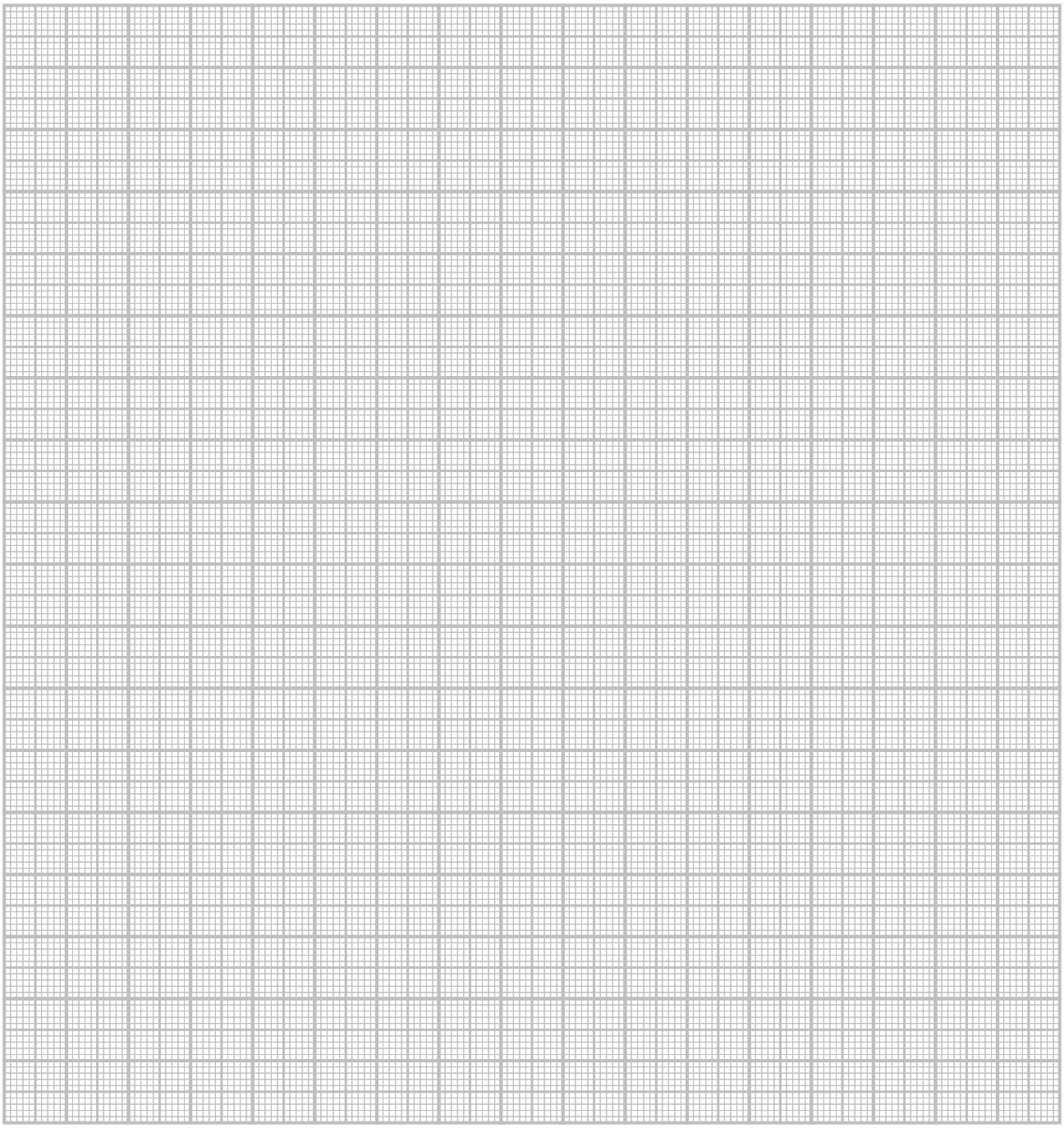


Draw a bar graph

The following chart shows the price of crude oil in dollars in each year (from google search)

Year	2003	2009	2015	2021
Price in dollars per barrel	45	80	40	60

Take 1 cm on the graph paper as 5 dollars. How many cm for 45 dollars? for 80? for 40? for 60? Draw the bar graph.



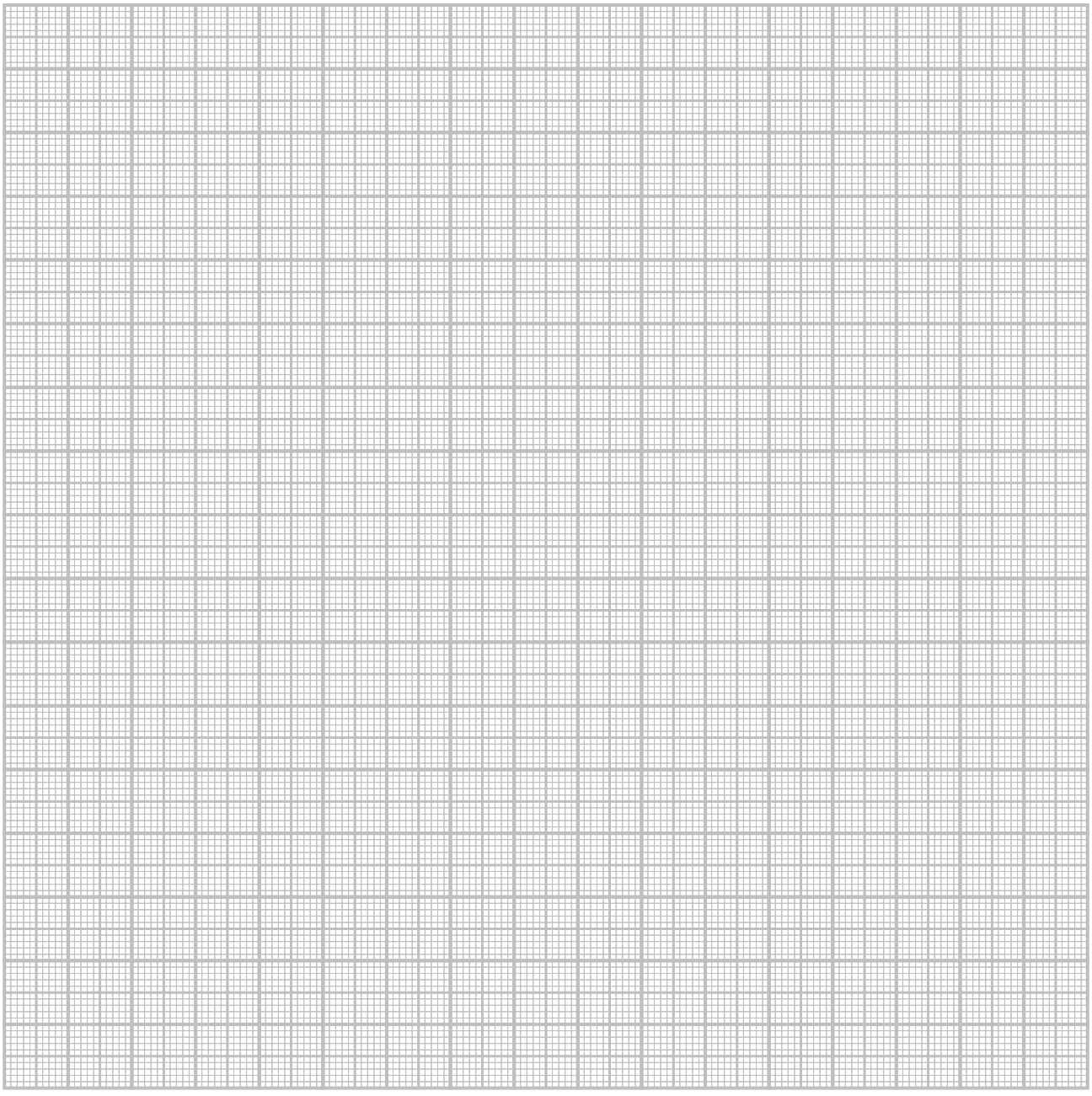
Draw a bar graph

Price of one dollar in rupees (from google search)

Year	2003	2009	2015	2021
Price of 1 dollar in ₹	45₹	47₹	65₹	72₹

Take 1 cm = 10 rupees. How many cm for 45 ₹? for 47₹ ? for 65₹ ? for 72₹ ?

On a graph paper draw the bar graph.



in the year 2003, crude oil cost 45 dollars ($) per barrel. In the same year, to buy 1 dollar we needed 45 rupees.
How many rupees did we need to buy one barrel of crude oil? (Use a calculator)

In 2021 : (do a google search)
The price of one barrel of oil = ...$
The price of one dollar = ... ₹
The price of 1 barrel of oil in rupees is ..... ₹

1 barrel = 159 litres
1 bucket = 20 litres
How many buckets in a barrel? (approximately?).....

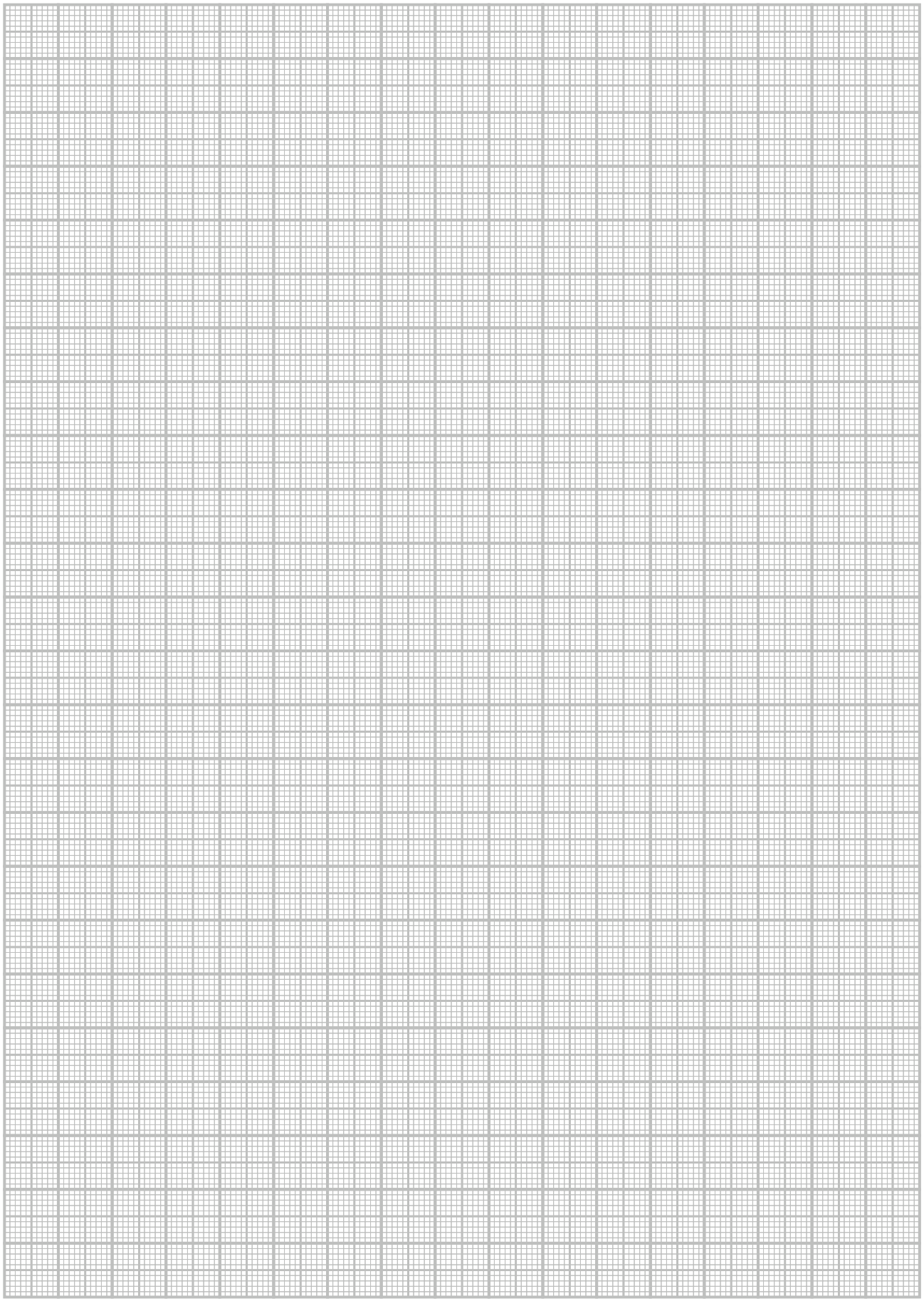
If one barrel of oil costs 60$ in 2021, what is its price in rupees ?.....
What is the price of one litre of crude oil in rupees in 2021? (Use calculator) .

Complete the following table :

Year	2003	2009	2015	2021
Price of 1 barrel of crude oil in rupees	2025	3670	2600	4200
Price of 1 litre of crude oil in rupees	13			

How did we calculate the price of one barrel of oil in rupees each year in the previous chart? (Discuss)

Take 2 cm = 10 rupees. On a graph paper draw a bar graph for the price of one litre of crude oil in each year.

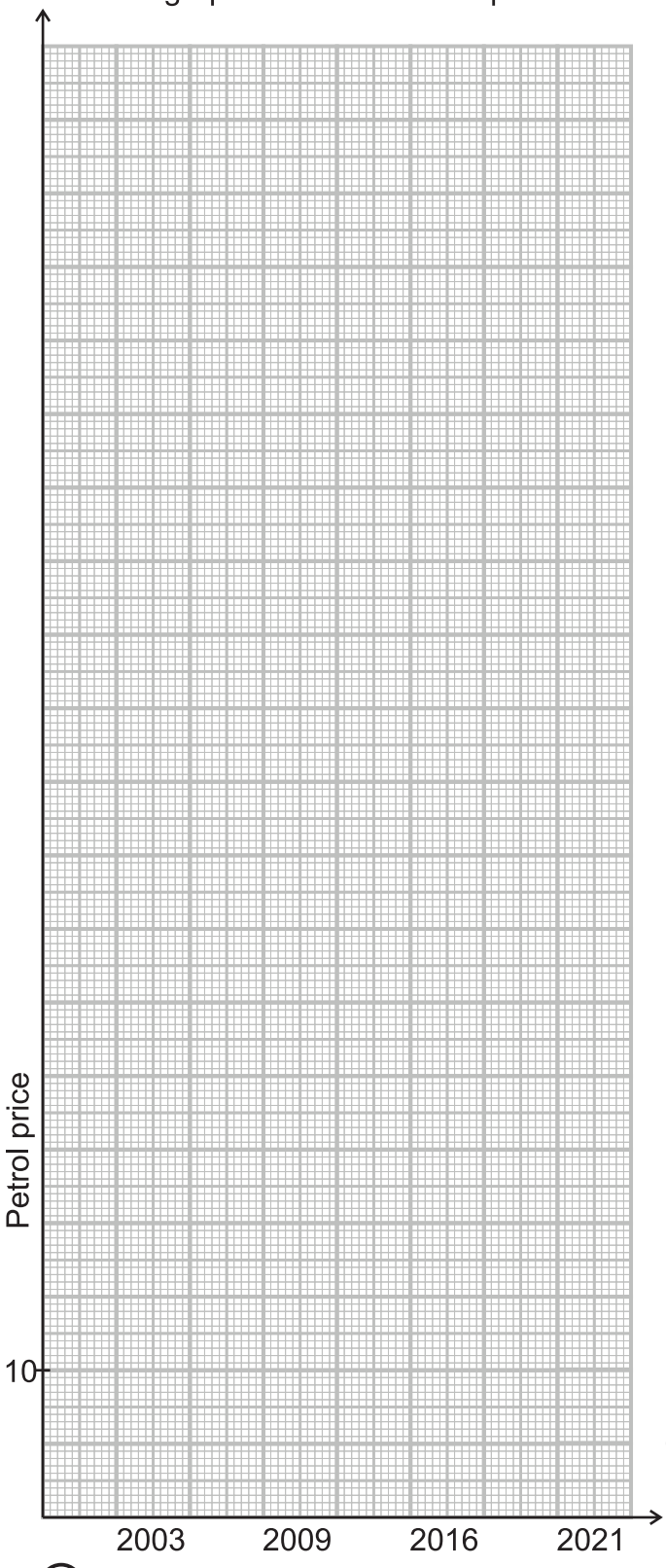


Price of petrol

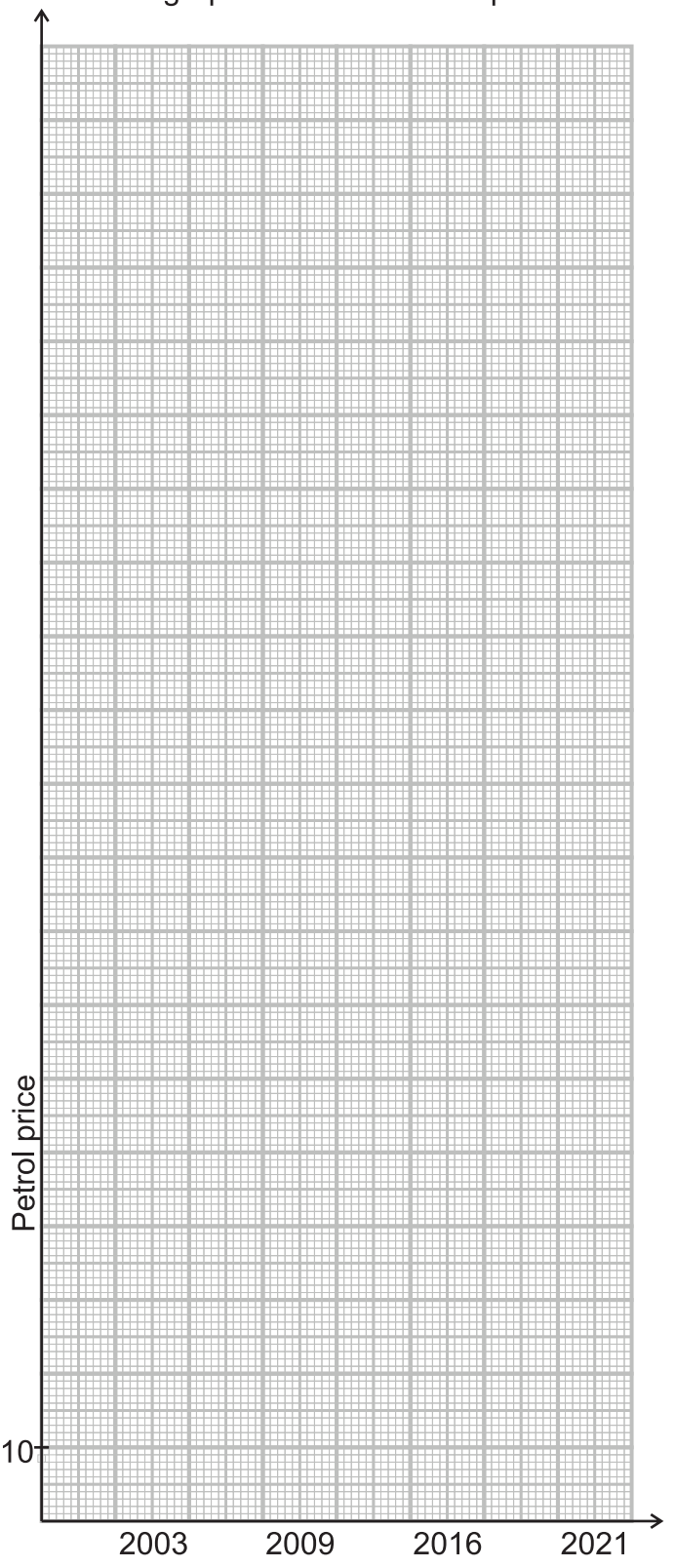
The following chart is an approximate record of the price of petrol in rupees in each year.

Year	2003	2009	2015	2021
Price of 1 litre in rupees	35	50	75	100

Bar graph with 2 cm = 10 rupees



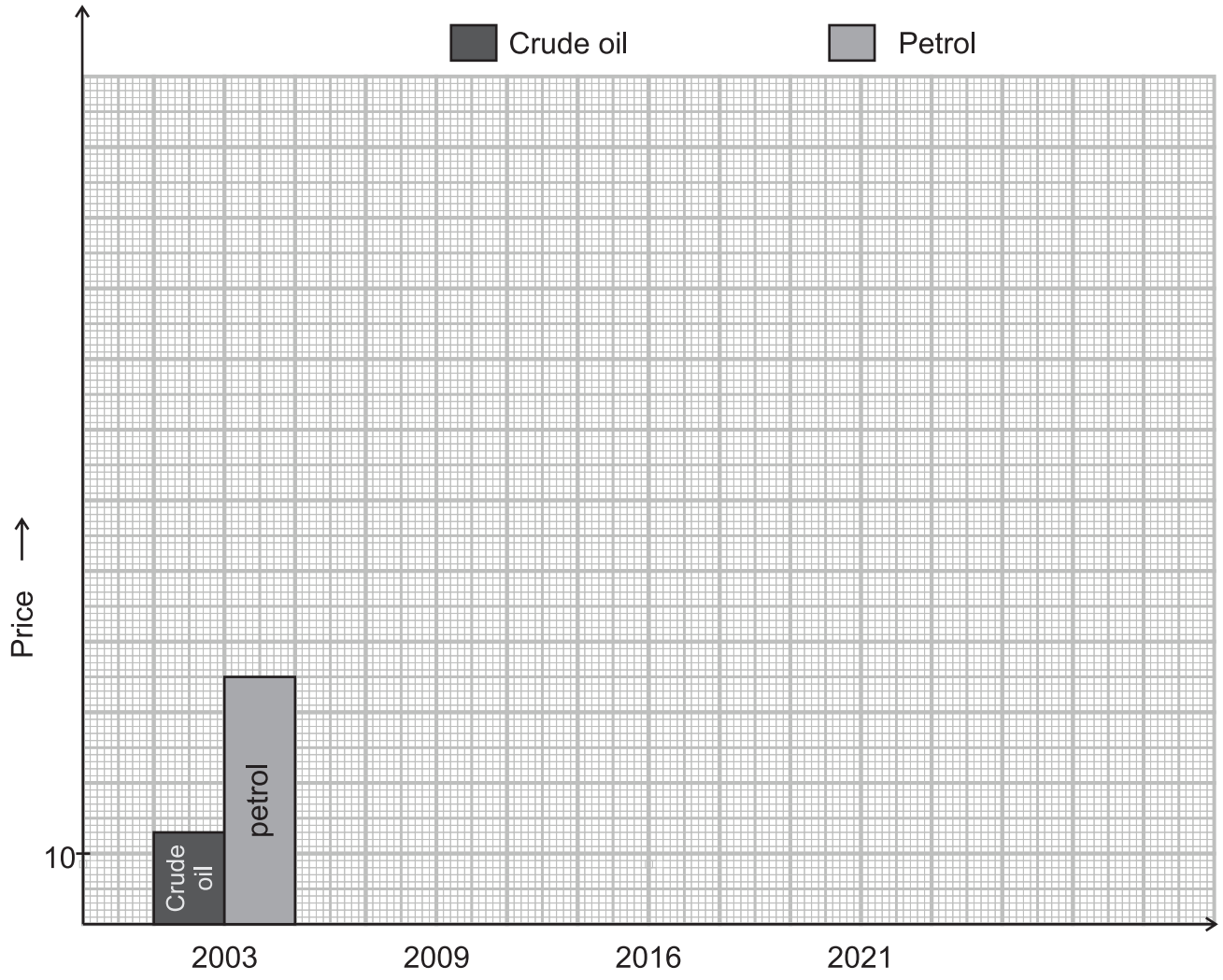
Bar graph with 1 cm = 10 rupees



Price of petrol and price of crude oil on the same graph

Year	2003	2009	2015	2021
Price of crude oil per litre	13	23	16	27
Price of petrol per litre	35	50	75	100

Take 1 cm = 10 rupees and draw the price of both crude oil and petrol on the same bar graph. This type is called as Double bar graph.



Discuss what you observe from this double bar graph? Write the main points here :

Double Bar Graph

If we want to compare the temperatures of two locations in India, Kochi and Srinagar, we can represent the data in a double bar graph.

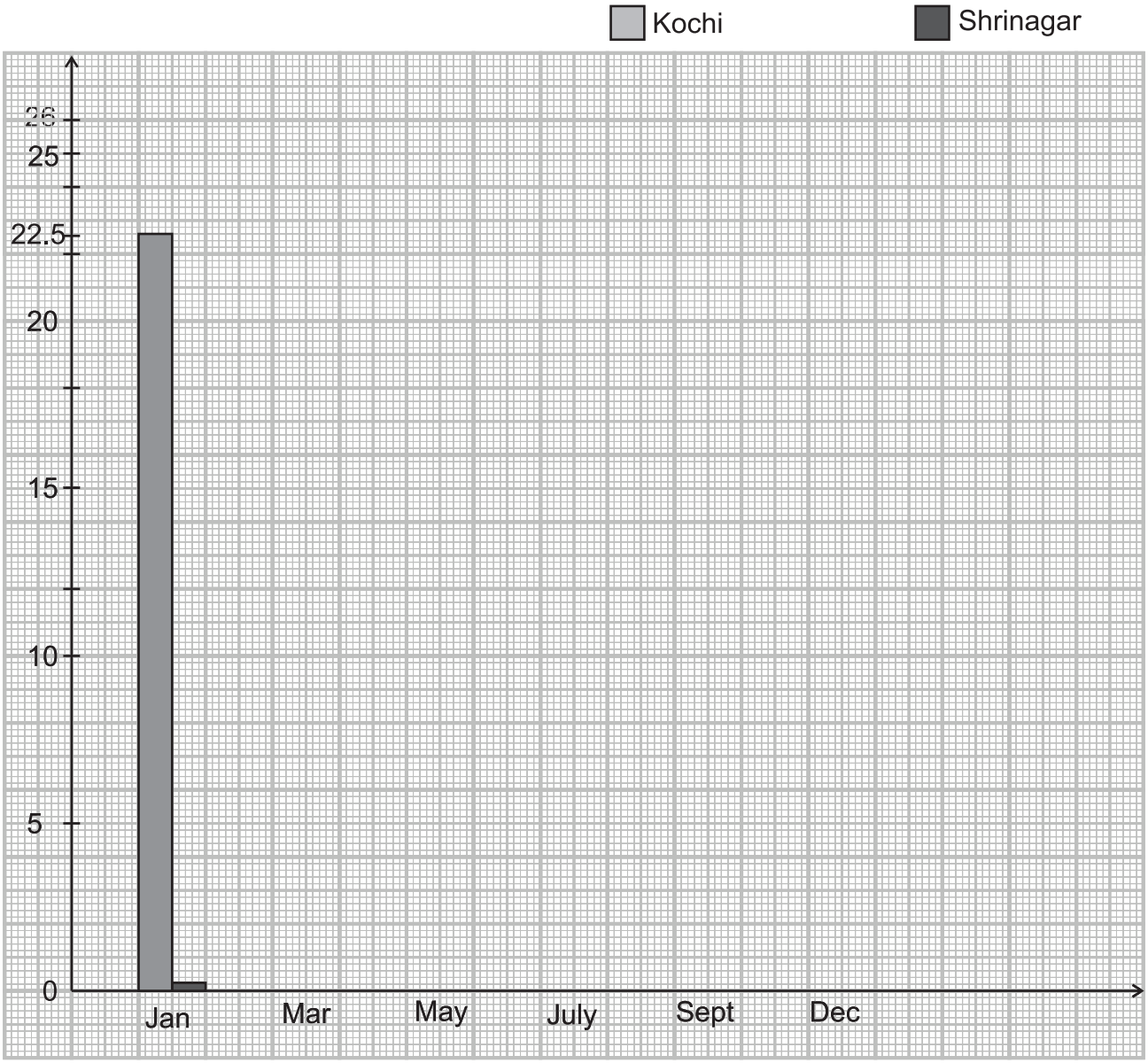
Graph of January is shown. Draw the other months.

^{0}C	Jan	Mar	May	July	Sept	Dec
Kochi	22.5	25.5	24	24	24.2	23
Shrinagar	0.3	6.5	16	21	18.5	3

Which place is usually warmer?.....

In which month is the temperature difference between Kochi and Shrinagar Maximum?.....

Study the graph and discuss what you see from the graph.



“Let’s improve our marks”

In a school all the 18 students of class 7 were promoted to class 8.

Their math teacher looked at the final test marks in math, which were as follows :

62, 69, 22, 50, 62, 79, 63, 74, 27, 25, 44, 35, 75, 68, 65, 35, 45, 52

The teacher doesn’t need exact marks of each child.
She wants to understand approximately where the children are.
So, she decided to make frequency distribution chart.
For that she decided the range as 0-10, 10-20, 20-30... etc. (Boundary value to be included in higher class.)

You make your own frequency distribution chart of the above data.

Groups	Tally marks	Frequency
0 -10		0
10 - 20		0
20 - 30	III	3
30 - 40		
40 - 50		
50 - 60		
60 - 70		
70 - 80		
80 - 90		
90 - 100		
	Total	

From this table the teacher calculated that the class average mark (mean score) was 52.77.

How did she arrive at this figure?

What, approximately, was the total number of marks obtained by all the students together?
Discuss with the whole class.

You have the following marks of all 18 students.
Find out the average (mean).
How close is the teacher's calculation?

62, 69, 22, 50, 62, 79, 63, 74, 27, 25, 44, 35, 75, 68, 65, 35, 45, 52

Teacher's calculation of average = 52.77
Actual average = (Total actual marks) / 18
= .....

Teacher and students had a meeting. "Let's make a special effort in the next three months, and try to improve everyone's performance."

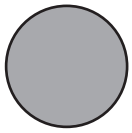
After three months they held another test of similar difficulty. The total marks increased to 1172. The frequency chart of marks was as follows :

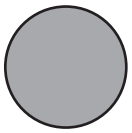
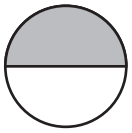
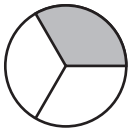
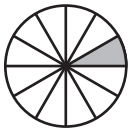
Groups	Frequency
0 -10	0
10 - 20	0
20 - 30	0
30 - 40	0
40 - 50	3
50 - 60	4
60 - 70	5
70 - 80	3
80 - 90	2
90 - 100	1
Total	

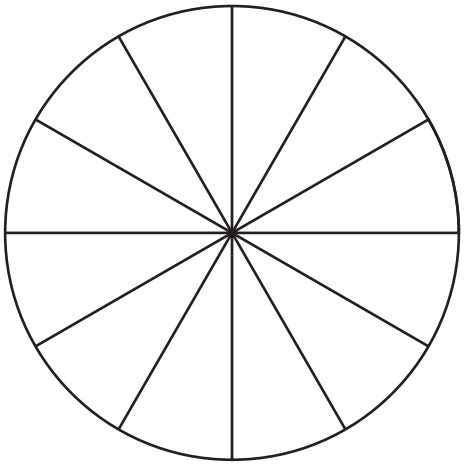
What is the mean (approximate) of the class in this second test?

What is the increase over the previous mean?

This is one whole. We write it as 1 and express in percentage as 100%.
The angle at the centre of full circle is 360^0.
Fill in the blank squares for the parts of this whole.



Fraction	Percent	Draw and shade	Angle of the coloured portion at the centre of the circle
1	100%		360^0
$\frac{1}{2}$	$\frac{1}{2} = \frac{50}{100} = 50\%$		$\frac{1}{2} = \frac{180}{380} \rightarrow 180^0$
$\frac{1}{4}$			
			120^0
$\frac{1}{6}$			
	10%		
$\frac{1}{12}$			
$\frac{1}{12}$			
			45^0
	30%		



Shade 30^0 in red.
What is the fraction represented?

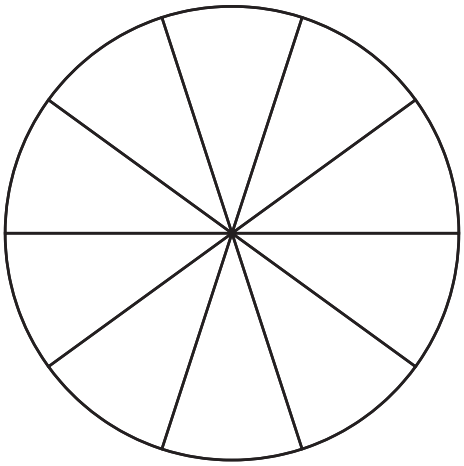
Shade 60^0 in blue.
What is the fraction represented?

Shade 90^0 in green.
What is the fraction represented?

Shade 180^0 in black.
What is the fraction represented?

A circle is divided into 10 equal parts.

What is the angle in each part?



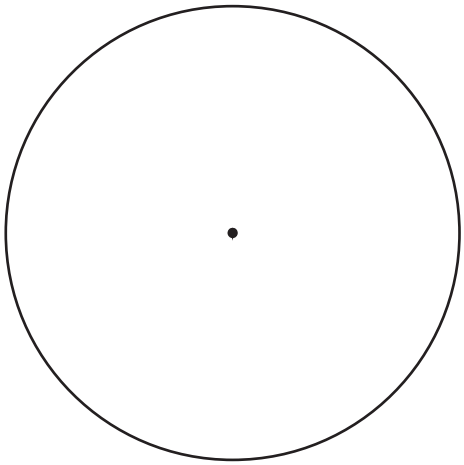
Shade $\frac{1}{5}$

Shade $\frac{3}{10}$

Shade $\frac{4}{10}$

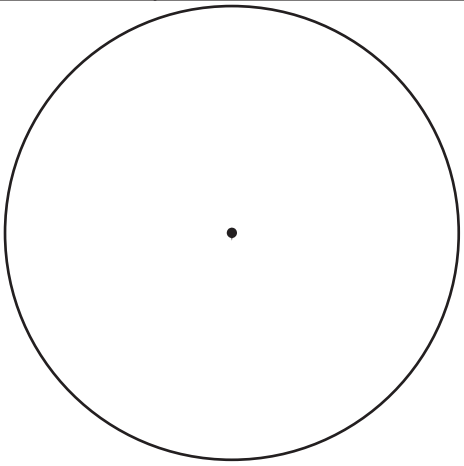
What percentage is remaining?

A family spends 50% of its income on food.
It spends 1/5 th of its income on house rent, water and electricity.
It spends 1/5 th of its income on education.
Draw a pie chart of the above expenditure.
How much portion of its income remains for other needs? Is it sufficient? Discuss.



There are 360 students in a school. 180 come by a motorbike, 120 walk to the school and 60 come by car. Draw a pie chart.

Mode of transport	Number of students	Angle in 360 degrees
Motorbike	180 out of 360	180^0
Walk		
Car		



Every 10 years there is a census of the population of India and all states.
In 2001 and 2011 census the population of the state of Mizoram was as follows :

2001	2011	2021
8,88,573	10,91,014	?

Use a calculator and find out the percentage increase in the population between 2001 and 2011.

The census 2021 is due but yet to be conducted.

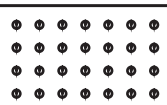
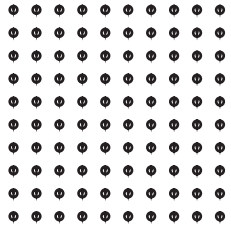
What do you expect the population of Mizoram in 2021? Make a reasonable assumption. Write your calculation here :

Using graph paper draw a bar graph of population of Mizoram in 2001, 2011, 2021.

What will you use as your unit scale?

I.e. 1 cm = ... Population?

Squares numbers

Dots arranged in square shape	Write as multiplication	Write as square	Square number
	1 x 1	1^2	1
	2 x 2	2^2	4
			
			
			
			
			
			
			
			

$7^2 = 49$. We read this as 7 squared is equal to 49

We say, 'square root' of 49 is 7. We write it as $\sqrt{49} = 7$

$7^2 = 49$ Therefore $\sqrt{49} = 7$

$11^2 = 121$ Therefore $\sqrt{121} = 11$

$12^2 = 144$ Therefore $\sqrt{} =$

$13^2 = 169$ Therefore $\sqrt{} =$

$20^2 = 400$ Therefore $\sqrt{} =$

$21^2 = 441$ Therefore $\sqrt{} =$

$25^2 = 625$ Therefore $\sqrt{} =$

$30^2 = 900$ Therefore $\sqrt{} =$

$33^2 = 1089$ Therefore $\sqrt{} =$

$\sqrt{1089} = 33$ Therefore $33^2 = 1089$

$\sqrt{100} = 10$ Therefore $10^2 = 100$

$\sqrt{81} = 9$ Therefore

$\sqrt{144} = 12$ Therefore

$\sqrt{529} = 23$ Therefore

$\sqrt{400} = 20$ Therefore

$\sqrt{1024} = 32$ Therefore

$\sqrt{225} = 15$ Therefore

$\sqrt{625} = 25$ Therefore

$\sqrt{324} = 18$ Therefore

$\sqrt{2500} = 50$ Therefore

Use calculator and find squares of 1 to 30

Number	Square
1	1
2	
3	
29	
30	900

Observe the square numbers. Fill in this table.

Digit in unit's place of the square	Which numbers' square have this digit in unit's place?
1	1, 9, 11, 19, 21, 29
2	
3	
4	
5	
6	
7	
8	
9	
0	

Can you list down the digits that can never be in the unit's place of a perfect square?

A number having any of these digits in the unit's place cannot be a perfect square.

Refer to the table you made on the previous page.
If the digit in unit's place of a number is 3, the digit in unit's place of its square will be 9.
If the digit in unit's place of a perfect square is 9, can we say that the digit in unit's place of its square root will be always 3? No. It may be 3 or 7.

Digit in unit's place of the square	Digit in unit's place of the square-root
1	1, 9
4	
5	
6	
9	
0	

(2, 3, 7 and 8 do not come in the unit's place of a square.)

Refer to the above table and guess the digit

Number	Digit in the unit's place of its square
52	4
37	
325	
5789	
52698	

Perfect Square	Digit in unit's place of its square-root
2809	3 or 7
3249	
7396	
9604	
3025	

35782^2 = 35782 x 35782 Digit in unit's place will be 4 because (2 x 2) = 4

35789^2 = 35789 x 35789 Digit in unit's place will be 1 because (9 x 9) = 81, which has 1 unit.

Guess the digit in unit's place (ending digit) of the square of the following numbers :

Number	Unit's digit of the square
23	
32	
51	
37	
69	
84	
55	
62	
70	
325	
1325	
231325	
567831	
35782	
1234	
9106	
52698	
26387	
54328987	
54328983	
54328980	
54328981	
54328986	
54328989	
54328984	
54328982	

Count the number of ending zeros in the square, observe the pattern and complete the table :

10^2	=	100
20^2	=	400
30^2	=	900
40^2	=	1600
80^2	=	6400
90^2	=	8100
100^2	=	10000
200^2	=	
300^2	=	
700^2	=	
900^2	=	
50^2	=	
500^2	=	
5000^2	=	

Could you observe any pattern? Write what you observed .

.....

.....

.....

What do you notice about the number of zeros at the end of the number and the number of zeros at the end of its square?

.....

.....

.....

Can we say that a square number can have only even number of zeros at the end.
If a number has odd number of zeros at the end, (e.g. 4000), it cannot be a perfect square.

Finding square of a number

$(23)^2 = (20 + 3)^2$

$= (20)^2 + (2 \times 20 \times 3) + (3)^2$

$= 400 + 120 + 9$

$= 529$

$(32)^2 = (30 + 2)^2$

$(41)^2 = (40 + 1)^2$

$(53)^2 =$

$(44)^2 =$

$(24)^2 =$

$(33)^2 =$

$(19)^2 = (20 - 1)^2$

$(28)^2 = (30 - 2)^2$

Prime factorisation

Number	Factors	Square	Factors of square
6	2 x 3	$6^2 = 36$	36 = 2 x 2 x 3 x 3
8			
9			
10			
12			

Observe : the occurrence of a prime factor in factors of a a number and in factors of its square.

How many times a prime factor 2 comes in number 6 ? .....

How many times 2 comes in prime factors of 36?.....

How many times a prime factor 3 comes in number 6 ? .....

How many times3 comes in prime factors of 36?.....

Number	Occurrence of Factors in the number	Occurrence of Factors in its square
6	Number of 2s in factors of 6 = 1 Number of 3s in factors of 6 = 1	Number of 2s in factors of 36 = 2 Number of 3s in factors of 36 = 2
8	Number of 2s in factors of 8 = ...	Number of 2s in factors of 64 = ...
9	Number of 3s in factors of 9 = ...	Number of 3s in factors of 81 = ...
10	Number of 2s in factors of 10 = ... Number of 5s in factors of 10 = ...	Number of 2s in factors of 100 = ... Number of 3s in factors of 100 = ...
12	Number of 2s in factors of 12 = ... Number of 3s in factors of 12 = ...	Number of 2s in factors of 144 = ... Number of 3s in factors of 144 = ...

In prime factorization of a square number, each prime factor appears twice.

Let's use this to find the square-root of a square number.

1. Write the prime factors
2. Make pairs of same factors
3. Take product of one factor from each pair.
4. This is your square root.

$49 = \underline{7 \times 7}$

$\sqrt{49} = 7$

$36 = \underline{2 \times 2} \times \underline{3 \times 3}$

$\sqrt{36} = 2 \times 3$

$64 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2}$

$\sqrt{64} = 2 \times 2 \times 2 = 8$

$900 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{5 \times 5}$

$\sqrt{900} = 2 \times 3 \times 5 = 30$

$6400 =$

$\sqrt{6400} =$

$625 =$

$\sqrt{625} =$

$1089 =$

$\sqrt{1089} =$

$1764 =$

$\sqrt{1764} =$

If all the prime factors form pairs the number is a perfect square.,

Number	Prime Factors	Is it a perfect square?
4	2 x 2	Yes
6	2 x 3	No
18	2 x 3 x 3	No, one 2 doesn't have a partner. So, if we multiply by 2 we get 36, which is a square.
125	5 x 5 x 5	No, 5 needs a partner. So, if we multiply by 5 we get 625, which is a square.
90		
26		
64		
14		
24		
50		
81		
144		
225		
80		

Patterns with square numbers

(1)	2	3	(4)	5	6	7	8	9	10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34		
35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50		

Circle all the square numbers.

Can you find the number of non-square numbers between two consecutive square numbers?

Between	Non-square numbers	Number of Non-square numbers
1^2 to 2^2	2, 3	2
2^2 to 3^2	5, 6, 7, 8	4
3^2 to 4^2		
4^2 to 5^2		
5^2 to 6^2		
9^2 to 10^2		

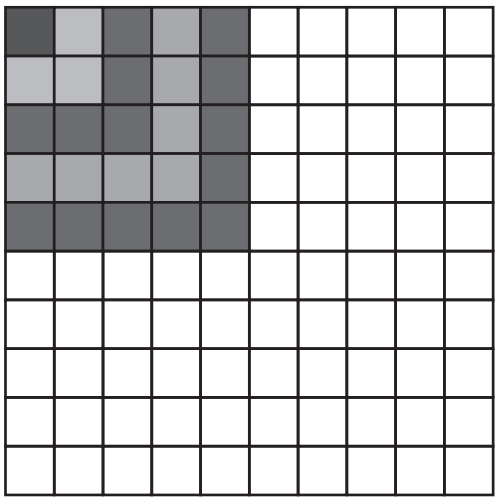
Can you observe any pattern?

.....

.....

Pattern with consecutive odd numbers

Colour one L shape when you add the next odd number.



$1 = \quad 1 \quad = 1^2$

$1 + 3 = \quad 4 \quad = 2^2$

$1 + 3 + 5 =$

$1 + 3 + 5 + 7 =$

$1 + 3 + 5 + 7 + 9 =$

$1 + 3 + 5 + 7 + 9 + 11 =$

$1 + 3 + 5 + 7 + 9 + 11 + 13 =$

Can you observe any pattern?

Can you predict the following sums?

$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 =$

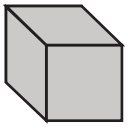
$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 =$

$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 =$

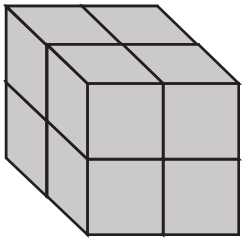
$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 =$

Cubes and cube roots

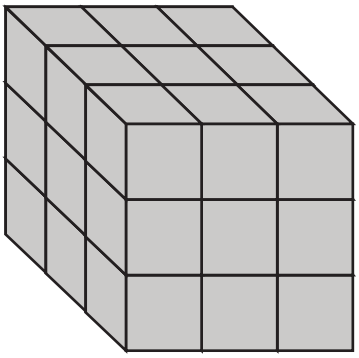
Make cubes of different sizes using unit cubes or Jodo blocks. First three cubes are shown here. Fill the table below. Use calculator to find the perfect cubes.



Each side = 1 unit
Total number of cubes = 1



Each side = 2 units
Total number of cubes
= 2 x 2 x 2 = 8



Each side = 3 units
Total number of cubes
= 3 x 3 x 3 = 27

Side of the cube	Volume of the cube (length x breadth x height)	Cube number (Perfect cube)
1	1 x 1 x 1	1
2	2 x 2 x 2	
3		
4		
5		
6		
7		
8		
9		
10		

You may use calculator or refer to the chart on previous page to fill in the numbers in this chart.

Cube of 2 is 2 x 2 x 2 which is 8. It is written as 2^3 and is read as 'two raised to three'.

A number multiplied to itself 3 times to get its cube (Long form)	Short form (Using index or power)	Cube number (Perfect cube)
5 x 5 x 5	5^3	125
8 x 8 x 8		
10 x 10 x 10		
	6^3	
	9^3	
		64
		343

Cube of 2 is 2 x 2 x 2 which is 8. Cube root of 8 is 2. It is written as $\sqrt[3]{8}$

Find using calculator and the previous chart :

1) 12^3

2) $\sqrt[3]{1000}$

3) 25^3

4) $\sqrt[3]{8000}$

Use calculator to find the cubes of following numbers :

Number	Cube
63	2,50,047
46	
50	
75	
82	

Number	Cube
21	
69	
34	
37	
28	

Observe the above table.
The digit in unit's place of 63 is 3.
The digit in unit's place of its cube is 7.
If the number has 3 in unit's place,
will its cube always have 7 in unit's place?
Try out and fill this table.

Digit in unit's place of a number	0	1	2	3	4	5	6	7	8	9
Digit in unit's place of its cube	0			7						

Guess the digit in unit's place of the cube of each number. Verify using calculator.

Number	Digit in its unit's place	Digit in its unit's place of its cube as per the above table	Cube as per calculator
47			
76			
88			
90			
99			

Cube root by prime factorization :

$64 = 2 \times 32$
$= 2 \times 2 \times 16$
$= 2 \times 2 \times 2 \times 8$
$= 2 \times 2 \times 2 \times 2 \times 4$
$= \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2}$

$\sqrt[3]{64} = 2 \times 2$

Each factor that comes thrice in the cube, will come once in the cube root.

Any number is a perfect cube only if each factor appears thrice in the prime factors.

Number	Prime factors	Cube root
400	$= 4 \times 10 \times 10$ $= 2 \times 2 \times 2 \times 5 \times 2 \times 5$ $= \underline{2 \times 2 \times 2} \times 2 \times 5 \times 5$	Not a perfect cube
216	$= 2 \times 108$ $= 2 \times 2 \times 54$ $= 2 \times 2 \times 2 \times 27$ $= \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3}$	$2 \times 3 = 6$
8000		
3375		
1728		
1100		

Cube root by estimation

Refer to the following two tables which you have created earlier :

Table 1

Digit in unit's place of a number	0	1	2	3	4	5	6	7	8	9
Digit in unit's place of its cube	0	1	8	7	4	5	6	3	2	9

Table 2

Number	1	2	3	4	5	6	7	8	9	10
Cube	1	8	27	64	125	216	343	512	729	1000

Find the cube root of 17576 :

Make groups of 3 digits starting from the unit's place. We get 17 576

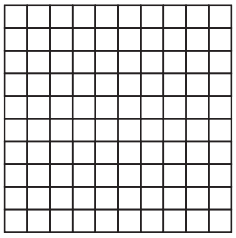
Observe the first group on right (576).
It has 6 in unit's place. Refer to table 1.
The cube root will have 6 in unit's place.

The second group is 17. Refer to table 2.
17 is between the cubes 8 and 27.
Therefore the ten's place of cube root will be 2.

Thus the cube root of 17576 is 26.

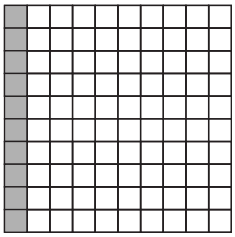
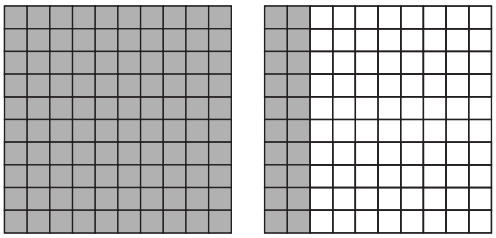
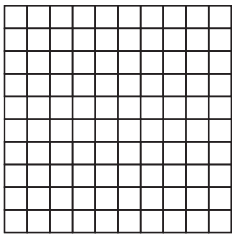
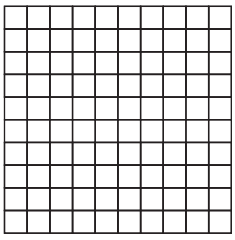
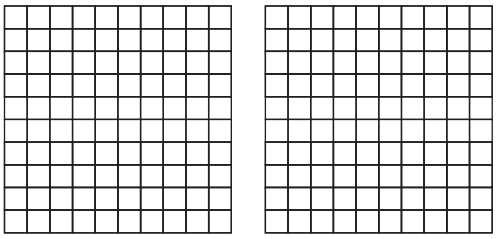
Verify using calculator.

Number (Cube)	Groups	Unit's place referring to group 1 and table1	Ten's place referring to group 2 and table2	Cube root
857375				
91125				
27000				
46656				



= 1

Colour the squares to show fraction and write it in houses and using decimal point. Fill all blank columns.

Fraction	Picture	Number written in houses	Decimal form
$\frac{1}{10}$		U • $\frac{1}{10}$ $\frac{1}{100}$ 0 • 1 0	0.1
$\frac{12}{10}$		U • $\frac{1}{10}$ $\frac{1}{100}$ 1 • 2 0	1.2
$\frac{4}{100}$		U • $\frac{1}{10}$ $\frac{1}{100}$ •	
$\frac{35}{100}$		U • $\frac{1}{10}$ $\frac{1}{100}$ •	
$\frac{170}{100}$		U • $\frac{1}{10}$ $\frac{1}{100}$ •	

Writing expanded form into short form

$300 + 20 + 4$ → 324

$300 + 20 + 4 + \frac{6}{10}$ → 324.6

$2 \times 10 + 5 \times 1 + 5 \times \frac{1}{10}$ →

$300 + \frac{5}{10}$ →

$3 \times 100 + 5 \times 1 + 6 \times \frac{1}{10} + 4 \times \frac{1}{100}$ →

$5 \times 100 + 2 \times 10 + 0 \times 1 + 3 \times \frac{1}{10} + 1 \times \frac{1}{100}$ →

Writing short form as expanded form

324 → $3 \times 100 + 2 \times 10 + 4 \times 1$

324.6 → $3 \times 100 + 2 \times 10 + 4 \times 1 + 6 \times \frac{1}{10}$

400.5 →

21.65 →

1.52 →

0.5 →

11.58 →

205.67 →

250.09 →

Dividing a number by 10, 100, 1000

number	number / 10	number / 100	number / 1000
125	12.5	1.25	0.125
42			
0.234			
1000			
500.05			

Multiplying a number by 10, 100, 1000

number	number x 10	number x 100	number x 1000
25			
17.231			
0.5463			
0.0001			
999.009			

Different ways of converting Fractions to Decimals :

1. Making denominator as 10, 100, 1000 etc. (when denominator is a factor of 10,100,1000)

$\frac{7}{2} = \frac{7 \times 5}{2 \times 5} = \frac{35}{10} = 3.5$	$\frac{15}{50} =$
$\frac{8}{125} =$	$\frac{20}{125} =$

2. Converting into improper fraction and then converting the remaining part into decimal.

$\frac{7}{2} = 3 + \frac{1}{2} = 3 + \frac{5}{10} = 3.5$	$\frac{115}{50} =$
$\frac{105}{20} =$	$\frac{28}{25} =$

3. Direct division including decimal point (Easier when denominator is a single digit number)

$\frac{1}{5} \rightarrow$

$$5 \overline{)\,1.0} \quad 0.2$$
$$-0\downarrow$$
$$10$$
$$-10$$
$$0$$

$\frac{1}{5} = 0.2$

$\frac{12}{8} \rightarrow$

Observe the numbers carefully and decide which method to use. Don't jump to procedure.

10 mm = 1 cm 100 cm = 1 m 1000 m = 1 km

millimeter (mm)	centimeter (cm)	meter (m)	kilometer (km)
1000000	100000	1000	1
1000	100	1	0.001
	1		
1			
			Diameter of earth 12742 km
		Height of Mount Everest 8848.86 m	
	Diameter of 10-rupee coin 2.7 cm		
Thickness of paper 0.1 mm			

Units of mass (weight) measurement and their conversions

1000 mg = 1 g 1000 g = 1 kg

milligram (mg)	gram (g)	kilogram (kg)
1000000	1000	1
1000	1	0.001
1	0.001	0.000001
		One liter of water weighs 1 kg
	A house-mouse weighs 19 g	
An ant weighs 3 mg		
		Indian elephant weighs 8818 kg

Unitary Method

5 mangoes cost 45 rupees. What is the cost of 1 mango? From that find the cost of 7 mangoes.

Mangoes	Cost (Rs.)
5	45
1	$\frac{45}{5}$
7	$7 \times \frac{45}{5}$

→

Mangoes	Cost (Rs.)
5	45
Skipping this step	
7	$7 \times \frac{45}{5}$

$$\frac{\square}{\square} = \frac{\square}{\square}$$

---

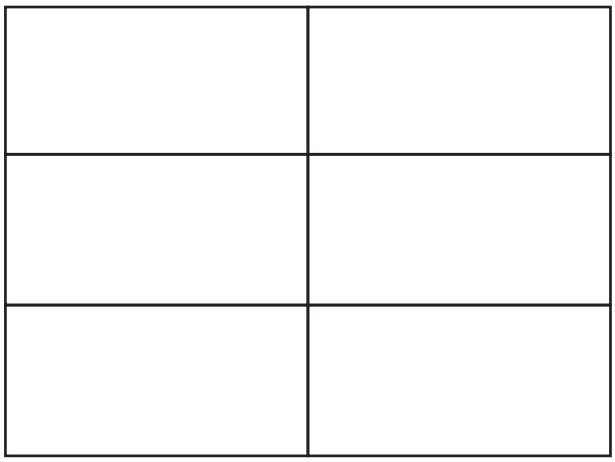
240 km in 4 hours. How many km in 5 hours?

Hours	km

$$\frac{\square}{\square} = \frac{\square}{\square}$$

_____, _____, _____, _____ are in proportion.

10 rupees off on purchase of 100 rupees. How many rupees off on purchase of 60 rupees?



$$\frac{\square}{\square} = \frac{\square}{\square}$$

_____, _____, _____, _____ are in proportion.

Read the table below. Write the question in words. Find the answer.

_____

_____

_____

_____

Petrol in lit	km
3	60
5	?

$$\frac{\square}{\square} = \frac{\square}{\square}$$

_____, _____, _____, _____ are in proportion.

A car goes 20 km in 1 liter petrol. How many liters of petrol will be needed to go 100 km?

liter	km

$$\frac{\square}{\square} = \frac{\square}{\square}$$

_____, _____, _____, _____ are in proportion.

---

4 notebooks cost Rs. 80/-. How many notebooks can you get in 200 rupees?

Manas walked 10 km in 2 hours. How much distance will he walk in 3 hours?

Ratio and percentage

Ratio is comparison of two quantities by division.

8 glasses of fruit pulp is mixed with 12 glasses of water to make juice. Find the following ratios :

Total quantity of fruit juice = ...

$\frac{\text{Fruit pulp}}{\text{Water}} = \square$ $\frac{\text{Fruit pulp}}{\text{Total juice}} = \square$ $\frac{\text{Water}}{\text{Total juice}} = \square$

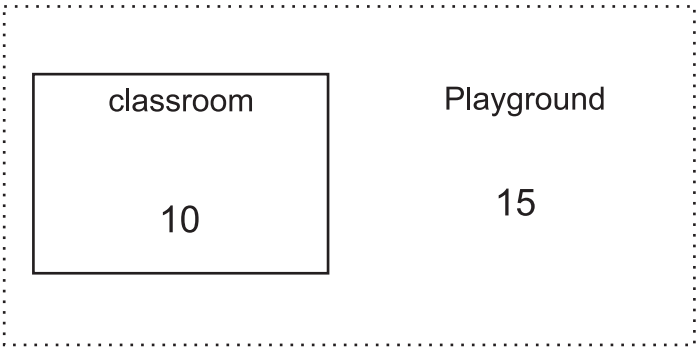
Find percentage of fruit pulp in total juice :

$\frac{\text{Fruit pulp}}{\text{Total juice}} = \frac{\square}{\square} = \frac{\square}{100} =$ ..... %

Find percentage of water in total juice :

Teacher guided problems with whole class. Use calculator.

There are 10 students in the classroom and 15 students on the playground. Find the percentage of students at each location.



% of students in the classroom =

% of students on the playground =

Data of Serchhip district in the census of 2011 and 2001 is given. Answer the following questions.

	Year 2011	Year 2001
Total Population	64,937	53,861
Male	32,851	27,380
Female	32,086	26,481
Total Literates	54,476	42,582
Male Literates	27,598	21,906
Female Literates	26,878	20,676

Check the data. Whether male and female population adds to total population.

Also check whether the male and female literates add up to total literates.

What is the ratio of number of males to total population?

What is the percentage of males in total population?

What is the ratio of number of females to total population?

What is the percentage of females in total population?

What is the ratio of literate people to total population?

What is the percentage of literate people in total population?

What is the ratio of literate males to total males?

What is the percentage of literate males in total males?

What is the ratio of literate females to total females?

What is the percentage of literate females in total females?

Total population in 2001 was ..... Total population in 2011 was .....

Increase in the population from 2001 to 2011 was .....

In 53861 , there is an increase of 11076

In 100, there is an increase of (100 x 11076) / 53861 = 20.56 % .

Find the percentage increase in the following factors. Fill the following table :

	% increase in 10 years Kum 10 hnu a percentage pun chhoh na
Total population	20.56
Total males	
Total females	
Literate males	
Literate females	

Teacher guided problems with whole class. Use calculator.

Data of covid cases in Serchhip as of 8th June 2021 is as follows :

Total cases = 651
Recoveries = 614
Deaths = 3
Active cases = 34

Check the data. Is total cases = recoveries + deaths + active cases ?.....

Keep aside active cases. Total cases - active cases = 651 - 34 = 617

Recovery percentage = (614 / 617) * 100 = ...

Death percentage = ...

In the same manner find the recovery and death percentage for whole Mizoram.

Total cases = 13994
Recoveries = 10769
Deaths = 57
Active cases = 3168

Check the data. Is total cases = recoveries + deaths + active cases ?.....

Recovery percentage =

Death percentage =

Percentage increase in petrol price

Petrol price in Delhi in 2010 was Rs. 48 per liter. In 2015 it is Rs. 60.50 per liter.
Find the percentage increase in petrol price between 2010 to 2015 years.

Increase in price = 60.50 - 48 = 12.50

In 48 there is increase of 12.50
In 100, there is increase of (100 x 12.50)/48 = 26% increase.

Petrol price in Delhi in 2015 was Rs. 60.50 per liter. In 2020 it was Rs.79 per liter.
Find the percentage increase in petrol price between 2015 to 2020.

Increase in price =

Percentage increase =

Petrol man percentage pun na

Kum 2010 a Delhi a petrol man chu liter khat ah cheng 48 ania, kum 2015 ah liter khat ah cheng 60.50 ani thung. Kum 2010 atanga kum 2015 inkar a petrol man percentage pun chhoh na zawng chhuak rawh.

A man a punna = 60.50- 48 = 12.50

48 ah chuan 12.50 in a pung a

100 ah chuan (100x 12.50)/48-26% in a pung thung.

Kum 2015 a Delhi a petrol man chu liter khat ah cheng 60.50 ani a. Kum 2020 ah liter khat ah cheng 79 ani thung. Kum 2015 atanga kum 2020 inkar a petrol man percentage pun chhoh na zawng chhuak rawh.

A man a punna =

Percentage pun na =

Profit and Loss

How do small shops or stalls run? Discuss your experience in the whole class.

Selling of products - (No processing done)

Shopkeeper purchases some items from the wholesale market. She sells it in retail shops / on the roadside stalls by adding small profit to the cost price. (Cost price + Profit) is her (Selling Price). Her family runs on the profit earned during each month. Sometimes she has to sell it at a price less than the cost price. Sometimes the perishable items get rotten and all her money paid is wasted. She bear a loss. It then becomes difficult to run the family.

Selling of processed products -

How does a restaurant or food stall run? They purchase some raw materials. Cook some items and sell at some price.

(Cost of raw materials + a component of other charges like rent of the shop, electricity etc + Labour charges + charges for owner's efforts + profit) = Selling price

Selling of services :

A tailor in your village or town stitches clothes for you and charges for her/his services. During festival season, the tailor has a lot of work. She can earn well. But at some other times there is not much work. During lockdown they had no work. Then they can't earn.

Write the names of 5 such services that we take and how they earn -

1)

2)

3)

4)

5)

Study each of the following situations. Find whether the fruitseller has got profit or loss. Find the amount of profit or loss.

A fruitseller bought 20 dozen bananas for Rs. 25/- per dozen from the wholesale market.
She sold it all at Rs. 35/- per dozen. How much of profit did she earn?
What is the percentage profit?

The same fruitseller bought 10 dozen bananas during lockdown at Rs. 20/- per dozen.
She sold 5 dozens for Rs. 30 each. Then she had to shut the shop and she could not sell the remaining bananas. They got rotten. How much is her total loss? What is the percentage loss?

After the lockdown opened she bought 15 dozen bananas at Rs. 20/- per dozen.
She sold 6 dozens for Rs. 30 each and 9 dozens for Rs. 20 each. How much is her total gain or loss? What is the percentage gain or loss?

Discount

20 percent discount means a discount of how many rupees on 90 rupees of purchase?

Purchase	Discount
100	20
90	$\frac{90 \times 20}{100}$

_____

A discount of 100 rupees on purchase of 400 rupees. What is the percentage discount?

Purchase	Discount

_____ %

20% students are absent in a school having 500 students. How many students are absent?

How do the banks work?

People deposit (keep) their extra money in their bank account. Bank gives some interest on this money to the depositors. Bank uses this money to give loans to other people or businesses. Bank charges interest from these borrowers. Discuss this with your teacher / parents.

State bank of India offers an interest of 5% per year on our deposits. It means that if we deposit 100 rupees we will get 5 rupees extra at the end of the year. If we deposit Rs. 10000/- How much interest will we get at the end of 1 year?

Principal (amount deposited)	Interest
100	5
10000	

The interest rate for senior citizens is 5.5% per year. If we deposit Rs. 10000/- How much interest will we get at the end of 1 year?

Principal (amount deposited)	Interest

If our grandmother deposits Rs. 200000/- rupees for 3 years, how much total interest will she get at the end of 3 year?

If we deposit P rupees for 1 years at 5% interest, how much interest shall we get?

Principal (amount deposited)	Interest
100	5
P	$\frac{P \times 5}{100}$

If we deposit P rupees for 1 years at R% interest, how much interest shall we get?

Principal (amount deposited)	Interest
100	R
P	$\frac{P \times R}{100}$

For principal amount P, at the rate of interest R, we get an interest of $\frac{P \times R}{100}$ for 1 year.

If we keep this amount in the bank for N years, we will get an interest of $\frac{P \times R \times N}{100}$

Use the above formula for simple interest and fill in the following table :

Principal (P)	Rate of interest (R)	Number of years (N)	$I = \frac{P \times R \times N}{100}$	Total amount to be received ($P + I$)
20000	4	1		
10000	4	2		
10000	5	3		
5000	5.5	2		
1000	5.5	1		
2000	6	2		
200000	6	2		

Generally interest is calculated as a compound interest.

(Principal + Interest) of the first year is treated as the principal for the second year and so on.

A sum of rupees 20000/- is taken as a loan for 3 years at the rate of 8% interest.

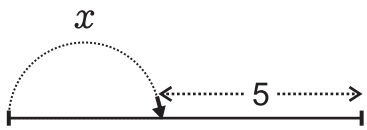
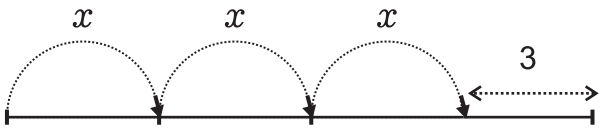
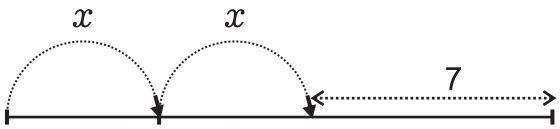
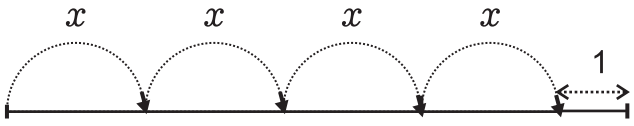
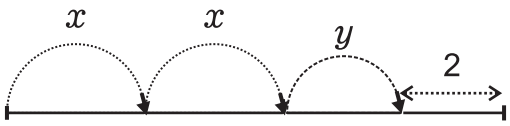
Find the compound interest at the end of 3 years.

Principal (P)	Rate of Interest (R)	Number of years (N)	$I = \frac{P \times R \times N}{100}$	Total amount to be received ($P + I$)
20000	8	1	$\frac{20000 \times 8}{100} = 1600$	21600
21600	8	1		

Find compound interest on Rs. 12600/- for 2 years at 10% per annum compounded annually.

Find compound interest on Rs. 8000/- for 2 years at 5% per annum compounded annually.

Number line and algebraic expressions

Number line (Distances should be taken approximately)	Expression in long form	Expression in short form
	$x + 5$	$x + 5$
	$x + x + x + 3$	$3x + 3$
		
		
		
	$y + y + y + y + 3$	
		$x + 3y + 2$
		$2x + y + m$

Monomial, Binomial, Trinomial and Polynomials

Expression	Type of polynomial
$4x$	Monomial
$3a + b$	Binomial
$2a + b + c$	Trinomial
$3xy + 4x - 2y + 3x^2 + 4y^2$	Polynomial
$2x + 3y - 4z$	
$a + 4$	
$3x^2$	
$5 - 3xy$	
-9	
$10y$	
$2x + 3y - 5$	
$x^2y - xy^2 + y^2$	
$x^2 + 2x + 5$	
	Monomial
	Binomial
	Trinomial
	Polynomial

Simplify by adding like terms together

1. $2x + 3x$
   $= 5x$

2. $3x + 2x + 5$
   $= 5x + 5$

3. $x + 3x + 2x + 5$

4. $5 + 3x + 2x + 3 + x$

5. $a + b + 3a + 2b + 2a$

6. x^2+2x^2

7. $x^2 + 2x + 3x^2 + 5x + 2 + 4$

8. $2x + 3y + 4x + y$

9. $7x^2 + 3x + 4 + 2x + 5$

10. $a^2 + ab + ab + b^2$

11. $a^3+a^2b + 2ab^2 + 2a^2b + ab^2+ b^3$

12. $5x^3 + 3x^2 + 2x + 7x^3 + 4 + 5x^2 + 4x$

Simplify by adding or subtracting like terms together :

1. $5x - 2x$
   $= 3x$

2. $7x + 5 - 3x + 2$
   $=$

3. $x - 5x$

4. $7x^2 - 3x^2$

5. $8x^2 - 4x + 5 + 9x - 10$

6. $5a + 3b - 3 - 4a - 5b + 4$

7. $3pq + p + 2q - 2pq + 4p + 6q$

8. $mn - nq + qn - qm + mq - mn$

9. $2p^2q^2 - 3pq + 4 + 5 + 7pq - 3p^2q^2$

10. $4a - 7ab + 3b + 12 + 12a - 9ab + 5b - 9$

11. $a^3 - a^2b + 2ab^2 - 2a^2b + ab^2 - b^3$

12. $-5x^3 - 3x^2 - 2x - 7x^3 - 4 - 5x^2 - 4x$

Multiplication of algebraic expressions

	x
y	$x \times y = xy$

	$2x$
$3y$	$2x \times 3y = 6xy$

	$4x$
$3y$	

	-3
$5x$	

	$-5x$
-2	

	$5y$
$-2x$	

	x
x	

	$2x$
$3x$	

	$5x$
$-4x$	

	$-y$
$-y$	

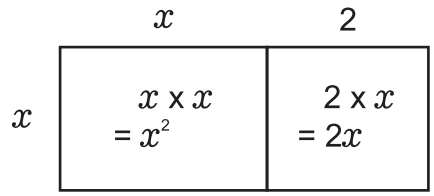
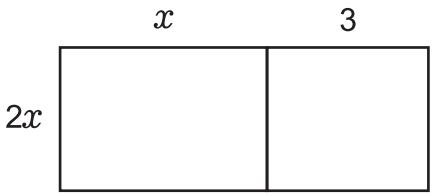
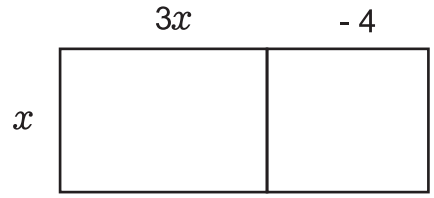
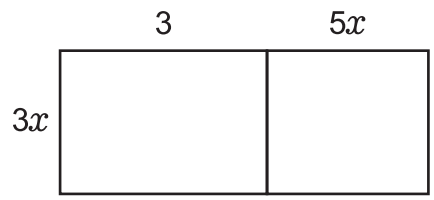
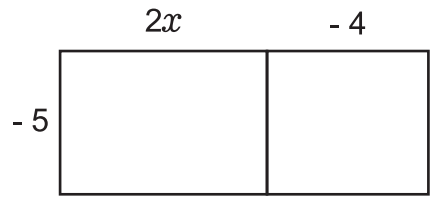
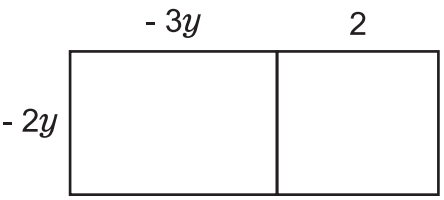
	$2y$
$3y$	

	$4y$
$3x$	

Multiplication of algebraic expressions - Write the factors in three different ways

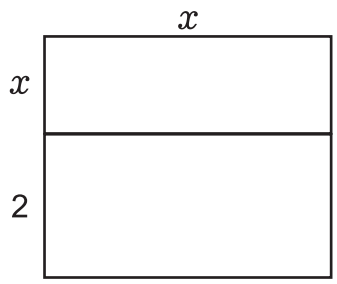
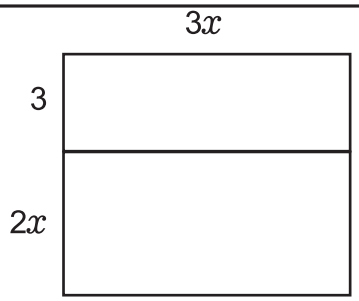
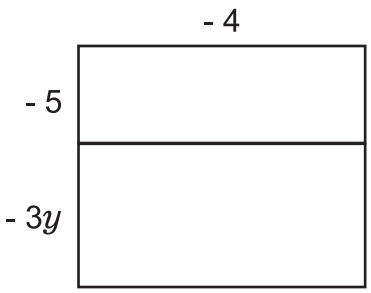
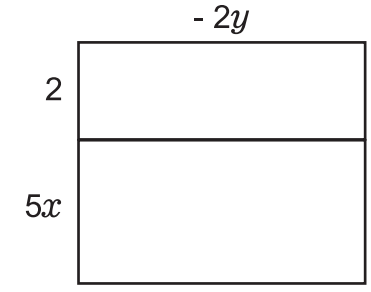
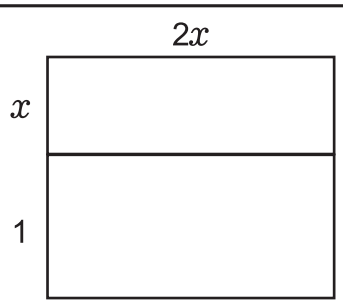
	$3y$	$2y$	$-3y$
$6xy \longrightarrow$	$2x$ $3y \times 2x = 6xy$	$3x$ $2y \times 3x = 6xy$	$-2x$ $(-3y) \times (-2x) = 6xy$
$12xy \longrightarrow$			
$20x^2 \longrightarrow$			
$-20xy \longrightarrow$			
$ab \longrightarrow$			
$x^2y^2 \longrightarrow$			

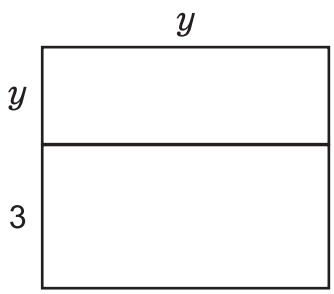
Observe the figure.
Write the products inside each rectangle.
Write the whole rectangle as multiplication and equate it with the sum of two parts.

Figure	Whole rectangle as multiplication = Whole rectangle as the sum of two parts
	$(x + 2) \times (x) = x^2 + 2x$
	
	
	
	
	

Product (factors)	Rectangle	Expansion (Expression)
$(3x + 2) \times (2x)$	$3x$ | 2 $2x$ | $3x \times 2x = 6x^2$ | $2 \times 2x = 4x$	$6x^2 + 4x$
$(3 + 4x) \times (5x)$		
$(2y - 3) \times (4y)$		
$(3 + 4y) \times (-5y)$		
$(x + y) \times (a)$		
$(5x + 4) \times (-3x)$		

Observe the figure. Write the products inside each rectangle.
Write the whole rectangle as multiplication and equate it with the sum of two parts.

Figure	Whole rectangle as multiplication = Whole rectangle as the sum of two parts
	$x \times (x + 2) = x^2 + 2x$
	
	
	
	

Product (factors)	Rectangle	Expansion (Expression)
(y) x (y + 3)		$y^2 + 3y$
$(5x)$ x ($4x$ + 2)		
$(2y)$ x ($3y$ - 3)		
(3 + $4y$) x ($-5y$)		
a x (b + c)		

Draw rectangle and write the expansion.

$(x+2)\ (x+3)$

	x	2
x	x^2	$2x$
3	$3x$	6

$x^2 + 2x + 3x + 6$
$= x^2 + 5x + 6$

$(y+3)\ (y+4)$

$(2x - 2)\ (3x + 5)$

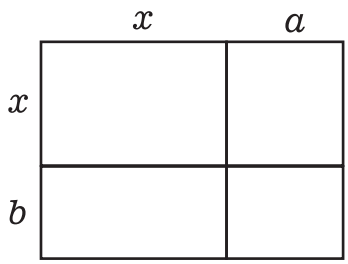
$(3x - 3)\ (5x - 3)$

$(y + 4)\ (2y - 2)$

$(a + b)\ (c + d)$

Draw rectangle and write the expansion.

$(x + a)(x + b)$



$(x - a)(x + b)$

$(x + a)(x - b)$

$(x - a)(x - b)$

$(2x - 3a)(3x - 2b)$

$(-2y - 3)(y - 5)$

Revisit (Draw a figure if you find it necessary)

$x + 2x =$

$3x + x + 2 =$

$(x)(x) =$

$(2x)(3x) =$

$(2x) + (3x) =$

$(2x) - (3x) =$

$(2x)(-3x) =$

$(-2x)(3x) =$

$(-2x)(-3x) =$

$(x)(-4x) =$

$(5x)(-x) =$

$(5x)(-4) =$

Revisit (Draw a figure if you find it necessary)

$x + x + x =$

$(x)(x)(x) =$

$x + x + x + x =$

$(x)(x)(x)(x) =$

$(2x)(3x^2) =$

$(2x^2)(3x) =$

$(4x^2)(-3x) =$

$(4x)(-3x^2) =$

$(-4x)(-3x^2) =$

$(-4)(3x^2) =$

$(4)(-3x^2) =$

$(2x)(3x) =$

$(a^2)(b^2) =$

$(a^2)(4b^2) =$

$(a^2)(-2b^2) =$

$(-a^2)(3b^2) =$

$(a^2+b^2)(2a+3b)$

	a^2	b^2
$2a$	$2a^3$	$2ab^2$
$3b$	$3a^2b$	$3b^3$

$(a^2+b)(a+b^2)$

$(5-2x)(3+x)$

$(x+7y)(7x-y)$

$(p^2-q^2)(2p+q)$

$(a^2 + 2a + 3) (a + 2)$

	a^2	$2a$	3
a	a^3	$2a^2$	$3a$
2	$2a^2$	$4a$	6

$$a^3 + 2a^2 + 3a + 2a^2 + 4a + 6$$
$$= a^3 + 4a^2 + 7a + 6$$

$(a^2 + b^2) (2a + 3b)$

$(a - 2) (a^2 + 2a + 3)$

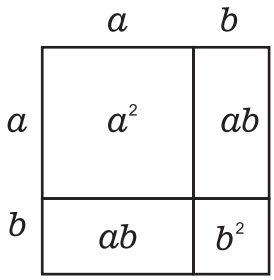
$(a - 2) (a^2 - 2a + 3)$

$(x + y)(x^2 - xy + y^2)$

$(x - y)(x^2 + xy + y^2)$

Identities

$(a+b)^2 = (a+b)(a+b)$



$a^2 + ab + ab + b^2$

$= a^2 + 2ab + b^2$

$(a+b)^2 = a^2 + 2ab + b^2$

$(a-b)^2 = (a-b)(a-b)$

$(a+b)^2 =$

$(a+b)(a-b)$

$(a+b)(a-b) =$

$(x+a)(x+b)$

$(x+a)(x+b) =$

Using Identities

Type 1 - (first term + second term)^2	$\longrightarrow$	$(a+b)^2 = a^2 + 2ab + b^2$
Type 2 - (first term - second term)^2	$\longrightarrow$	$(a-b)^2 = a^2 - 2ab + b^2$
Type 3 - (term 1 + term 2) (term 1 - term 2)	$\longrightarrow$	$(a+b)(a-b) = a^2 - b^2$
Type 4 - (term 1 + term 2) (term 1 + term 3)	$\longrightarrow$	$(x+a)(x+b) = x^2 + (a+b)x + y^2$

Decide the type for each problem. Use appropriate identity.

$(x+y)^2$ Type - 1

$(m-n)^2$ Type -

$(3x+2y)^2$ Type -

$(x+m)(x+n)$ Type -

$(2a-3)^2$ Type -

$(x+5)(x+2)$ Type -

$(2a+3)(2a-3)$ Type -

$(4p-3q)^2$ Type -

$(3x+1)(3x-1)$ Type -

$(\frac{1}{2}m+\frac{1}{2}n)(\frac{1}{2}m-\frac{1}{2}n)$ Type -

Using Identities for numerical calculations

Type 1 -	(first term + second term)^2	$\longrightarrow$ $(a + b)^2 = a^2 + 2ab + b^2$
Type 2 -	(first term - second term)^2	$\longrightarrow$ $(a - b)^2 = a^2 - 2ab + b^2$
Type 3 -	(term 1 + term 2) (term 1 - term 2)	$\longrightarrow$ $(a + b)(a - b) = a^2 - b^2$

Observe the numbers carefully.
In which of these formats can you convert them easily if you use nearest tens, hundreds or thousands etc?
Convert and use the identity to solve it.

Problem	Representing using nearest 10, 100, 1000 & type of identity	Solution
$(103)^2$	$(100 + 3)^2$ $\downarrow \quad \downarrow$ $(a + b)^2$	$a^2 + 2ab + b^2$ $= (100^2) + (2 \times 100 \times 3) + (3^2)$ $= 10000 + 600 + 9$ $= 10609$
$(102)^2$		
$(99)^2$	$(100 - 1)^2$ $\downarrow \quad \downarrow$ $(a - b)^2$	
(48 x 52)		
$(1002)^2$		
$(997)^2$		

There are 3 most important types of identities $(a+b)^2$, $(a-b)^2$ and $(a+b)(a-b)$

Type 1 - (first term + second term)^2 $\longrightarrow$ $(a+b)^2 = a^2 + 2ab + b^2$

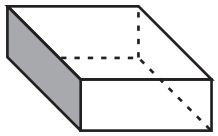
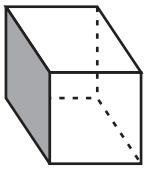
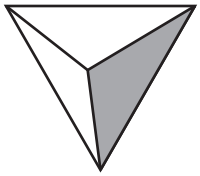
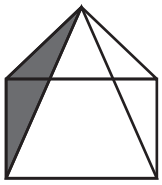
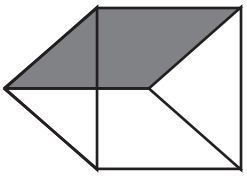
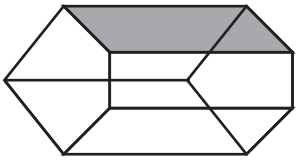
Type 2 - (first term - second term)^2 $\longrightarrow$ $(a-b)^2 = a^2 - 2ab + b^2$

Type 3 - (term 1 + term 2) (term 1 - term 2) $\longrightarrow$ $(a+b)(a-b) = a^2 - b^2$

Observe the numbers carefully.
In which of these formats can you convert them easily if you use nearest tens, hundreds or thousands etc? Convert and use the identity to solve it.

Problem	Representing using nearest 10, 100, 1000 and type of identity	Solution
103 x 97		
78 x 82		
$51^2 - 49^2$	Hint : Looks like $a^2 - b^2$ Convert to $(a+b)(a-b)$	
$153^2 - 147^2$		
$1.02^2 - 0.98^2$		
10.5 x 9.5		

Make these polyhedron using Jodo Straw kit. Count the number of faces, vertices and edges .

Polyhedra	Name	Vertices (V)	Faces (F)	Edges (E)	V + F	E + 2
	Cuboid	8	6	12		
	Cube					
	Triangular Pyramid					
	Square Pyramid					
	Triangular Prism					
	Pentagonal Prism					

Did you discover that for polyhedra, $V + F = E + 2$

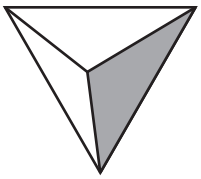
This is Euler's formula.

1. Using Euler's formula find the number of edges of a polyhedron which has 20 faces and 12 vertices. .....

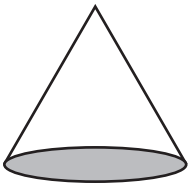
2. Find the number of faces of a polyhedron which has 18 edges and 12 vertices.....

Match the following

Cone

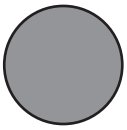


Sphere

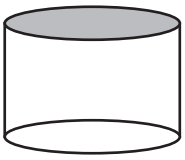


Cylinder

Cuboid



Pyramid



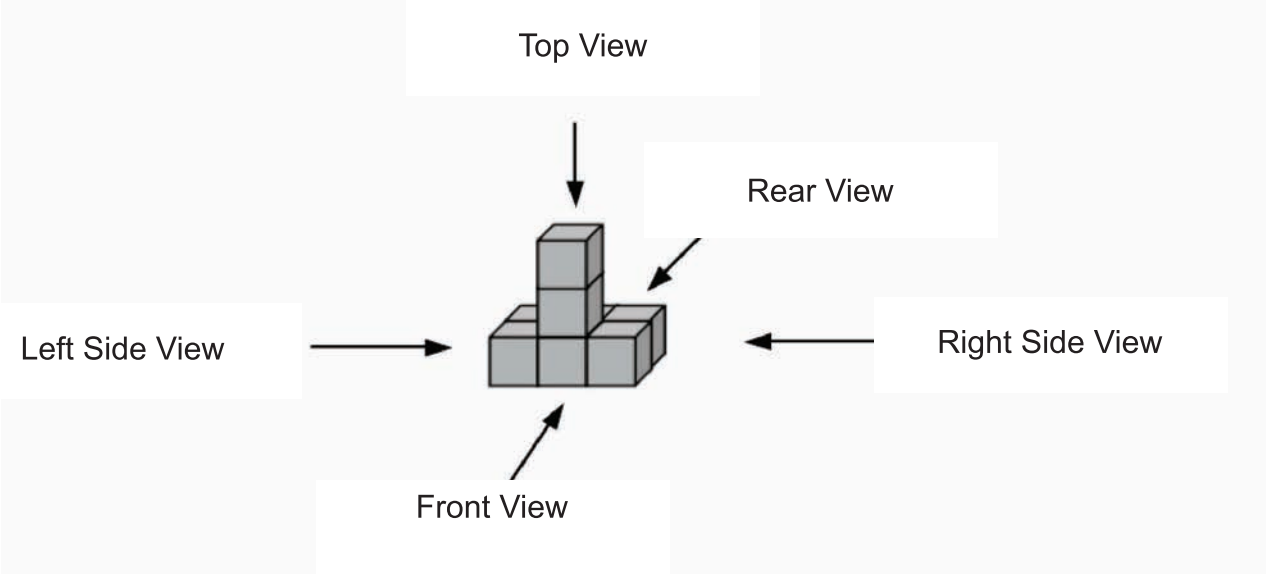
What shape is

a) Roshogulla or Laddu ----------

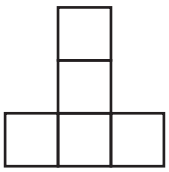
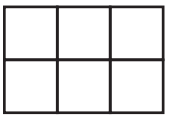
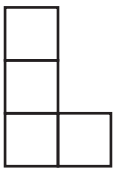
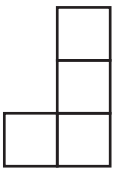
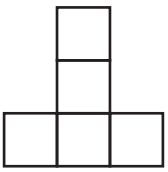
b) A brick ----------

c) A ball ----------

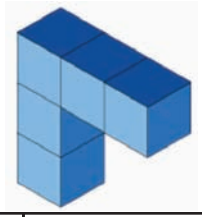
Build the structure shown in this picture using Jodo blocks.



Observe the shape from all sides and compare with the views given here.

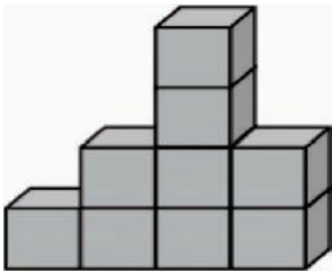
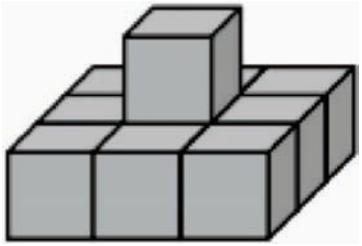
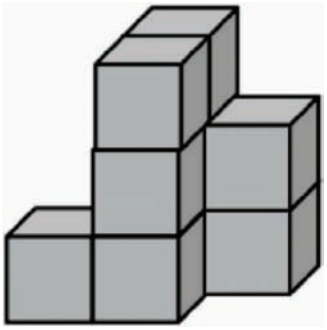
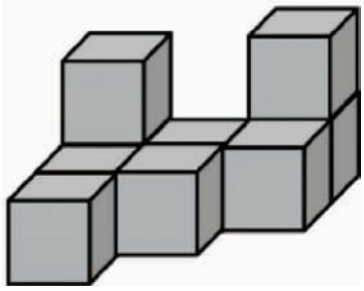
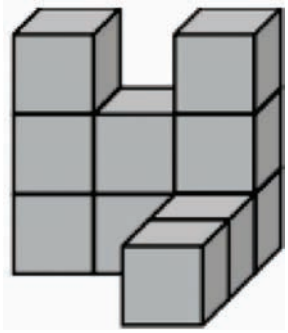
Front view	Top view	Right side view	Left side view	Rear view
				

Make this shape using Jodo blocks, observe from all sides and draw the views in this table.

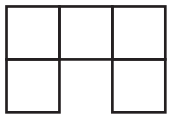
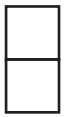
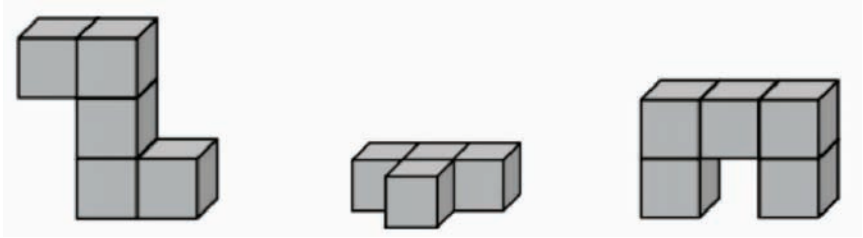
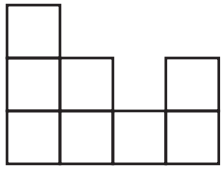
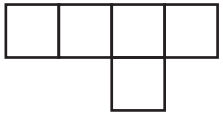
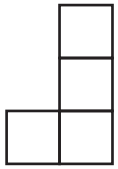
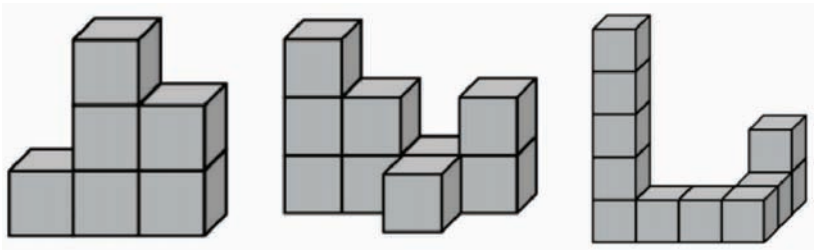
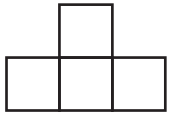
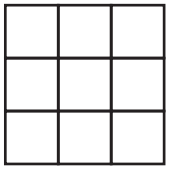
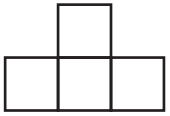
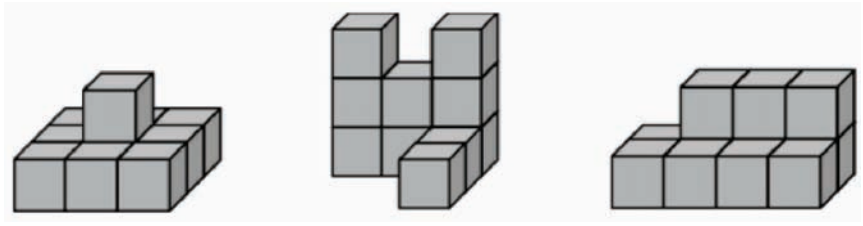


Front view	Top view	Right side view	Left side view	Rear view

Make the given structure using Jodo blocks and draw the views in this table.

Structure	Front view	Top view	Right side view
			
			
			
			
			

Look at the front view, top view and the right side view. Build the structure having these front, top and right side views using Jodo blocks. Circle the shape from A, B and C which matches the shape you made.

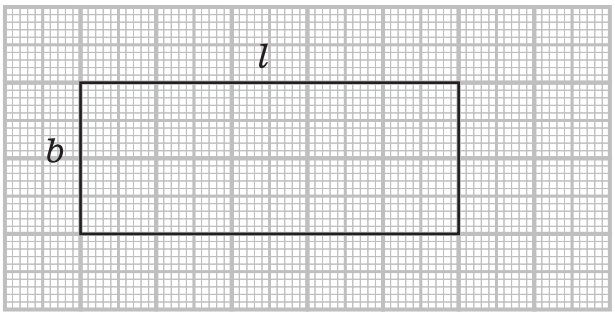
Front view	Top view	Right side view	
			 A B C
			 A B C
			 A B C

Mensuration

Area is the number of unit square tiles needed to cover the shape. It is in square units.

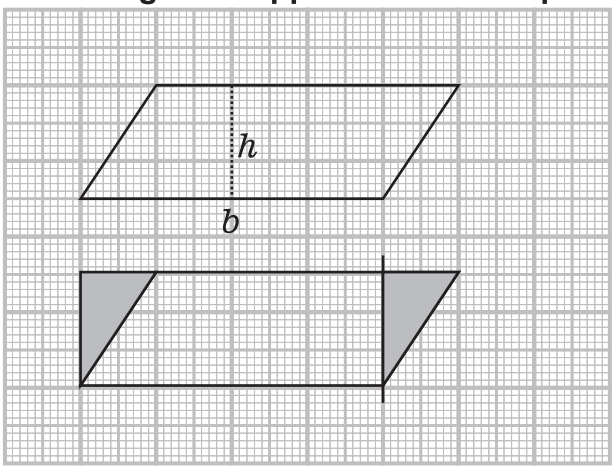
Perimeter is the total boundary length. It is in units.

Rectangle : Opposite sides equal, all angles right angles



Length = l Breadth = b
l squares of 1 unit size in each row.
b such rows.
Area = Total number of unit squares = l x b

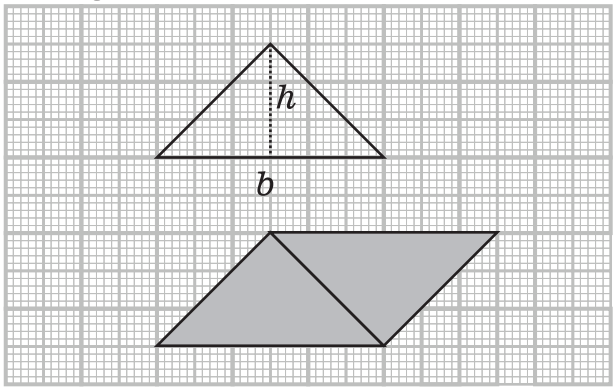
Parallelogram : Opposite sides are parallel



When we cut the extra right angled triangle on one side and put it on the other side we get a rectangle of length as b and breadth as h. Therefore,

Area of parallelogram = b x h

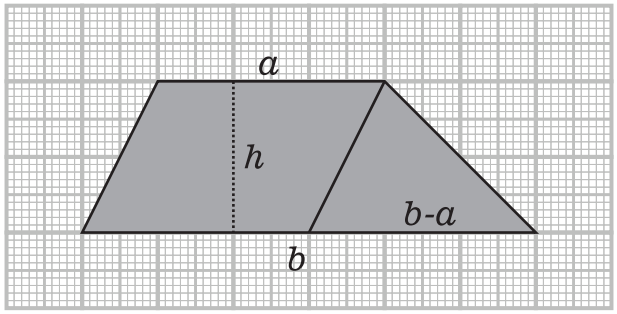
Triangle



Two triangles make a parallelogram of base b and height h. Therefore,

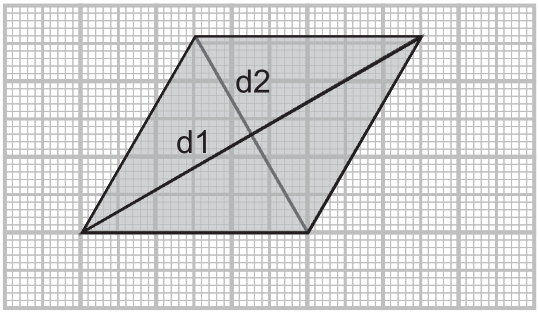
Area of triangle = 1/2 x b x h

Trapezium : One pair of opposite sides is parallel



Trapazium can be converted into a parallelogram + triangle.
Area = area of paralleogram + area of triangle
= ah + 1/2 (b-a)h = 1/2 h (2a + b - a)
Area of trapezium = 1/2 h (a + b)

Rhombus : All sides equal. Diagonals are perpendicular bisectors of each other.



Diagonal 1 = d1 Diagonal 2 = d2

Diagonal divides the rhombus into two equal parts.

If we take d1 as base of the triangle,

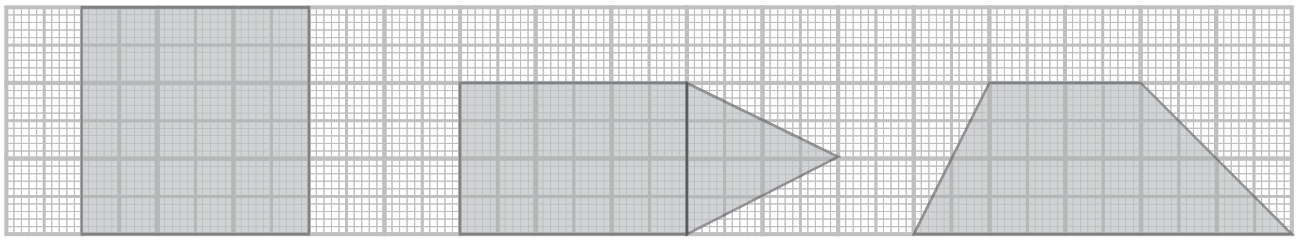
its height is (d2/2) (because the diagonals bisect each other at 90 degrees),

Area of triangle = 1/2 x d1 x d2/2

Area of rhombus = 2 x (1/4 x d1 x d2)

Area of rhombus = (d1 x d2) / 2

Now you know the basics. Count the required sides in cm. Find the total area of coloured portion in each figure.

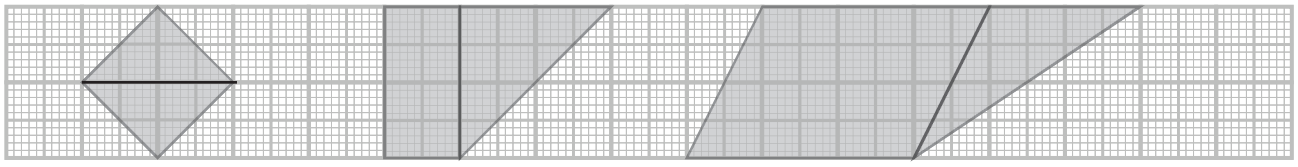


A =

Hint : Use the width of rectangle as base of triangle

A =

A =

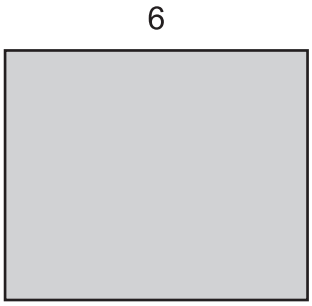


A =

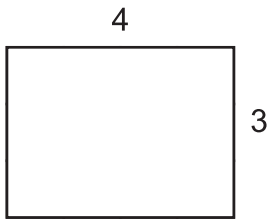
A =

Hint : Use top side of the triangle as base.

A =

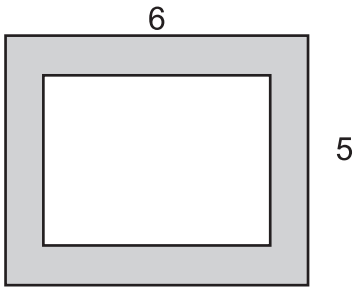


Area of grey rectangle =



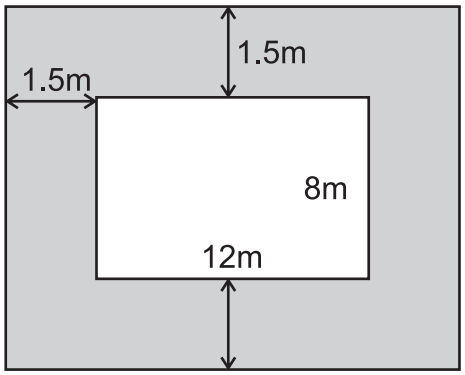
Area of white rectangle =

White rectangle is placed at the centre of grey rectangle.



Area of grey path =

Area of path outside a garden :



Length of inner garden =

Breadth of inner garden =

Area of garden =

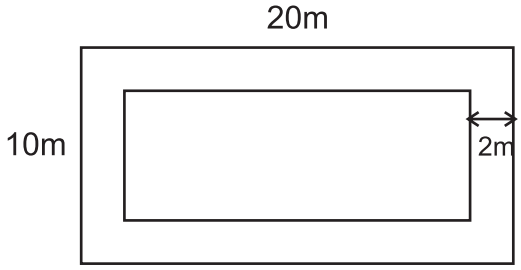
Length of outer rectangle = 12 + 1.5 + 1.5 = 15 m

Breadth of outer rectangle =

Area of outer rectangle =

Area of path around the garden = area of outer rectangle - area of garden =

Area of path inside a garden :



2 m wide path is made inside a garden of 20m x 10m.

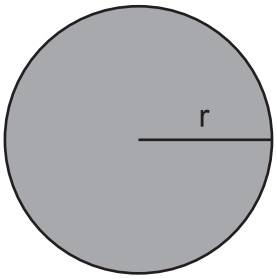
Area of garden =

Length of inside rectangle = 20 - 2 - 2 = 16 m

Breadth of inside rectangle =

Area of inside rectangle =

Area of path = area of outside garden - area of inside rectangle =

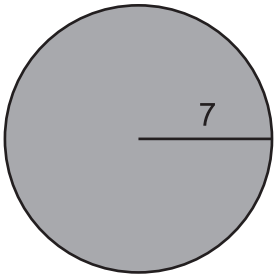


Circumference of circle = length of its boundary = $2 \pi r$

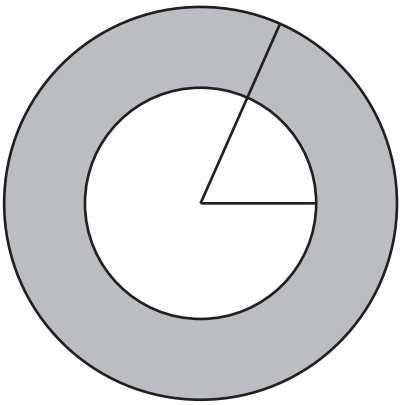
Area of circle = space covered = πr^2

Use π as 3.14 or 22/7

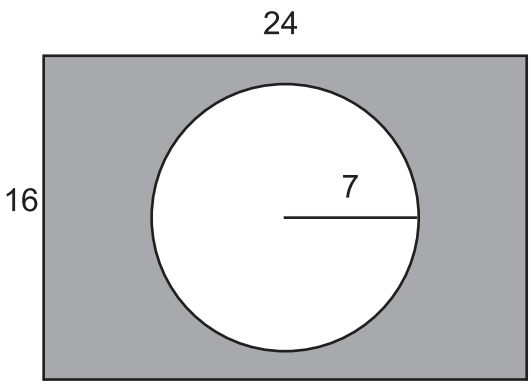
Find the area of shaded portion in each figure. Use calculator.

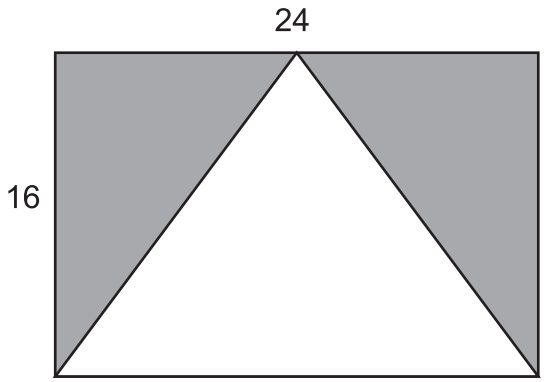


Use π as 22/7

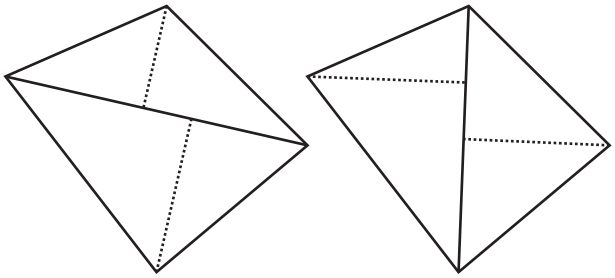


Radius of inner circle = 5
Radius of outer circle = 8





Area of a general quadrilateral



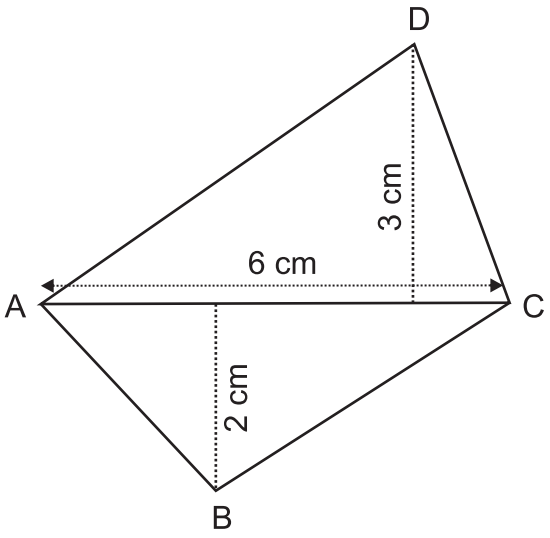
Break it into triangles as per the available information.

You have to decide which diagonal or side to be used as base.

For each base you need to know the height.

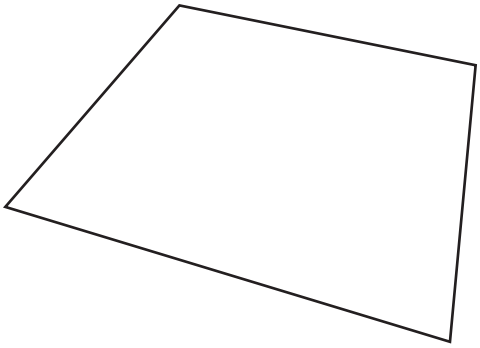
Observe the given figure carefully and choose your parts.

Find the area of ABCD. (Figure not to scale)



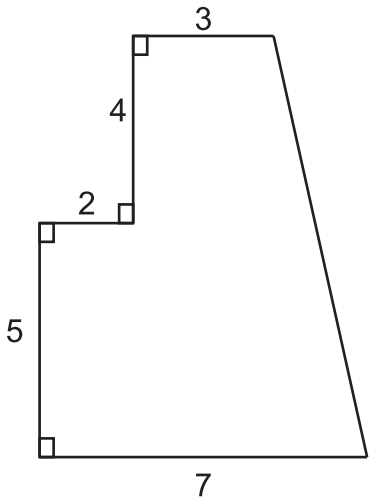
Area =

Measure the required sides and heights of this quadrilateral. Find its area.



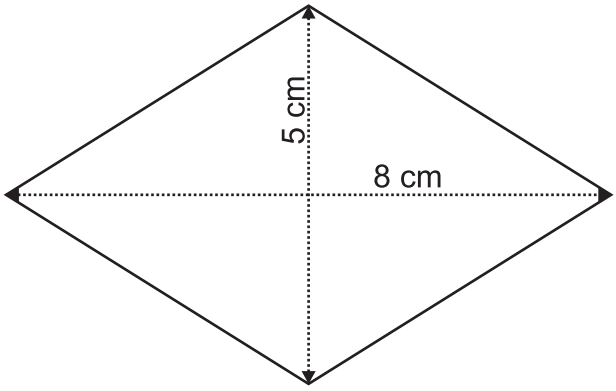
Area =

Divide the figure into rectangle and triangles and find the total area. (Figure not to scale)



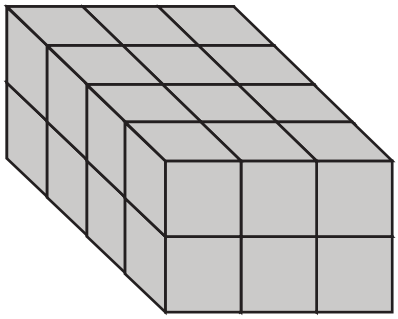
Area =

Find the area of this rhombus.



Area =

Surface area and volume of cuboids



Volume = total number of cubes

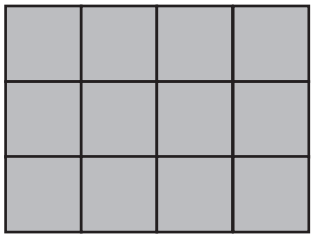
= (4 x 3) in the base and 2 such layers

= 4 x 3 x 2 = 24 cm^3

Volume of a cuboid = l x b x h

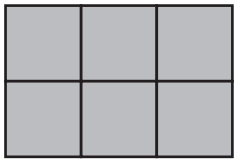
Surface area

Top view and bottom view



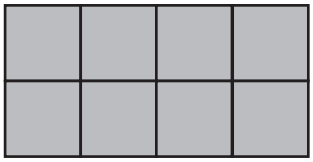
(4 x 3)

Front view and back view



(3 x 2)

Left side view
and right side view



(4 x 2)

We have two faces of each of these types.

Total surface area = 2 x (4x3) + 2 x (3x2) + 2 x (4x2)

=

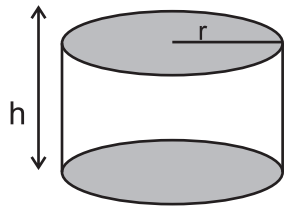
= cm^2

Total surface area of a cuboid = 2 x (l x b + b x h + h x l)

Find total surface area and volume of the following cuboids :

l = 20 m, b = 15 m, h = 10 m	l = 8 cm, b = 6 cm, h = 5 cm	l = 10 m, b = 10 m, h = 12 m

Surface area and volume of a cylinder

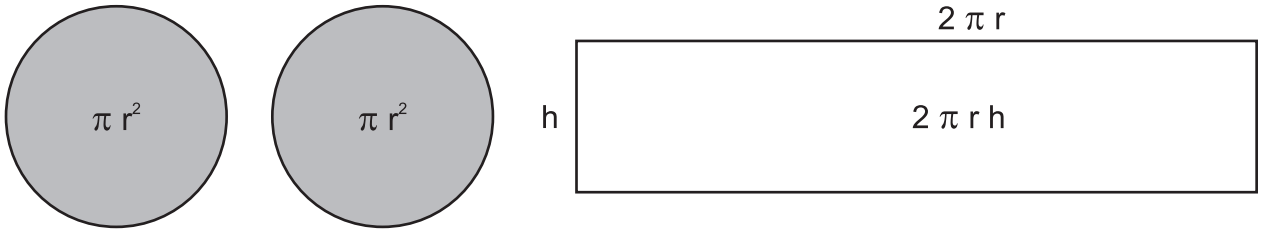


Volume of a cylinder = base area x height

$= \pi r^2 h$

Volume of a cylinder = $\pi r^2 h$

Total surface area = area of top circle + area of bottom circle + area of side wall



Total surface area of a cylinder = $2 \pi r^2 + 2 \pi r h$

Find the volume and total surface area of the following cylinders (use calculator) :

r = 14 cm, h = 30 cm	r = 1 m, h = 2 m	r = 50 cm, h = 100 cm

Indices

As Product	Using Powers	Number
2 x 2 x 2	2^3	8
3 x 3 x 3 x 3		
5 x 5 x 5		
4 x 4 x 4 x 4		
2 x 2 x 2 x 2 x 2		
	2	64
	5^4	
	7^2	
	$9^{\square}$	81
	$3^{\square}$	81
	$8^{\square}$	64
	$4^{\square}$	16
	$2^{\square}$	16

As Product	Using Powers
$x \times x \times x$	
	y^4
	x^3
	a^2
$a \times a \times b$	
	ab^2
	a^3
	a^3b^3
$a \times x \times x$	
$(x \times x \times x) + (y \times y)$	$x^3 + y^2$
$(x \times x \times x) - (y \times y)$	
$(x \times x \times x) - (x \times x)$	

Fill in the blanks.

Mixed Form	Expanded Form	Using Powers (Index form)
$2^2 \times 2^3$	(2 x 2) x (2 x 2 x 2)	2^5
$4^2 \times 4^5$		
$10^4 \times 10^2$		
$x^2 \times x$		

Let's discover the rule :

$2^m \times 2^n$ = 2 x 2 x 2.. m times x 2 x 2 x 2.. n times = $2^{(m+n)}$

$\mathbf{2^m \times 2^n = 2^{(m+n)}}$

$a^m \times a^n$ = $a \times a \times a$.. m times x $a \times a \times a$.. n times = $a^{(m+n)}$

$a^m \times a^n = a^{(m+n)}$

Solve (Use calculator for multiplications of big numbers):

1) 3 + 5 = ...

2) 3 x 5 = ...

3) 3^5 = ...

4) 2 x a = ...

5) If a = 4, 2 x a = ...

6) a^2 = ...

7) If a = 4, a^2 = ...

8) $2^2 \times 2^3$ = ...

9) $5^3 \times 5^4$ = ...

10) $3^1 \times 3^5$ = ...

11) $a^2 \times a^4$ = ...

12) If a = 3, find $a^2 \times a^4$ =.....

13) $a^k \times a^p$ = ...

14) If a = 3, k = 5 and p = 6 find $a^k \times a^p$

Fill in the blanks.

Mixed Form	Expanded Form	Number
$2^2 \times 2^3$	(2 x 2) x (2 x 2 x 2)	2^5
$3^2 \times 3^3$		
$4^2 \times 4^5$		
$x^2 \times x$		
$x^2 \times x^3$		
	$(x \times x \times x) \times (x \times x \times x \times x)$	
		x^4
		y^{10}
		a^3
$a^2 \times a \times b + b^2$		
		b^6
$2^2 \times 2^3 \times 3^5 \times 3^1$		
$2^2 \times 2^3 \times 3^5 \times 3^1$		

Fill in the blanks.

Mixed Form	Expanded Form	Number
$\frac{2^5}{2^2}$	$\frac{2 \times 2 \times 2 \times \cancel{2} \times \cancel{2}}{\cancel{2} \times \cancel{2}}$	2^3
$\frac{4^7}{4^3}$		
$\frac{10^6}{10^1}$		
$\frac{x^{10}}{x^5}$		
$\frac{6^3}{6^3}$		
$\frac{a^{10}}{a^{10}}$		

Let's discover the rule :

$$\frac{2^m}{2^n} = \frac{2 \times 2 \times 2 \text{.. m times}}{2 \times 2 \times 2 \text{.. n times}} = 2^{(m-n)}$$

$$\boxed{\frac{2^m}{2^n} = 2^{(m-n)}}$$

$$\frac{a^m}{a^n} = \frac{a \times a \times a \text{.. m times}}{a \times a \times a \text{.. n times}} = a^{(m-n)}$$

$$\boxed{\frac{a^m}{a^n} = a^{(m-n)}}$$

Meaning of index as 0 :

$$\frac{n^5}{n^5} = \frac{n \times n \times n \times n \times n}{n \times n \times n \times n \times n} = 1$$

by the above rule, $\frac{n^5}{n^5} = n^{(5-5)} = n^0$

Therefore $n^0 = 1$

Another way of looking at it :

$a^3 \times a^0 = a^{3+0} .= a^3$ It means a^0 must be 1.

Fill in the blanks.

Mixed Form	Expanded Form	Index form
$(2^3)^2$	(2 x 2 x 2) x (2 x 2 x 2)	2^6
$(4^2)^5$	(4x4)x(4x4)x(4x4)x(4x4)x(4x4)	
$(10^3)^3$	(10x10x10)x(10x10x10)x(10x10x10)	
$(m^2)^4$	(mxm)x(mxm)x(mxm)x(mxm)	

Let's discover the rule :

$(2^m)^n$ = (2 x 2 x 2.. m times) taken n times = 2 taken (mxn) times = $2^{(mn)}$

$(2^m)^n = 2^{(mn)}$

$(a^m)^n$ = (a x a x a.. m times) taken n times = a taken (mxn) times = $a^{(mn)}$

$(a^m)^n = a^{(mn)}$

Mixed Form	Expanded Form	Index form
2^2 x 3^2	(2 x 2) x (3 x 3) = (2 x 3) x (2 x 3)	$(2 \times 3)^2$
4^3 x 6^3		
a^4 x b^4		
x^a x y^a		

Find using the rule and verify using calculator :

1) 5^3 x 10^3

2) 7^5 x 1^5

Fill in the blanks.

Mixed Form	By rule	By expanded Form	Index form
$\frac{2^5}{2^3}$	$2^{5-3} = 2^2$	$\frac{2 \times 2 \times \cancel{2} \times \cancel{2} \times \cancel{2}}{\cancel{2} \times \cancel{2} \times \cancel{2}}$	2^2
$\frac{2^4}{2^3}$			
$\frac{2^3}{2^3}$			
$\frac{2^2}{2^3}$			
$\frac{2^1}{2^3}$			
$\frac{2^0}{2^3}$			

Let's discover the rule :

$\frac{a^0}{a^m} = a^{(0-m)} = a^{(-m)}$ Therefore, $\boxed{a^{(-m)} = \frac{a^0}{a^m} = \frac{1}{a^m}}$

Find :

(1) $a^m \times a^n$ = ...

(2) $(a^m)^n$ = ...

(3) $\frac{a^m}{a^n}$ =

(4) $a^m \times b^m$ = ...

(5) $\frac{5^6}{5^2}$ =

(6) $\frac{5^{10}}{5}$ =

(7) $\frac{a^m}{b^m}$ =

(8) a^{-m} =

(9) a° = ...

(10) 2^{-4} = ...

(11) 10^{-5} = ...

(12) $\frac{a^0}{b^{-m}}$ =

Solve :

1) $3456 = 3 \times 1000 + 4 \times 100 + 5 \times 10 + 6 \times 1$

$= 3 \times 10^{\square} + 4 \times 10^{\square} + 5 \times 10^{\square} + 6 \times 10^{\square}$

2) $23.5 = 2 \times 10 + 3 \times 1 + 5 \times \frac{1}{10}$

$= 2 \times 10^{\square} + 3 \times 10^{\square} + 5 \times 10^{\square}$

3) Simplify and write in exponential form.

(a) $(-2)^{-3} \times (-4)^{-4}$

(b) $P^{3} \times P^{-10}$

(c) $5^{2} \times 5^{-3} \times 5^{\circ}$

4) Find the value of

(a) 5^{-2}

(b) $\frac{1}{2^{-3}}$

5) Simplify and write the answer in the index form :

(1) $(2^{5} \div 2^{8})^{5} \times 2^{-5}$

(2) $(-4)^{-3} \times (5)^{-3} \times (-5)^{-3}$

6) Find m so that :

$(-3)^{m+1} \times (-3)^{5} = (-3)^{7}$

7) Find the value of

(1) 3^{-2}

(2) $\left(\frac{1}{2}\right)^{-2}$

Expressing large numbers in standard form (using exponents) :

Number in usual form	Expressed as a product of a number having one decimal point and a power of ten	Number in standard form
300	3 x 100	3.0×10^2
3000	3 x 1000	
30000		
35000	3.5 x 10000	
3500000		
3500000000		
350000000000000		
		5.0×10^7
		5.8×10^7
		3×10^8
		7.3×10^{10}
		9.9×10^1
		9.9×10^{11}
		7.8×10^5
		1.1×10^{11}

Project : Where do we get such large numbers? What is the diameter of the Earth? What is the diameter of the Sun? How far is the Sun from us? What is the speed of light? How many molecules are there on the tip of a pin? and so on... Find these numbers and write them in standard form.

Expressing small numbers in standard form (using exponents) :

Number in usual form	Expressed as a product of a number having one decimal point and a power of ten	Number in standard form
3	3×1	3.0×10^{0}
0.3	$\frac{3}{10}$	3.0×10^{-1}
0.03	$\frac{3}{100}$	3.0×10^{-2}
0.035	$\frac{35}{1000} = \frac{3.5}{100}$	3.5×10^{-2}
0.0035		
0.00035		
0.000035		
		5.0×10^{-2}
		5.8×10^{-2}
		6.8×10^{-8}
		7.3×10^{-10}
		9.9×10^{-1}
		9.9×10^{-11}
		7.8×10^{0}
		1.1×10^{-11}

Project : Where do we get such small numbers? What is the diameter of hydrogen atom? What is the diameter of covid virus? Find such small numbers and write them in standard form.

Direct and inverse proportion

1) If the cost of 1 mango is 5 rupees what would be the cost of 4 mangoes ? (5 x 4 = 20 rupees)

Direct proportion : When the number of mangoes increases, cost also increases proportionally.

2) If one person cleans the school in 3 hours, how many hours will be needed if 3 persons work?

Inverse proportion : When the number of persons increases, number of hours decreases proportionally.

Study the problems you solved on pages 67 and 68 and fill in the following information.

Quantities	Change in first quantity	Change in second quantity
Mangoes and Cost	Number of mangoes increased	Cost increased proportionally
Time taken and distance covered		

All these are examples of direction proportion.

If the cost of 1 mango is 5 rupees, complete the following table.

Number of mangoes (x)	1	2	5	3	8	4	7	10	6
Cost in Rs. (y)	5								
What is $\frac{y}{x} = k$	5								

$\frac{y}{x} = k$ (constant)

$\therefore y = kx$

$\therefore x$ and y are in DIRECT proportion.

Observe the following table. Find $\frac{y}{x}$. Find if x and y are directly proportional.

x	20	17	14	11	8	5	2
y	40	34	28	22	16	10	4
$\frac{y}{x}$							

$\frac{y}{x} =$ ☐ (constant)

$\therefore y =$ x

$\therefore x$ and y are in ..... proportion.

A machine fills 840 bottles in 6 hours. How many bottles will it fill in 5 hours ?

We have 300 rupees to purchase pens for students in our school.
Fill in the following table with price of pens and how many pens can be bought.

Price of one pen (x)	30	25	20	15	10	6	5	3	2
Number of pens(y)	10								
What is xy (= k)	300								

$xy = k$ (constant)

$\therefore y = \frac{k}{x}$

$\therefore x$ and y are in INVERSE proportion.

Observe the following table. Find xy. Find if x and y are inversely proportional.

x	90	60	45	30	20	15	10
y	10	15	20	30	45	60	90
xy							

$xy =$ ☐ (constant)

$\therefore y = \frac{k}{x}$

$\therefore x$ and y are in ..... proportion.

If Saeeda reads 20 pages every day she finishes reading a sixty-page book in 3 days.
How many days would she take to finish reading it if she reads 30 pages every day?

Number of pages every day (x)	20	30
Number of days (y)	3	a

a) Would the number of days increase if the number of pages per day increase ?
b) Is this direct proportion or inverse proportion?
c) Find value of a.

Problem	Quanitities	Direct or Inverse	Putting in the format	Solution
6 pipes fill a tank in 80 minutes. How long will it take if only 5 pipes of the same type are used?	Number of pipes and Minutes	Inverse	Pipes Minutes 6 80 5 x	$x = \frac{6 \times 80}{5}$
There is food provision of 20 days for 100 students. If there are 25 more students, how long will those provisions last?				
If 15 workers can build a wall in 48 hours, how many workers would be required to do the same work in 30 hours?				
If a box of sweets is divided among 24 children, they will get 5 each. How many would each one get if the number of children is 20?				

Factors : Making parts by multiplication till we get all prime numbers.

$$90 = 10 \times 9$$

10 and 9 can be further factorised.

$$90 = 2 \times 5 \times 3 \times 3$$

Vertical method of factorization

We want prime factors of a number.
We divide the number by the first prime number 2, as many times as possible.
Then we divide by 3 as many times as possible.
We divide by 2, 3, 5, 7, 11,13, 17, 19, 23.... sequentially as many times as we can.
We repeat this till we get 1.
The product of all prime numbers you divided by is the prime factorization.

2	84
2	42
3	21
7	7
	1

$$84 = 2 \times 2 \times 2 \times 3$$

Observe the number to be factorised.
If you can easily think of breaking it by multiplication, horizontal method will be easy.
Otherwise vertical method will certainly guide you to the answer.

Term / Expression	Write T if term E if Expression	Write each term as a product (Write numbers as a product of prime factors)
10	T	2 x 5
12	T	2 x 2 x 3
$12a$	T	2 x 2 x 3 x a
a + 2	E	(a x 1) + (2 x 1)
xy		
$x + y$		
$3xy$		
$10xy$		
$10xy$ + $5x$		
x^2		
$6x^2$		
$3x(x+2)$		3 x x x (x+2)
$(x+2)\ 5x$		
$10x\ (x+2)\ (x+3)$		

Expression	Terms and factors Underline common factors	Take the common factor outside of the bracket
$2x + 4$	$2x = \underline{2} \times x$ $4 = \underline{2} \times 2$	$2x + 4 = 2 \times (x + 2)$
$5xy + 10x$		
$12ab + 4b$		
$12a^2b + 15ab^2$		
$5x^2y - 15xy^2$		
$7a^2 + 14a$		
$7a + 14a^2$		
$7x - 42$		
$2a^2bc + 6ab^2c$		
$xyz - xyz$		
$-2xy + y^2$		
$-20x - 5$		
$15ab + 18b$		
$10 + 20m$		

Expression	Terms and factors Underline common factors	Take the common factor outside of the bracket
$14pq + 35pqn$		
$10x^2 - 18x^3 + 14x^4$		
$x^2yz + xy^2z + xyz^2$		
$-4a^2 + 4ab - 4ca$		
$-16z + 20z^3$		

Factorise using identity : $a^2 - b^2 = (a + b)(a - b)$

Expression	Write in the format $(\text{term 1})^2 - (\text{term 2})^2$	Factors (term 1 + term 2) x (term 1 - term 2)
$25x^2 - 4y^2$	$(5x)^2 - (2y)^2$	$(5x + 2y)(5x - 2y)$
$49p^2 - 9q^2$		
$49p^2 - 16$		
$a^2 - 1$		
$m^2 - 25$		
$n^4 - 256$		

Factorise using identities : $a^2 + 2ab + b^2 = (a + b)^2$

$a^2 - 2ab + b^2 = (a - b)^2$

Expression	Write in format $a^2 + 2ab + b^2$ $a^2 - 2ab + b^2$	Factors
$x^2 + 8x + 16$	$(x)^2 + (2 \times x \times 4) + (4)^2$	$(x + 4)^2$
$x^2 - 8x + 16$		
$x^2 + 4x + 4$		
$x^2 - 4x + 4$		
$x^2 - 6x + 9$		
$x^2 + 6x + 9$		
$4x^2 + 4x + 1$		
$4x^2 - 4x + 1$		

Factorise using identities : $a^2 + 2ab + b^2 = (a + b)^2$

$a^2 - 2ab + b^2 = (a - b)^2$

Expression	Write in format $a^2 + 2ab + b^2$ $a^2 - 2ab + b^2$	Factors
$4y^2 - 12y + 9$		
$p^2 - 10p + 25$		
$4x^2 - 8x + 4$		
$49y^2 + 84yz + 36z^2$		
$a^4 + 2a^2b^2 + b^4$		
$25m^2 + 30m + 9$		
$25m^2 + 9 - 30m$		

Think - Why are the terms having square always positive?

Factorise using identity : $(x + a)(x + b) = x^2 + (a+b)x + ab$

sum product

$x^2 + 5x + 6$ Find a pair of numbers which has product as 6 and sum as 5.

6 = 2 x 3..... (sum of 2 and 3 is 5)

= 1 x 6..... (Sum of 1 and 6 is 7)

$= x^2 + 2x + 3x + 6$ Therefore we choose 2 and 3. Split $5x$ as $2x + 3x$

Take out x as common from first two terms and 3 as common from the last two terms.

$= x(x + 2) + 3(x + 2)$ Take out $(x + 2)$ common from the two terms

$= (x + 2)(x + 3)$

$x^2 + 7x + 6$ Find a pair of numbers which has product as 6 and sum as 7.

6 = 2 x 3..... (sum of 2 and 3 is 5)

= 1 x 6..... (Sum of 1 and 6 is 7)

Therefore we choose 1 and 6. Split $7x$ as $x + 6x$

$= x^2 + x + 6x + 6$ Take out x as common from first two terms and 6 as common from the last two terms.

$= x(x + 1) + 6(x + 1)$ Take out $(x + 1)$ common from first the two terms

$= (x + 1)(x + 6)$

$x^2 - 5x + 6$ Find a pair of numbers which has product as 6 and sum as - 5.

As the sum is negative and product is positive, both numbers must be negative.

6 = (-2) x (-3)..... (sum of -2 and -3 is -5)

= (-1) x (-6)..... (Sum of -1 and -6 is -7)

Therefore we choose -2 and -3. Split $-5x$ as $-2x - 3x$

$x^2 + 7x + 6$

Product as +6
Sum as +7
+6, +1

$x^2 - 7x + 6$

Product as +6
Sum as -7
-6, -1

$x^2 + 5x - 6$

$x^2 + x - 6$

$x^2 - 5x - 6$

$x^2 - x - 6$

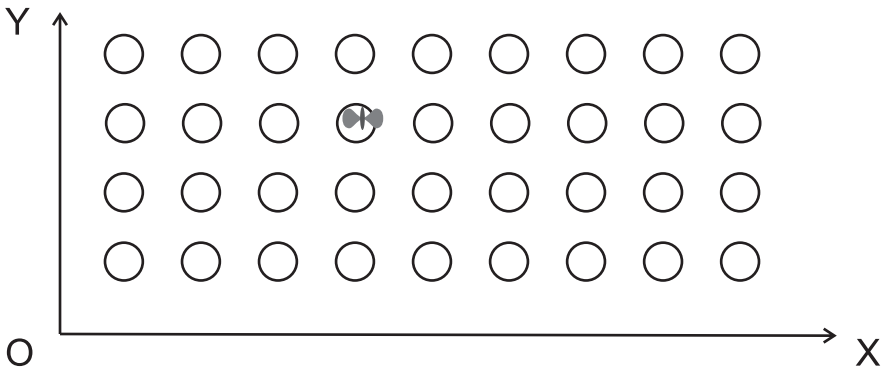
$$\frac{6x^2}{2x} = \frac{2 \times 3 \times x \times x}{2 \times x} = \frac{\cancel{2} \times 3 \times x \times \cancel{x}}{\cancel{2} \times \cancel{x}} = \frac{3x}{1}$$

Division	Factorise numerator and denominator and cancel the common factors	Answer
$\frac{7x^2y^2z^2}{14xyz}$		
$\frac{-20\,x^4}{10\,x^2}$		
$\frac{7xy^2z^3}{6yz^2}$		
$\frac{63a^2b^4c^6}{7a^2b^2c^3}$		
$\frac{ab + ac}{a}$	$\frac{\cancel{a}\,(b + c)}{\cancel{a}}$	$b + c$
$\frac{2xy + 4x^2}{2x}$		
$\frac{4y^3 + 5y^2 + 6y}{2y}$		
$\frac{24\,(x^2yz + xy^2z + xyz^2}{8xyz}$		

Division	Factorise numerator and denominator and cancel the common factors	Answer
$\frac{10x - 25}{5}$		
$\frac{10x - 25}{2x - 5}$		
$\frac{10y(6y + 21)}{5\,(2y + 7)}$		
$\frac{5\,(2x + 1)\,(3x + 5)}{(2x + 1)}$		
$\frac{x\,(x + 1)\,(x + 2)}{x\,(x + 1)\,(x + 2)}$		
$\frac{x\,(x + 1)\,(x + 2)}{x\,(x + 2)}$		
$\frac{(x + y)\,(2x + y)}{(x + y)}$		
$\frac{(10x + 20y)\,(3x + 5)}{(x + 2y)}$		

Children are standing in a row on a playground.
All children are wearing hats.
We are watching them from terrace of the building.
These circles are their hats.
A butterfly is sitting on the hat of one child.
How will you describe which child has the butterfly?

Will you say child number 3, or 7?
Which one is right? Discuss in your class.
So, we need a starting point.
Child number 3 from the left or child number 7 from the right.



If children are standing in rows and columns, how can we describe which child has a butterfly?
We need horizontal and vertical reference line. They are called as X axis and Y axis.

Their point of intersection is called as origin (O).

Starting from the origin to reach to the child having butterfly we have to go 4 positions to right (on X axis) and 3 positions to top (on Y axis).

Therefore that position is written as (4, 3).

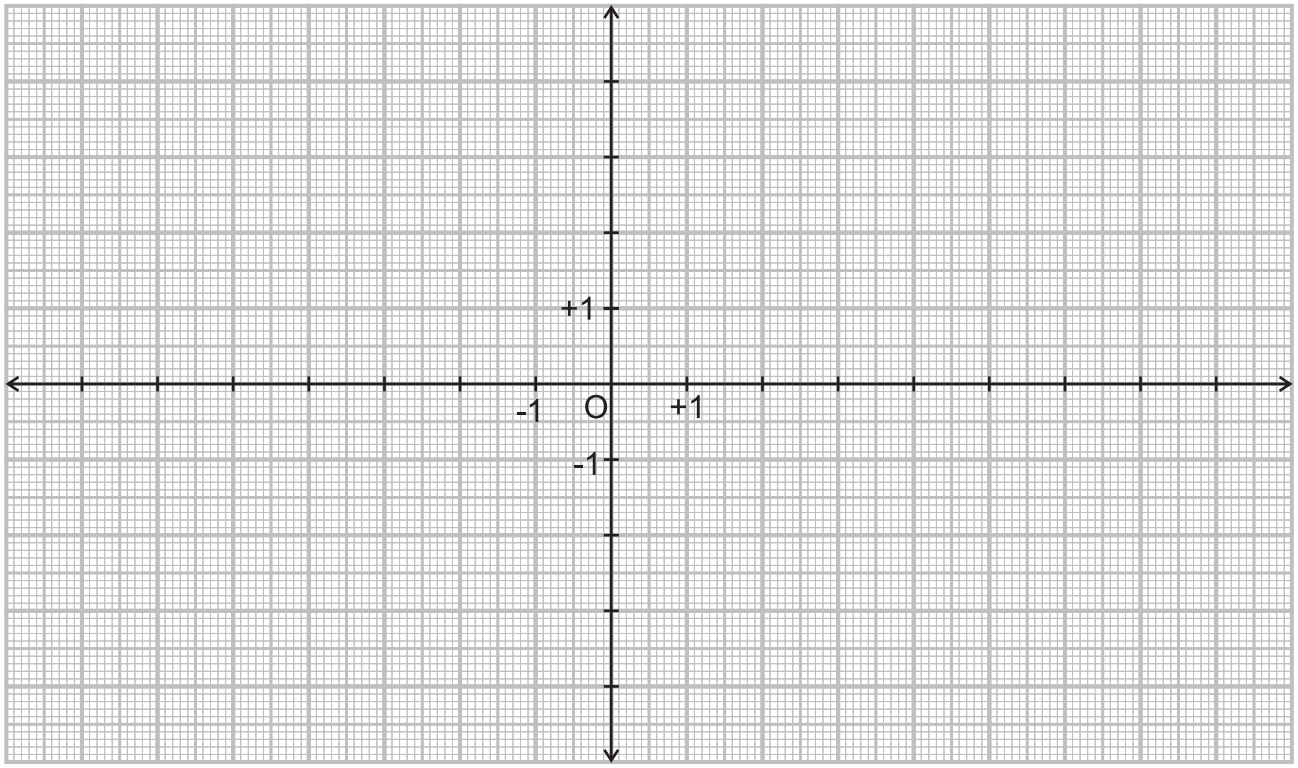
Colour the following children's hats :

(1,2) (4,4) (7,3) (9,4) (6,1) (2,2)

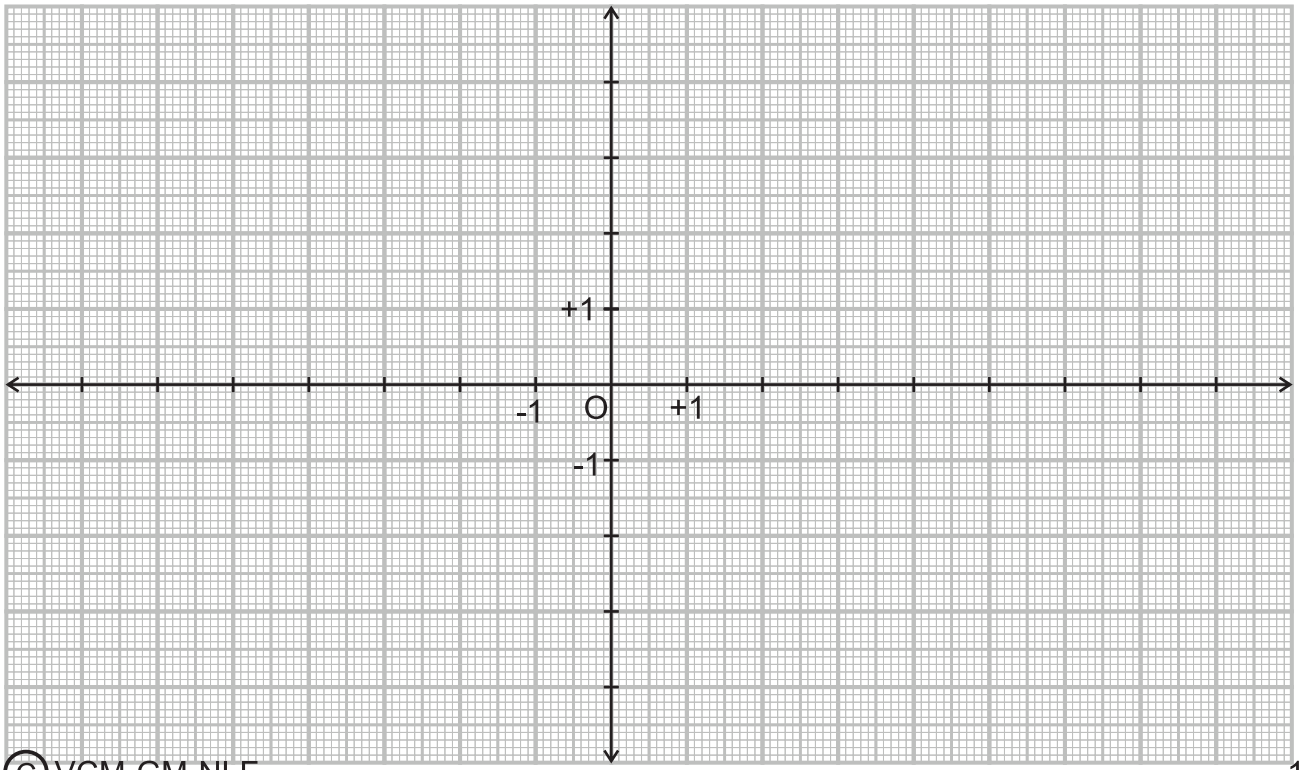
X axis and Y axis are shown here.
+1 and -1 on both axes are marked. Mark the points on both axes.
Plot the following points :

O (0,0) A (1,2) B (4,4) C (6,0) D(0,5)

E (-2, +3) F (+3, -2) G (-4, -4) H (-3,0) E(0,-3)

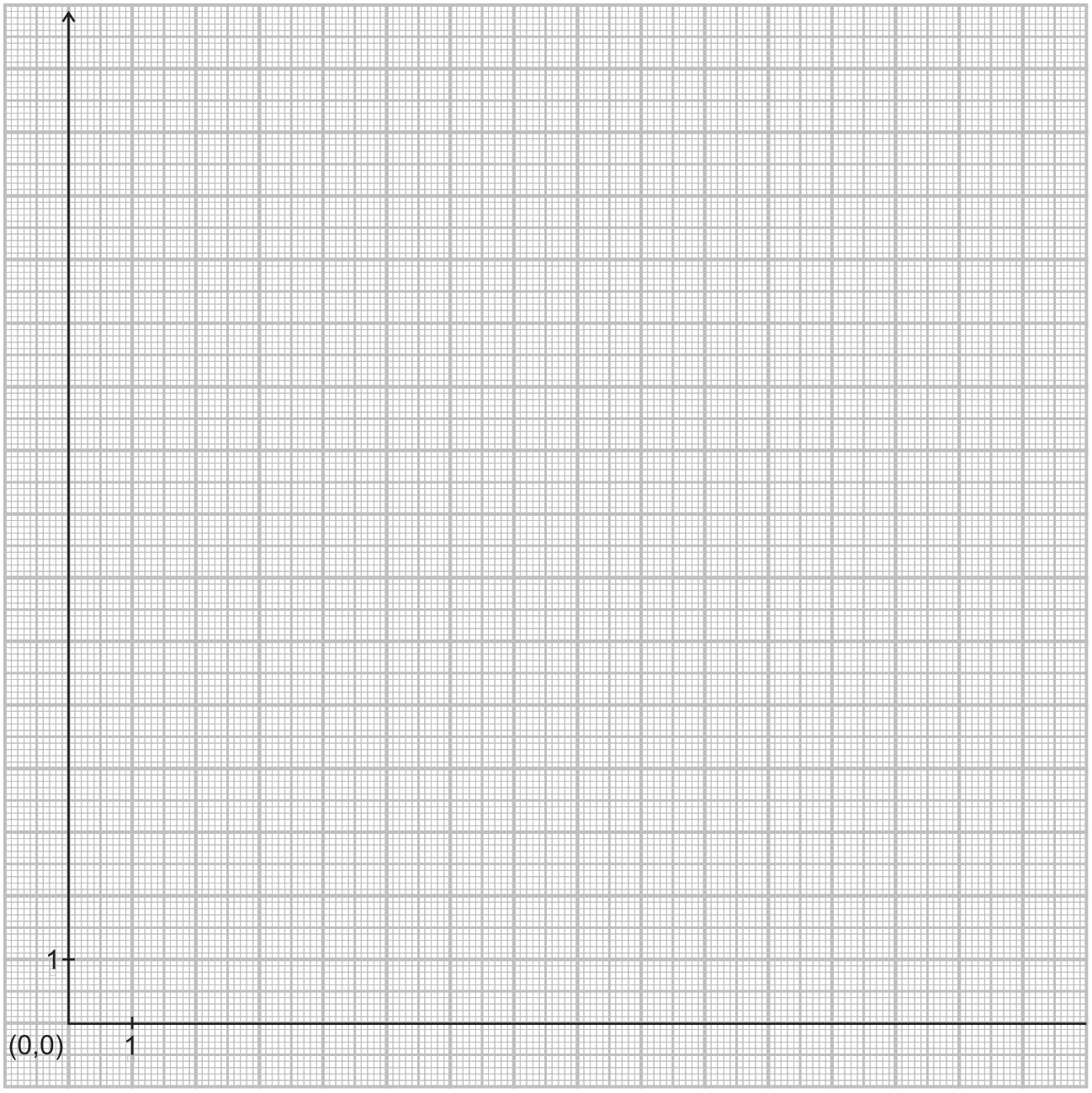


Draw a rectangle, a square and a parallelogram.
Write the coordinates of all vertices.



We have seen this example in unitary method and in direct proportion.
If the cost of 1 mango is 5 rupees, find the cost (y) of given number of mangoes (x)

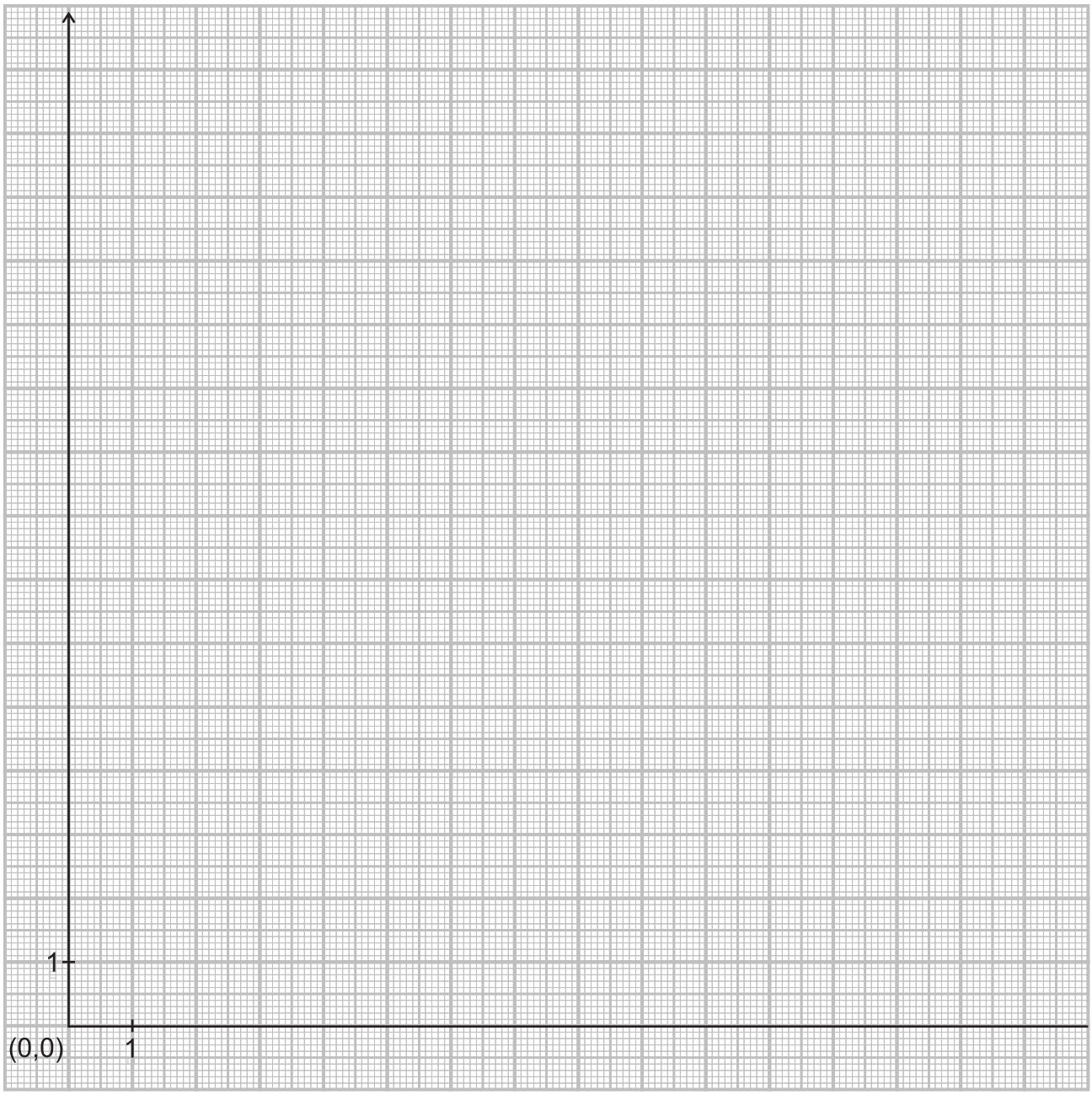
Number of mangoes (x)	1	2	5	3	8	4	7	10	6
Cost in Rs. (y)	5								
Point to plot	(1,5)								



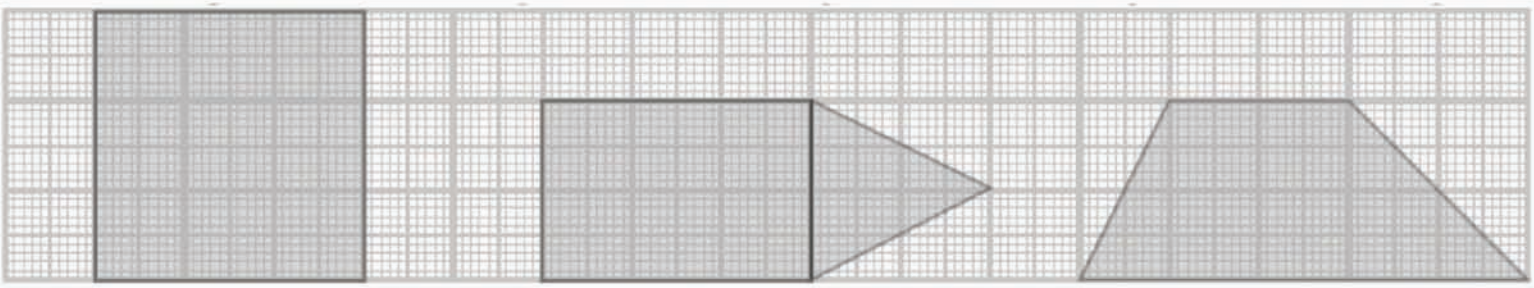
Which shape do you get if you join these point?.....

Let's see an example of inverse proportion.
30 children have to stand in equal rows.
Make a table of number of children in each row (x) and number of rows (y).

Number of children in each row (x)	15	10	6	5	3	2
Number of rows(y)	2					
Point to plot	(15,2)					



Would you get a straight line if you join these point?.....



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