1 Pie Graph

- **Let us remember :**

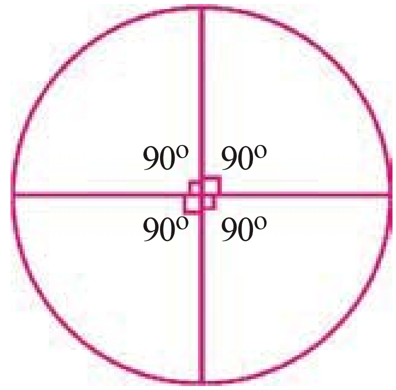
Draw bar graph from the given information :

Name of fruit	Chikoo	Grapes	Watermelon	Mango	Apple
Sale (kg)	18	36	45	54	27

Title : ....

1 : Pie Graph

- **Let us learn new :**
  - If the information given in the bar-graph is shown in a single circle, it is called a pie-graph.
  - To show the information in a circle, the information should be transformed into degree measure.
  - The measure of all the angles at the center of the circle is 360°. See in the figure here.
  - When the information other than measure of angles is to be shown, the base of 360° is taken.



  - Let's construct the pie-graph with the help of the information given in the bar-graph.

Sr. No.	Fruit	kg
(1)	Chikoo	18
(2)	Grapes	36
(3)	Watermelon	45
(4)	Mango	54
(5)	Apple	27

  - Total sale of fruits (in kg) = 180 kg
  - The complete circle is shown with 360°.

Total sale 180 kg : 360°

∴ 18 kg : (?)

$$= \frac{18 \times 360}{180} = 36^{\circ}$$

  - **Transfer of information into percentage :**

Sale of Chikoo out of total 180 kg = 18 kg

∴ Sale of Chikoo out of total 100 kg = (?)

$$= \frac{18 \times 100}{180} = 10 \text{ kg}$$

∴ Sale of Chikoo was 10 %.

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1 : Pie Graph

- You have seen that for finding degree measure, base of 360^{o} is taken and for finding percentage, base of 100 is taken.
- Fill the given Table by calculating the information in the above manner. Later, with the help of your teacher, prepare a pie-graph in a computer.

Sr. No.	Fruit	kg	Degree	Percentage
(1)	Chikoo	18	36^{o}	10 %
(2)	Grapes	36		
(3)	Watermelon	45		
(4)	Mango	54		
(5)	Apple	27		

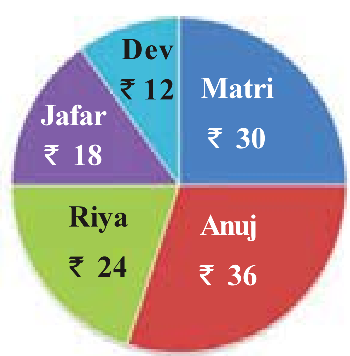
The pictorial representation of the information in a circular area is known as pie-graph.

- Where have you find such pie-graphs ? What kind of different information is shown with the pie-graph ?
- Discuss this with your teacher and note down about the uses of pie-graph in your note-book.

Practice 1

1. Some questions are given based on the below given pie graph. Study the pie graph and answer the questions with calculation in your notebook :

The contribution given by the students of Std. 7 for the celebration of Teacher's day is shown in the pie graph given below :



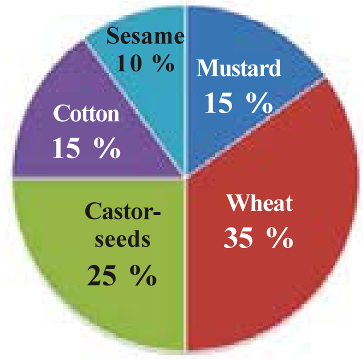
(1) In all how many rupees were collected as fund ?

(2) How much contribution was given by Jafar ?

(3) Calculate the degree measure of the contribution by Anuj and measure it in the figure.

(4) Who contributed the least fund ?

2. As shown in the pie graph, Ajaybhai bought 3600 kilogram grains from the market for his shop during the day, answer the following questions :



(1) How much percentage is cotton more than wheat ?

(2) How many kilograms of sesame was bought ?

(3) Calculate the degree measure of the part of cotton and measure it.

(4) How many kilogram of Castor-seeds are there ?

3. Based on the pie graph showing 50 runs scored in the first over in a cricket match, answer the following questions :

(1) In which over maximum runs were scored ?

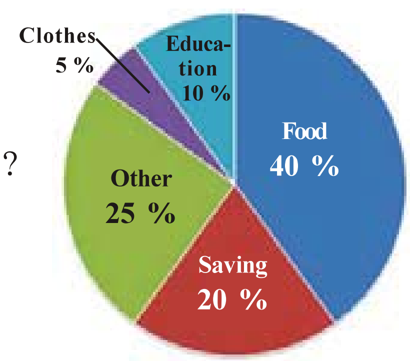
(2) In which over, not a single run was scored ?

(3) How many runs were scored in the third over ?

(4) In which over, 28 percentage of runs were scored ?

Exercise

1. The monthly income of Anjaliben is ₹ 7200. Study the pie-graph of the monthly budget prepared by her and answer the following questions :



(1) How many percentage of expenditure is done for education ?

(2) What is the budget for savings in terms of money ?

(3) How many degree measure is shown by the expenditure on clothes ?

(4) On what is the maximum expenditure done ?

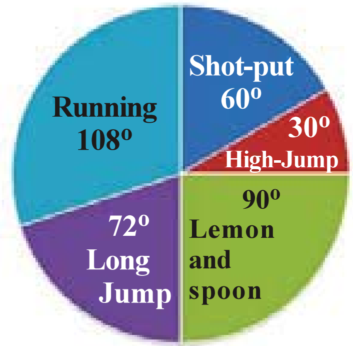
2. The following pie graph shows the information about the participation of 60 students of a school in various games during the sports day. Answer the questions based on that :

(1) How many students took part in lemon and spoon race ?

(2) In which game, least number of students took part ?

(3) In which game, maximum number of students took part ?

(4) How many students took part in shot put ?



3. The following pie graph shows the various items worth ₹ 540 bought by the parents of Soham, which is shown in the percentage form in the given pie-graph when the school started. Answer the questions based on that :

(1) What is the cost of the bag in rupees ?

(2) What is the cost of the water-bag in rupees ?

(3) What degree measure is shown by the sketch pen ?

(4) For which item, the maximum amount was spent ? How much ?

Note : Make four other questions. Write the questions and answers in your notebook.

Answer

Practice 1

1.	(1) 120	(2) 15 %	(3) 108°	(4) Dev
2.	(1) 20 %	(2) 360 kilogram	(3) 54°	(4) 900 kilogram
3.	(1) Fifth over	(2) Second over	(3) 24 %	(4) Fourth over

Exercise

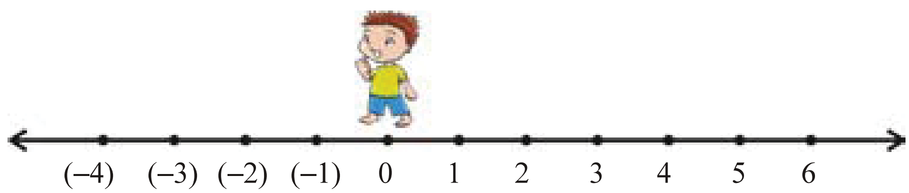
1.	(1) 10 %	(2) ₹ 1440	(3) 18°	(4) Food
2.	(1) 15 students	(2) High jump	(3) Running	(4) 10 students
3.	(1) ₹ 162	(2) ₹ 54	(3) 18°	(4) Note book, ₹ 216

2 Integers

◆ **Let us remember :**

Students, we have learnt about integers and its addition and subtraction. Let us remember them again.

1. Fill in the blanks with the help of number line :



(1) The cartoon is standing on .... digit.

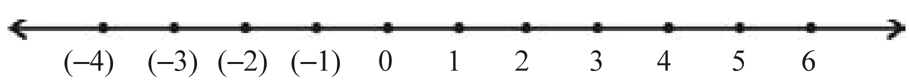
(2) .... integers are there on the left side of zero.

(3) Positive integers are on the .... side of zero (0).

(4) There is .... integer, 4 units right to zero.

(5) There is .... integer, 4 units left to zero.

2. Fill in the blanks with the help of number line :



(1) $0 + 5 =$ ....

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

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

(4) $(-3) - (-8) =$ ....

(5) $5 - 5 =$ ....

◆ **Let us learn new :**

Absolute value :

The numerical value of 5 = 5 The numerical value of (−5) = 5

The numerical value of 4 = 4 The numerical value of (−4) = 4

Thus, the numerical value of a number obtained by disregarding the sign prefixed to the number is called its absolute value.

To denote the absolute value the sign '| |' (modulus) is used.

That is, the absolute value of 5 = 5

It is written symbolically $|5| = 5$ (Read as : modulus five is equal to five)

The absolute value of $(-6) = 6$

It is written symbolically $|-6| = 6$ (Read as : modulus minus six is equal to six)

The absolute value of 0 = 0

It is written symbolically $|0| = 0$ (Read as : modulus zero is equal to zero)

The absolute value of no number can be negative.

- **Zero, positive numbers and negative numbers are included in integers.**

Properties of addition of integers :

We have learnt about properties of addition of whole number in fifth standard. Now, in the same way, we are going to learn about properties of addition of integers.

1. Look, understand and complete :

(−5)	+	4	=	(−1)
integer		integer		integer
(−7)	+	(−8)	=	(−15)
integer		integer		integer
.....	+	6	=	2
integer		integer		integer
(−7)	+	(−1)	=	.....
integer		integer		integer

It is clear from the above Table that the addition of any two integers is also an integer.

Activity 1 :

- Prepare small ☐ flash cards from a thick paper.
- Write 0 to 9 and (–1) to (–9) on the cards.
- Prepare flash cards with signs of +, – and =.
- Gather all the cards in one box.
- Now, from that take any two digit cards and put + or – sign card between them.
- Then arrange the answer card after the card with = sign.
- **Example :**

–6	+	4	=	–2
4	+	–6	=	–2

- If the position of the digit card is changed, what will be the answer ?
- Do this activity, three to four times by changing the flash cards.
- What difference do you find in the answer ? Note down with practice.
- If the same activity is done using subtraction, what can be seen ?
- Is the answer same or different ?

2. Look, understand and complete :

$(-4) + 5 = 5 + (-4) = 1$

$3 + (-7) = (-7) + 3 = (-4)$

$(-8) +$ .... $= (-6) + (-8) = (-14)$

$(-10) + 5 = 5 +$ .... $= (-5)$

It is clear from the above examples that if we add any integers in any order the result is same.

3. Look, understand and complete :

$[(-3) + 6] + 7$	or	$(-3) + [6 + 7]$	or	$[(-3) + 7] + 6$
$= 3 + 7$		$= (-3) + (13)$		$= 4 + 6$
$= 10$		$= 10$		$= 10$

Complete as above :

$[4 + (-5)] + 7$	or	$4 + [(-5) + 7]$	or	$[4 + 7] + (-5)$
$= (-1) +$		$= 4 +$		$=$ .... $+ (-5)$
$= 6$		$= 6$		$= 6$

Thus, to do the addition of any three integers, taking a group of first two integers and then adding the third integer to the sum, the result will be the same.

4. Look, understand and complete :

$7 + 0 = 7$

$(-8) + 0 =$ ....

$0 + 9 = 9$

$0 +$ .... $= (-15)$

If we add zero to any integer, then we get the same integer.

Thus, 0 is called the neutral number (identity) for addition.

5. Look, understand and complete :

$7 + (-7) = 0$

$(-8) + 8 =$ ....

$15 +$ .... $= 0$

$(-12) +$ .... $= 0$

Thus, if addition of any two integers is zero, then each one is opposite integer (or additive inverse) of each other.

That is to say opposite number of $7 = (-7)$. The opposite numbner of $(-9) = 9$ and $0 + 0 = 0$, **that is to say opposite number of 0 = 0**.

Addition and subtraction of integers :

We know that if the number added decreases by 1 the result also decreases by 1.

Addition of positive integer or zero to positive integer gives positive integer.	$3 + 3 = 6$
	$3 + 2 = 5$
	$3 + 1 = 4$
	$3 + 0 = 3$
Addition of negative integer to positive integer gives negative integer, zero or positive integer.	$3 + (-1) = 2$
	$3 + (-2) = 1$
	$3 + (-3) = 0$
	$3 + (-4) = (-1)$
	$3 + (-5) = (-2)$
	$3 + (-6) = (-3)$

$(-3) + 6 = 3$	Addition of positive integer to negative integer gives positive integer, zero or negative integer.
$(-3) + 5 = 2$	
$(-3) + 4 = 1$	
$(-3) + 3 = 0$	
$(-3) + 2 = (-1)$	
$(-3) + 1 = (-2)$	
$(-3) + 0 = (-3)$	
$(-3) + (-1) = (-4)$	Addition of negative integer to negative integer gives negative integer.
$(-3) + (-2) = (-5)$	
$(-3) + (-3) = (-6)$	
$(-3) + (-4) = (-7)$	

Let us perform the addition and subtraction of integers without the help of number line. Let us understand the following :

Explanation 1 : If a negative integer comes after the sign of addition or subtraction, remove the negative sign and change the sign of the process.

e.g., $5 + (-3) = 5 - 3 = 2$ and $5 - (-3) = 5 + 3 = 8$

Explanation 2 : If a bigger number is to be subtracted from a smaller one, subtract the smaller number from the bigger one but the result should be given a negative sign.

e.g., $3 - 5 = (-2)$, $7 - 10 = (-3)$

Explanation 3 : If the first number is negative and the process is of addition, according to the rule of commutative property, their order can be changed.

e.g., $(-5) + 3 = 3 + (-5) = 3 - 5 = (-2)$

$(-7) + 9 = 9 + (-7) = 9 - 7 = 2$

Explanation 4 : If the first number is negative and the process is of subtraction give negative sign to the sum of both the numbers.

e.g., $(-5) - 3 = (-8)$, $(-7) - 9 = (-16)$

Example 1 :

(1) $65 + (-35)$

$= 65 - 35$ (As explanation (1))

$= 30$

(2) $(-52) + 38$

$= 38 + (-52)$ (As explanation (1))

$= 38 - 52$ (As explanation (2))

$= (-14)$

(3) $(-25) + (-37)$

$= (-25) - 37$ (As explanation (1))

$= (-62)$ (As explanation (4))

(4) $35 - (-25)$

$= 35 + 25$ (As explanation (1))

$= 60$

(5) $(-45) - 25$

$= (-70)$ (As explanation (4))

(6) $(-35) - (-25)$

$= (-35) + 25$ (As explanation (1))

$= 25 + (-35)$ (As explanation (3))

$= 25 - 35 = (-10)$

Note : There is no need to write details shown in the brackets while solving the examples.

Practice 1

1. Write the absolute value :

(1) 17 (2) (–18) (3) 0 (4) (–25) (5) 16

2. Make appropriate pairs :

(1)

(–5)		2
6	+ 6 =	(–6)
(–4)		12
(–12)		1

(2)

8		5
(–2)	+ (–5) =	(–7)
(–4)		3
10		(–9)

(3)

(−5)		1	
6	+ (−5) =	(−17)	
(−4)		(−10)	
(−12)		(−9)	

(4)

7		11
(−8)	−(−5) =	(−3)
(−4)		12
6		1

3. Calculate and obtain the result :

(1) 17 + (−12) (2) (−18) + 15 (3) 12 − (−18)

(4) (−25) + (−15) (5) (−9) − (−8) (6) 14 − 20

- **Multiplication of two integers :**

7 × 3 = 21	Positive × Positive = Positive (+) × (+) = (+)	(−7) × 3 = (−21)	Negative × Positive = Negative (−) × (+) = (−)
7 × 2 = 14		(−7) × 2 = (−14)	
7 × 1 = 7		(−7) × 1 = (−7)	
7 × 0 = 0	Positive × Zero = Zero (+) × (0) = (0)	(−7) × 0 = 0	Negative × Zero = Zero (−) × (0) = (0)
7 × (−1) = (−7)	Positive × Negative = Negative (+) × (−) = (−)	(−7) × (−1) = 7	Negative × Negative = Positive (−) × (−) = (+)
7 × (−2) = (−14)		(−7) × (−2) = 14	
7 × (−3) = (−21)		(−7) × (−3) = 21	
When the multiplicand in the multiplication by 7 is reduced by one unit, the result is reduced by 7 units.		When the multiplicand in the multiplication by (−7) is reduced by one unit, the result will be increased by 7 units.	

From the above two Tables, it can be said that the multiplication of zero with any positive or negative integer gives zero and zero multiplied by zero gives the result zero.

Thus, the multiplication of any integer with zero result into zero only.

- **Look, understand and calculate :**

(1)	5 × (–5) = (–25)	(7)	4 × (–3) = ...
(2)	(–12) × 5 = (–60)	(8)	(–10) × 4 = ...
(3)	0 × 12 = 0	(9)	0 × 8 = ...
(4)	(–5) × (–10) = 50	(10)	(–4) × (–5) = ...
(5)	(–120) × 1 = (–120)	(11)	35 × 1 = ...
(6)	1 × 45 = 45	(12)	1 × (–14) = ...

- **Properties of multiplication for integers :**

In Standard 5, we have studied about the properties of multiplication of whole numbers. Now in the same way, we will study about the properties of multiplication of integers :

1. Look, understand and complete :

(–5) **Integer**	×	**11** **Integer**	=	(–55) **Integer**
(–10) **Integer**	×	(–15) **Integer**	=	**150** **Integer**
..... **Integer**	×	(–7) **Integer**	=	**0** **Integer**
5 **Integer**	×	(–7) **Integer**	=	..... **Integer**

It is clear from the above Table that the product of any two integers will be an integer only.

2. Look, understand and complete :

(–7) × 10	=	10 × (–7) = (–70)
(–3) × (–7)	=	(–7) × (–3) = 21
8 × 0	=	0 × 8 = ...
7 × (–6)	=	(–6) × .... = (–42)

It is clear from the above Table that the multiplication of any two integers can be done in any order. The result will be the same.

3. Look and understand the following :

$[(-3) \times 4] \times (-5)$ or	$(-3) \times [4 \times (-5)]$ or	$[(-3) \times (-5)] \times 4$
$= (-12) \times (-5)$	$= (-3) \times (-20)$	$= (15) \times 4$
$= 60$	$= 60$	$= 60$

Complete as above :

$[(-4) \times 5] \times (-7)$ or	$(-4) \times [5 \times (-7)]$ or	$[(-4) \times (-7)] \times 5$
$= (-20) \times$	$= (-4) \times$	$=$ .... $\times 5$
$= 140$	$= 140$	$= 140$

Thus, for the multiplication of any three integers taking a group of first two integers and then multiplying the product by the third integer, the result will be the same.

4. Look, understand and complete :

$(-7) \times 1 = (-7)$ $\qquad$ $1 \times (-25) = (-25)$

$8 \times 1 =$ .... $\qquad$ $1 \times$ .... $= (-16)$

If we multiply any integer by 1, then we get the same integer as the result. Thus, 1 is called neutral (identity) number for multiplication.

- **Distribution of multiplication over addition :**

We know that multiplication is repeated addition.

Look and understand :

$$(-4) + (-4) + (-4) + (-4) + (-4) = (-4) \times 5 = (-20)$$

$(-4) + (-4) + (-4) + (-4) + (-4)$	$\underline{(-4) + (-4) + (-4)} + \underline{(-4) + (-4)}$
$= (-4) \times 5$	$= [(-4) \times 3] + [(-4) \times 2]$
$= (-4) \times (3 + 2)$	$= (-12) + (-8)$
$= (-20)$	$= (-20)$

Thus, $(-4) \times (3 + 2) = [(-4) \times 3] + [(-4) \times 2]$

Thus, multiplication is distributive over addition.

Think : Is it possible to distribute addition over multiplication ?

Practice 2

1. Fill in the blanks :

(1) $(-12) \times 5 =$ ....

(2) $(-15) \times (-10) =$ ....

(3) $14 \times (-7) =$ ....

(4) $0 \times (-17) =$ ....

(5) $20 \times 0 =$ ....

(6) $(-5) \times (-8) =$ ....

(7) $(-24) \times 5 =$ ....

(8) $20 \times (-15) =$ ....

(9) $100 \times 0 =$ ....

(10) $(-15) \times (-1) =$ ....

2. Answer the following and join the answers in the order of the examples. Colour the figure formed in this way :

(1) $5 \times (-5) =$ ....

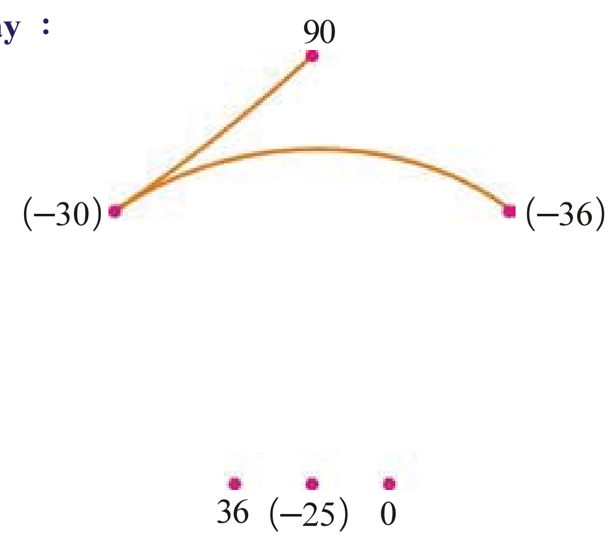
(2) $(-18) \times (-5) =$ ....

(3) $(-9) \times 4 =$ ....

(4) $(-6) \times (-6) =$ ....

(5) $0 \times 10 =$ ....

(6) $2 \times (-15) =$ ....



- Addition of any two integer is zero, then each one is opposite integer (or additive inverse) of each other.
- Multiplying a positive integer by a negative integer the result will be a negative integer.
- Product of two positive integers will be positive integer.
- Product of two negative integers will be positive integer.
- Multiplication is distributive over addition.

Exercise

1. Write the absolute value of the following integers :

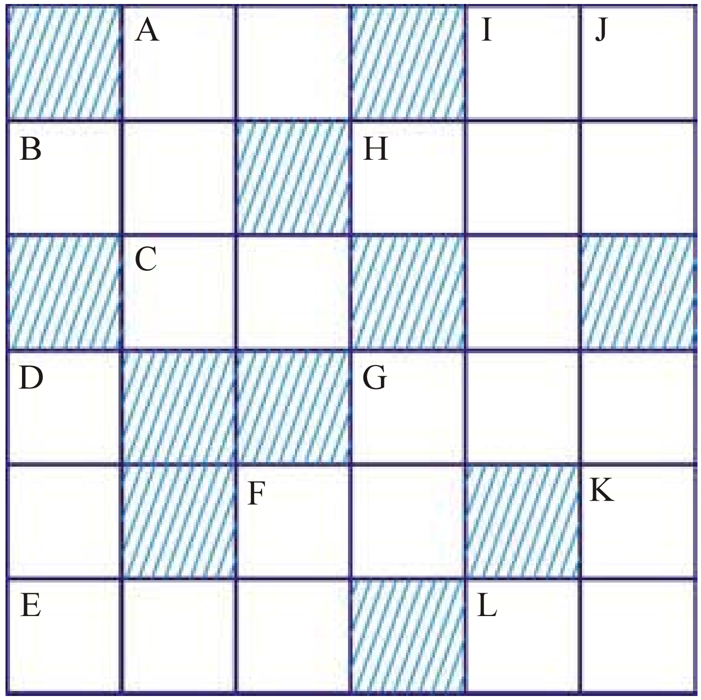
(1) 27 (2) (–15) (3) 0 (4) (–35) (5) 24

2. Match the following :

A	B
(1) (–4) + (–3)	(1) 0
(2) (–5) + 6	(2) (–12)
(3) (–7) – 5	(3) (–7)
(4) (–5) + (–4)	(4) 15
(5) (–4) × 4	(5) (–16)
(6) (–3) × (–5)	(6) 1
(7) 5 × 0	(7) (–9)

3. Number square - use the horizontal and vertical keys and fill the number-square :

Horizontal key		Vertical key	
A	The smallest whole no. of two digits	A	(–21) × (–5)
B	34 + (–4)	D	Absolute value of (–124)
C	18 × 3	F	(–9) × 7
E	(–23) × (–21)	G	21 + 14
F	(–8) + (–57)	I	The largest whole number of four digits.
G	13 × 30	J	27 – (–27)
H	(–6) – (–200)	K	(–6) + 28
I	(–19) × (–5)		
L	7 × (–6)		



Answer

Practice 1

1. (1) 17 (2) 18 (3) 0 (4) 25 (5) 16

3. (1) 5 (2) (–3) (3) 30 (4) (–40) (5) (–1) (6) (–6)

Practice 2

1. (1) (–60) (2) 150 (3) (–98) (4) 0 (5) 0
(6) 40 (7) (–120) (8) (–300) (9) 0 (10) 15

2. (1) (–25) (2) 90 (3) (–36) (4) 36 (5) 0 (6) (–30)

Exercise

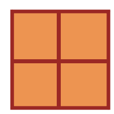
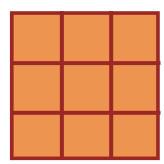
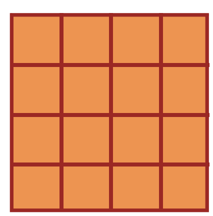
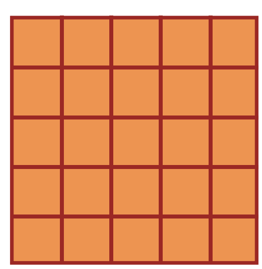
1. (1) 27 (2) 15 (3) 0 (4) 35 (5) 24

2. (1) → (3) (2) → (6) (3) → (2) (4) → (7)
(5) → (5) (6) → (4) (7) → (1)

3 Square and Square Root

Let us remember :

You have already learnt about square and its area. Measure of all the sides of square are equal, aren't they ? Area of a Square = Length × Length. Let us do some activity with the help of a square having measure of 1 cm length to solve the following questions :

Questions	Figure	Area (sq. cm)
• What is the area of a square with length 1 cm ?		$1 \times 1 = 1$
• What is the area of a square with length 2 cm ?		$2 \times 2 = 4$
• What is the area of a square with length 3 cm ?		$3 \times 3 = 9$
• What is the area of a square with length 4 cm ?		....
• What is the area of a square with length 5 cm ?		....

The area of a square having length 1 to 5 cm will be 1, 4, 9, 16, 25 sq cm respectively.

If we think further in this manner,

$6 \times 6 = 36$, $7 \times 7 = 49$, $8 \times 8 = 64$, $9 \times 9 = 81$,...

We have seen that we get the integers 1, 4, 9, 16, 25, 36, 49, 64, 81,... etc. by multiplying the integer with that same integer.

A perfect square is the product of two same integers.

- $1 \times 1 = 1^2 = 1$ (Read as one square)
- $2 \times 2 = 2^2 = 4$ (Read as two square)
- $3 \times 3 = 3^2 = 9$ (Read as three square)
- $4 \times 4 = 4^2 = 16$ (Read as four square)

Example : Find the square of 12 :

$12^2 = 12 \times 12$

$= 144$

$\therefore\ 12^2 = 144$

Practice 1

Write the square of the following numbers :

(1) 10^2 = ...	(2) 11^2 = ...
(3) 13^2 = ...	(4) 18^2 = ...
(5) 32^2 = ...	(6) 46^2 = ...

Perfect squares :

1, 4, 9 and 16 are squares of 1, 2, 3 and 4 respectively. These numbers are called perfect squares.

If the given number is a square of a number, it is called a perfect square number.

Therefore, $9 \times 9 = 9^2 = 81$

$10 \times 10 = 10^2 = 100$

Here, 81 and 100 are perfect squares.

- Every number is not a perfect square number.
- e.g., 12 is not a square of any number, therefore 12 is not a perfect square number.

Think : How many such perfect squares can be found out ?

- **Complete the following Table :**

Table : 1

Number	Square	Perfect square number	Number	Square	Perfect square number
1	$1 \times 1 = 1^2 = 1$	1	11	....	....
2	$2 \times 2 = 2^2 = 4$	4	12	....	....
3	....	9	13	$13 \times 13 = 13^2 = 169$	169
4	....	....	14	....	....
5	....	....	15	....	....
6	....	....	16	$16 \times 16 = 16^2 = 256$	256
7	....	....	17	....	....
8	$8 \times 8 = 8^2 = 64$	64	18	$18 \times 18 = 18^2 = 324$	324
9	....	....	19	....	....
10	$10 \times 10 = 10^2 = 100$	100	20	....	....

Based on the above Table 1, answer the following questions :

- Which digits are at the unit place in a perfect square ?
- Which digits do not come at unit place in a perfect square ?

Answer :

- **A perfect square has either 0, 1, 4, 5, 6 or 9 at its unit place.**
- **Digits other than 0, 1, 4, 5, 6 or 9 at the unit place of a number cannot be a perfect square. That means, the digits 2, 3, 7 or 8 never come at the unit place of a perfect square.**

Example 2 : Do the below given numbers have the possibility of being a perfect square ? Verify it.

(1) 5287 (2) 4302 (3) 361 (4) 3648 (5) 25 (6) 256

Solution :

(1) The given number is not a perfect square because 7 is at its unit place.

(2) The given number is not a perfect square because 2 is at its unit place.

(3) The given number can be a perfect square because there is 1 at the unit place.

(4) The given number is not a perfect square because its unit place is 8.

(5) The given number can be a perfect square because its unit place is 5.

(6) The given number can be a perfect square because its unit place is 6.

Example 3 : Write two such numbers looking at their unit place, it can be concluded that the numbers are not perfect squares.

Solution : (1) 3412 (2) 5007

Practice 2

1. Is your roll number a perfect square number ? Why ?
2. In 1 to 100, how many perfect squares are found ? Note them down.
3. Which of the following numbers has the possibility of having perfect squares :

   (1) 9285 (2) 2312 (3) 2307 (4) 2001 (5) 2305

   (6) 2508 (7) 2160 (8) 44101 (9) 1069
4. Write ten such numbers, looking at their unit place, it can be concluded that they are not perfect squares.

- **Write the squares of given numbers and complete the Table :**

Table : 2

Number	Square	Number	Square	Number	Square
21	$21 \times 21 = 441$	26	$26 \times 26 = 676$	35	
22		27		40	$40 \times 40 = 1600$
23		28		50	
24	$24 \times 24 = 576$	29	$29 \times 29 = 841$	100	
25		30		500	$500 \times 500 = 250000$

Based on Table 1 and Table 2, complete Table 3 and Table 4 and get to the conclusion :

Table : 3

Unit place of perfect square numbers	**1**	**4**	**6**	**9**
Perfect square numbers	1	4	16	9
	81	64	36	49
	121	144	196	169
	....	....	....	....
	....	....	....	....
	....	....	....	....
Unit place digit of the original number	1 or 9	....	4 or 6	3 or 7
Conclusion	The number having 1 or 9 at its unit place will have 1 at the unit place of perfect square of that number.	The number having 2 or 8 at its unit place will have 4 at the unit place of perfect square of that number.	....	The number having 3 or 7 at its unit place will have 9 at the unit place of perfect square of that number.

Table : 4

The last digit of the perfect square number	**25**	**00**	**0000**
Perfect square numbers	25	100	10000
	225	400	....
	....	....	....
	....	....	....
Unit place digit of the original number	5	0	00 (last two digits)
Conclusion	The number with 5 at its unit place will surely have 25 as the last two digits.	The numbers with 0 at its unit place will surely have 00 as the last two digits.	The number with 0 at its unit and ten's place, will surely have 0000 as the last four digits.

Example 4 : By squaring the below given number, which digits are found at the unit place.

Number	Digit found at the unit place by squaring the number	Number	Digit found at the unit place by squaring the number
225	5	53004	6
157	9	83091	1

Example 5 : Mention the last two digits of the square of the following number :

(1) 25 (2) 30 (3) 35

Solution : (1) We get 25. (2) We get two zeros. (3) We get 25.

Example 6 : How many zeros are obtained by squaring the below given numbers ?

(1) 20 (2) 200

Solution : (1) We will get two zeros because zero is only at the unit place.

(2) We will get four zeros because it has zero at its unit and ten's place.

Based on the above conclusion answer the following

(1) By squaring the total number of students in your class, what will be the digit at unit place ?

(2) If you square your roll number which digit will be obtained at the unit place ?

(3) If you square the number of your birthdate which digit will be obtained at the unit place ?

(4) If you square the number of your weight, which digit will be obtained at its unit place ?

(5) If you square the number of pages of your notebook, which digit will be obtained at its unit place ?

Method to obtain square of a number having 5 at its unit place :

- **Study the following Table :**

Number	Square	In perfect squares, digit formed at hundredth and thousandth place
15	225	$2 = 1 \times 2$
25	625	$6 = 2 \times 3$
35	1225	$12 = 3 \times 4$
45	2025	$20 = 4 \times 5$
55	3025	$30 = 5 \times 6$

By studying the above Table we conclude that if we square a number with 5 in its unit place, the perfect square formed will have 2 and 5 i.e. (25) at tens and unit place respectively. The number preceding 25 is the product of two consecutive numbers. For example, to get square of 35, first multiply the number 3 in tens place with the number 4 next to it. Write 25 at the end of the result. So, $35^2 = 1225$

$$35^2 = 35 \times 35 = \underline{12}\ \underline{25}$$

($5 \times 5 \rightarrow 25$; $3 \times 4 \rightarrow 12$)

By squaring a number having 5 in its unit's place, the number formed by tens and unit place is always 25.

Practice 3

Write the squares of the following numbers :

(1) 75^2 = ... (2) 65^2 = ...

(3) 85^2 = ... (4) 105^2 = ...

Square root :

(1) $1 \times 1 = 1^2 = 1$ (2) $4 \times 4 = 4^2 = 16$

(3) $10 \times 10 = 10^2 = 100$ (4) $15 \times 15 = 15^2 = 225$

Here, 1, 16, 100, 225 are the perfect squares obtained by squaring 1, 4, 10 and 15 respectively. 16 is the square of 4, therefore 4 is the square root of 16. 100 is the square of 10, therefore 10 is the square root of 100.

[redacted]

- **Complete the following Table :**

Square	Square root	Square	Square root
$11^2 = 121$	$\sqrt{121} = 11$	$16^2 =$	....
$12^2 = 144$	$\sqrt{144} = 12$	$17^2 = 289$	$\sqrt{289} = 17$
$13^2 =$	$\sqrt{169} = 13$	$18^2 = 324$	....
$14^2 =$	....	$19^2 =$	$\sqrt{361} = 19$
$15^2 =$	....	$20^2 =$	....

Finding the square root by the method of indivisible factors :

Example 6 : Find the square root of 36.

Solution :

2	36
2	18
3	9
3	3
	1

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

$= 2^2 \times 3^2$

$= (2 \times 3)^2$

$= 6^2$

$\therefore \sqrt{36} = \sqrt{6^2} = 6$

Example 7 : Find the square root of 1089.

Solution :

3	1089
3	363
11	121
11	11
	1

$1089 = \underline{3 \times 3} \times \underline{11 \times 11}$

$= 3^2 \times 11^2$

$= (3 \times 11)^2$

$= 33^2$

$\therefore \sqrt{1089} = 33$

- **Do it yourself : Find the square root of 25, 64 and 100.**

Indivisible factors of 32 $= 2 \times \underline{2 \times 2} \times \underline{2 \times 2}$

Here, 2 has total two pairs and one 2 remains alone, therefore 32 is not a perfect square.

Practice 4

1. Find the square root by the method of indivisible factors :

(1) 64 (2) 100 (3) 484 (4) 900 (5) 1156

(6) 3136 (7) 1225 (8) 1764 (8) 12100 (10) 3249

2. Are 42 and 50 the perfect squares ? Why ?

Example 8 : Is 252 a perfect square ? By which smallest number should it be multiplied, so that the result becomes a perfect square ?

Solution :

2	252
2	126
3	63
3	21
7	7
	1

$252 = 2 \times 2 \times 3 \times 3 \times 7$

In factors of 252 pair of 7 is not formed, so 252 is not a perfect square. If we multiply both the sides by 3, we get perfect square.

$252 \times 7 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{7 \times 7}$

By multiplying 252 by 7, we get perfect square.

Example 9 : Is 1620 a perfect square ? By which smallest number should it be divided so that the result becomes a perfect square ?

Solution :

2	1620
2	810
3	405
3	135
3	45
3	15
5	5
	1

$1620 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{3 \times 3} \times 5$

In factors of 1620 pair of 5 is not formed, so 1620 is not a perfect square.

If we remove factor 5 from both the sides i.e. by dividing by 5 on both the sides we get perfect square.

$1620 \div 5 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{3 \times 3} \times \underline{5 \div 5}$

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

Now every indivisible factor forms a pair.

So, by dividing 1620 by 5, we get a perfect square.

Square and square root of a fraction :

We have learnt to find the squares of an integer. To find the square of a fraction, we place square of numerator in numerator's place and the square of denominator in denominator's place.

$$\left(\frac{1}{2}\right)^2 = \frac{1}{2} \times \frac{1}{2} = \frac{1 \times 1}{2 \times 2} = \frac{1}{4}$$

$$\left(\frac{2}{5}\right)^2 = \frac{2}{5} \times \frac{2}{5} = \frac{2 \times 2}{5 \times 5} = \frac{4}{25}$$

$$\left(\frac{3}{4}\right)^2 = \frac{3}{4} \times \frac{3}{4} = \frac{3 \times 3}{4 \times 4} = \frac{9}{16}$$

In the same way, square root of a fraction means placing the square root of numerator at numerator's place and square root of denominator at denominator's place.

$$\left(\frac{1}{2}\right)^2 = \frac{1}{4}, \text{ thus } \sqrt{\frac{1}{4}} = \sqrt{\frac{1^2}{2^2}} = \frac{1}{2}$$

$$\left(\frac{3}{4}\right)^2 = \frac{9}{16}, \text{ thus } \sqrt{\frac{9}{16}} = \sqrt{\frac{3^2}{4^2}} = \frac{3}{4}$$

$$(1.5)^2 = \left(\frac{15}{10}\right)^2 = \frac{225}{100}, \text{ so, } \sqrt{2.25} = \sqrt{\frac{225}{100}} = \sqrt{\frac{15^2}{10^2}} = \frac{15}{10} = 1.5$$

Example 10 : Find the value of $\sqrt{\frac{25}{49}}$.

Solution : Now, we factorize the numerator and denominator.

$$\therefore \sqrt{\frac{25}{49}} = \sqrt{\frac{5 \times 5}{7 \times 7}} = \sqrt{\frac{5^2}{7^2}} = \sqrt{\frac{5}{7}}$$

$$\therefore \sqrt{\frac{25}{49}} = \frac{5}{7}$$

5	25
5	5
	1

7	49
7	7
	1

Example 11 : Find the square root of $11\frac{14}{25}$.

Solution : Here, $11\frac{14}{25}$ is a vulgar fraction. Let us convert it into improper fraction and then find the square root by the method in the above example.

$$11\frac{14}{25} = \frac{289}{25}$$

$$\frac{289}{25} = \frac{17 \times 17}{5 \times 5}$$

$$\therefore \sqrt{\frac{289}{25}} = \sqrt{\frac{17^2}{5^2}} = \frac{17}{5} = 3\frac{2}{5}$$

$$\therefore \sqrt{11\frac{14}{25}} = 3\frac{2}{5}$$

17	289
17	17
	1

5	25
5	5
	1

Example 12 : Find the square of 12.25.

Solution : Here 12.25 is a decimal fraction, so it can be transformed into simple fraction and square root could be found out.

$$12.25 = \frac{1225}{100}$$

$$\frac{1225}{100} = \frac{5 \times 5 \times 7 \times 7}{2 \times 2 \times 5 \times 5}$$

$$\therefore \sqrt{\frac{1225}{100}} = \sqrt{\frac{5^2 \times 7^2}{2^2 \times 5^2}} = \frac{5 \times 7}{2 \times 5} = \frac{35}{10}$$

$$= 3.5 \text{ or } 3\frac{5}{10}$$

$$\therefore \sqrt{12.25} = 3.5$$

5	1225
5	245
7	49
7	7
	1

2	100
2	50
5	25
5	5
	1

Practice 5

Find the square root :

(1) $\frac{36}{49}$ (2) $\frac{484}{625}$ (3) $5\frac{19}{25}$ (4) 72.25 (5) 39.69

Exercise

1. Write the digit in unit place by squaring the number :

Sr. No.	Number	Digit in unit place by squaring the number
1	125	....
2	137	....
3	140	....
4	78	....
5	95	....
6	108	....

2. **By squaring the given numbers, state whether it is odd or even :**
(1) 1985 (2) 253 (3) 444 (4) 99

3. **By squaring the given numbers, how many zeros will be obtained ?**
(1) 20 (2) 200 (3) 30 (4) 700

4. **Find the square root of the given numbers by prime factorisation method :**
(1) 256 (2) 400 (3) 9216 (4) 9604
(5) 529 (6) 729 (7) 8100 (9) 5929

5. **By which smallest number the given numbers below should be multiplied, so that the result becomes a perfect square ? Find the square root of the result obtained :**
(1) 1008 (2) 2028 (3) 180 (4) 1458 (5) 768

6. **By which smallest number the given numbers below should be divided, so that the result becomes a perfect square ? Find the square root of the result obtained :**
(1) 396 (2) 1620 (3) 2800 (4) 2645

7. **Find the square root of the following by factorization :**
(1) $\frac{196}{225}$ (2) $1\frac{49}{576}$ (3) 21.16 (4) $72\frac{1}{4}$

- **Pattern :**

(1) 1, 4, 9, 16, ...	(2) 169, 144, 121, ...
(3) 2, 5, 10, 17, ...	(4) 6, 9, 14, 21, ...

Answers

Practice 1

(1) 100 (2) 121 (3) 169 (4) 324 (5) 1024 (6) 2116

Practice 2

3. (1), (4), (5), (7), (8), (9) has possibility of having perfect square.

Practice 3

(1) 5625 (2) 4225 (3) 7225 (4) 11025

Practice 4

1. (1) 8 (2) 10 (3) 22 (4) 30 (5) 34 (6) 56 (7) 35 (8) 42 (9) 110 (10) 57

3 : Square and Square Root

Practice 5

1. (1) $\frac{6}{7}$ (2) $\frac{22}{25}$ (3) $\frac{12}{5} = 2\frac{2}{5}$ (4) 8.5 (5) 6.3

Exercise

1. (1) 5 (2) 9 (3) 0 (4) 4 (5) 5 (6) 4

2. (1) odd (2) odd (3) even (4) odd

3. (1) two (2) four (3) two (4) four

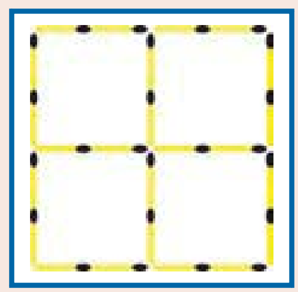
4. (1) 16 (2) 20 (3) 96 (4) 98 (5) 23 (6) 27 (7) 90 (8) 77

5. (1) 7, 84 (2) 3, 78 (3) 5, 30 (4) 2, 54 (5) 3, 48

6. (1) 11, 6 (2) 5, 18 (3) 7, 20 (4) 5, 23

7. (1) $\frac{14}{15}$ (2) $\frac{25}{24}$ or $1\frac{1}{24}$ (3) 4.6 (4) 8.5 or $8\frac{1}{2}$

Extra knowledge :



1. With the help of 6 matchsticks, form 5 squares.

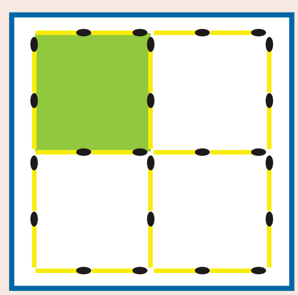
2. With the help of 15 matchsticks, form 11 squares.

3. With the help of 12 matchsticks, form the following figure :

(1) How many squares are there in this figure ?

(2) From the original figure remove matchsticks and arrange them in such a way that 3 squares are formed.

(3) From the original figure, remove 4 matchsticks, arrange them in such a way that 10 squares are formed.



4. With the help of 24 matchsticks, form the adjoining figure. Now remove 2 matchsticks and add 4 matchsticks. Arrange these 6 matchsticks in such a way that the part except the coloured part, are arranged equally in 4 shapes of equal area.

(For answer see page no. 42)

4 Profit-Loss

- **Let us remember :**
  - The amount at which a trader buys a product is known as its **Cost price**.
  - After buying a product, the additional expenditure incurred on a product is called **Additional expense**. The expenditure on labour, rent, octroi tax, maintenance work is called additional expense.
  - **The sum of cost price and additional expense is called Net price.** When there is no extra expenditure, the cost price is considered the Net price.

    Net price = Cost price + Additional expense
  - The amount at which a trader sells the product is called the **Sale price**.
  - The excess amount got over the cost price after selling the product is called the **profit**.

    Profit = Sale price − Net price

    So, **Profit = S.P. − N.P.**
  - The amount got at the time of sale less than the net amount is called the **Loss.**

    Loss = Net price − Sale price

    So, **Loss = N.P. − S.P.**

    When there is profit, **Sale price = Net price + Profit**

    When there is loss, **Sale price = Net price − Loss**

Now, find the answers from above information :

A trader bought a TV for ₹ 9950. He paid ₹ 50 as labour charge to bring the TV home. Selling the TV at ₹ 10,700, he earned the profit of ₹ 700.

Cost price	= ₹	Additional expense	= ₹ ....
Net price	= ₹	Sale Price	= ₹ ....
Profit	= ₹	Profit	= .... %

- **Let's learn something new :**

  - In Std. 6, we learnt how to find profit or loss in terms of percentage. Now on the basis of profit and loss percentage and net price, let's understand how to find the selling price.

Example 1 : To earn a profit of 10 %, at what price should a product costing ₹ 400 be sold ?

Solution : Method - 1

Profit on the cost price of ₹ 100 = ₹ 10

∴ Profit on the cost price of ₹ 400 = $\left(10 \times \frac{400}{100}\right)$

= ₹ 40

∴ Sale price = Profit + Net price

= ₹ (40 + 400)

= ₹ 440

Method - 2

To earn a profit of 10 %, a product of ₹ 100 should be sold at ₹ 110.

The sale price of a product of ₹ 100 = ₹ 110

Then, the sale price of a product of ₹ 400 = ₹ $\frac{110 \times 400}{100}$ = ₹ 440

∴ To earn a profit of 10 % on a product of ₹ 400, it should be sold at ₹ 440.

Practice 1

1. Fill the following Table after calculation :

Sr. No.	Cost price (in ₹)	Addi. Exp. (in ₹)	Profit (in %)	Loss (in %)	Sale price
1.	60	–	5	–	....
2.	40	–	10	–	....
3.	1000	–	12	–	....
4.	240	–	–	15	....
5.	1500	–	–	5	....
6.	24	–	–	12.5	....
7.	1650	150	–	5	....
8.	750	50	–	10.5	....
9.	3800	200	15.5	–	....

2. Vairagi bought a table for ₹ 450. There is ₹ 50 additional expenses on this table. For earning 12 % profit, what should be the sale price ?

3. Vivekbhai bought a TV for ₹ 16,000. ₹ 200 was spent on transportation and labour. For earning 12 % profit, what price should it be sold ?

4. Deepali has bought a sofa set for ₹ 14,500. There is an additional expense of ₹ 500 on it. Since she did not like the sofa set, she sold it bearing a loss of 8.5 %. For how much did she sell the sofa set ?

5. Akhileshbhai bought a house for ₹ 9,50,000. ₹ 50,000 was spent on colour. For earning a profit of 14.5 %, how much should sell the home for ?

6. Tamiza sold off her Activa costing ₹ 55,000 to Sharmin earning a profit of 14 %. How much amount should Tamiza have got ?

- **Brokerage, Commission :**

Nareshbhai wants to buy an old tractor. He tells this to Hareshbhai.

Hareshbhai : I remember that there is a tractor used for two years only.

Nareshbhai : Wow, that is very nice.

Hareshbhai : I will show you a tractor as you wish to buy it at an economical price. But, if you buy that tractor, you should give me ₹ 2000.

Nareshbhai : Ok. Kindly show me that tractor.

Hareshbhai : Come on (Going to Pareshbhai's field).

Pareshbhai... Come on this side. Look, my friend Nareshbhai had come. He wants to buy your tractor, if he likes it. Talk to him on your own, but if it is sold, your must give me ₹ 1000.

On seeing the tractor, Nareshbhai likes it. He asks the cost and at the end of negotiation, Nareshbhai buys the tractor on giving ₹ 1,80,000. According to the condition gives ₹ 2000 to Hareshbhai. Pareshbhai calls Hareshbhai and gives ₹ 1000 as decided earlier for helping him to see the tractor.

- **Now answer the following :**

(1) At what price did Pareshbhai sell the tractor ?
(2) At what price did Nareshbhai buy the tractor ?
(3) How much money did Pareshbhai give to Hareshbhai ? Why ?
(4) How much money did Nareshbhai give to Hareshbhai ? Why ?
(5) How much money did Pareshbhai actually get on selling the tractor ?
(6) How much money was actually paid by Nareshbhai to buy the tractor ?
(7) From whom did Hareshbhai get money ? How much ?
(8) Hareshbhai did not actually buy or sell any thing, yet he get money, why ?

A person who bring the buyer and seller together is called a broker.

In the above conversation, Hareshbhai is a broker.

When any product is to be sold or bought, the amount that a broker gets from either seller or buyer or both is called brokerage. In the above conversation Hareshbhai takes ₹ 2000 from Nareshbhai and ₹ 1000 from Pareshbhai as brokerage.

Brokerage is a kind of additional expense.

Amount received by the seller = S.P. − Brokerage

Amount to be paid by the buyer = C.P. + Brokerage

Example 2 : Prakruti bought an old sofa set for ₹ 9600, with the help of a broker at 2 % brokerage. At what price did she get the sofa set ?

Solution : 2 % brokerage means on the cost price ₹ 100 the brokerage is ₹ 2.

∴ Here, brokerage = 2 % of ₹ 9600

$= ₹ \left(9600 \times \frac{2}{100}\right) = ₹\ 192$

∴ Net price = C.P. + Brokerage

= ₹ 9600 + ₹ 192 = ₹ 9792

∴ Prakruti got the sofaset for ₹ 9792.

Example 3 : Kasambhai bought a shop for ₹ 6,00,000, through a broker. The broker took 1 % brokerage from the seller and 2 % brokerage from the buyer. How much brokerage did the broker get ?

Solution : Method 1 : The broker takes 1 % brokerage from the seller :

∴ Brokerage paid by the seller

= ₹ 6,00,000ના 1 %

$= ₹ \left(600000 \times \frac{1}{100}\right)$

= ₹ 6000

The broker takes 2 % brokerage from the buyer :

∴ Brokerage paid by the buyer

= 2 % of ₹ 6,00,000

$= ₹ \left(600000 \times \frac{2}{100}\right)$

= ₹ 12,000

∴ Total brokerage earned by the broker = Brokerage paid by the seller + Brokerage paid by the buyer

= ₹ 6,000 + ₹ 12,000 = ₹ 18,000

∴ The broker gets total ₹ 18,000 as brokerage.

Method 2 : The brokerage earned by the broker = 2 % + 1 %

= 3 %

In this way, total brokerage can be calculated at the rate of 3 % on ₹ 6,00,000.

Total brokerage earned by the broker = ₹ $\left(600000 \times \frac{3}{100}\right)$

= ₹ 18,000

Practice 2

1. By paying 2 % brokerage for buying an old scooter for ₹ 15,000 through a broker. At what amount is the scooter bought ?
2. A car was sold at ₹ 80,000 through a broker. The broker charged 2.5 % brokerage from both the seller and the buyer. What is the total amount of brokerage received by the broker ?
3. Vinodbhai sold his shop through a broker for ₹ 7,50,000. The broker charged 1 % brokerage for this work. What amount did Vinodbhai get on selling the shop ?
4. Dharmendrabhai sold a plot through a broker for ₹ 8,80,000. The broker charged 1.5 % brokerage for this work. What amount did Dharmendrabhai get on selling the plot ?
5. Manojbhai bought an old tractor through a broker for ₹ 2,50,000. The broker charged 1 % brokerage from the seller and 2 % brokerage from the buyer. What is the total amount of brokerage received by the broker ?

Rebate (Discount) :

MRP is the maximum amount at which a product can be sold. **MRP** (Maximum Retail Price) is printed on the product.

When a trader takes an amount less than the printed amount, that much amount is called **Rebate** for the buyer.

Rebate = Printed price × % or rebate

Amount to be paid = Printed price − Rebate

Example 4 : The printed price of a shirt is ₹ 400 and 40 % rebate is given on it. If this shirt is to be bought, how much amount is to be paid ?

∴ Rebate on shirt = Printed price × % of rebate

= ₹ (400 × 40 %)

= ₹ $\left(400 \times \frac{40}{100}\right)$

= ₹ 160

∴ Amount to be paid = Printed price − Rebate

= ₹ 400 − ₹ 160

= ₹ 240

∴ If this shirt is to be bought ₹ 240 is to be paid.

Example 5 : The printed price of a frock is ₹ 360. The trader gives 10 % rebate on it. Then, how much amount will the buyer have to pay ?

Solution : Rebate on the frock = Printed price × % of rebate

= ₹ (360 × 10 %)

= $\left(360 \times \frac{10}{100}\right)$

= ₹ 36

∴ Amount to be paid = Printed price − Rebate

= ₹ 360 − ₹ 36

= ₹ 324

∴ The buyer has to pay ₹ 324 for the frock.

Practice 3

1. Calculate and fill the table on the basis of the details given below :

Product	MRP(₹)	Rebate
Towel	125	15 %
Curtains	750	10 %
1 kg Biscuits	40	5 %

No.	Product	MRP (₹)	% rebate	Amount of the rebate (₹)	Amount to be paid (₹)
(1)	Towel				
(2)	Curtain				
(3)	1 kg Biscuits				

2. Calculate and fill the Table :

No.	Book	MRP (₹)	Rebate	Amount to be paid (₹)
(1)	My Experiments With Truth	20	10 %	
(2)	Srimad Bhagvad Geeta	65	20 %	
(3)	Bible	60	20 %	
(4)	Day Dreams	80	5 %	
(5)	Panchtantra	120	15 %	

3. Project : From the newspaper, cut the advertisement showing rebate and find the cost of that product.

- **Practical sums :**

Example 6 : A saree trader buys some sarees at a rebate of 20 % on the printed price of ₹ 600. If he sells these sarees at ₹ 540 each, how much profit or loss will he make per saree ? How much rebate in percentage does a customer get on each saree ?

Rebate for the trader = Printed price × % of rebate

= ₹ (600 × 20 %)

= ₹ $\left(600 \times \frac{20}{100}\right)$

= ₹ 120

Net price of the saree = Printed price − Rebate

= ₹ 600 − ₹ 120 = ₹ 480

The trader sells this saree for ₹ 540.

(1) Profit earned per saree = Selling price − Net price

= ₹ 540 − ₹ 480 = ₹ 60

Rebate earned by the customer = Printed price − Price paid

= ₹ 600 − ₹ 540 = ₹ 60

∴ Rebate earned by the customer on ₹ 600 = ₹ 60

(2) % rebate earned by the customer = ₹ $\left(100 \times \frac{60}{600}\right)$ = 10 %

∴ The customer earned a rebate of 10 % on each saree.

Practice 4

1. A trader buys some T-shirts at 10 % rebate on printed price ₹ 450 per piece. For a long time he could not sell any T-shirt, so he sells it for ₹ 360 per piece. What amount of profit or loss per piece does he make ? How much percentage of rebate does a customer earn ?

2. A trader buys some TVs at 20 % rebate on printed price ₹ 18,000. For a long time he could not sell any TV. So he sells it by giving a rebate of ₹ 2700 on printed price, what amount of profit or loss does he make ? How much percentage of rebate does a customer earn ?

Exercise

1. Calculate the sale price on the basis of the given information :

Cost price (₹)	Additional expense (₹)	Profit (%)	Loss (%)	Sale price (₹)
1800	–	–	7	
630	70	10	–	
1050	150	4	–	

2. A trader buys some cameras with printed price ₹ 750. If he sells each camera giving 10 % rebate, how much money could a customer have to pay ?

3. A saree trader brings some sarees at 25 % rebate on ₹ 1600 printed price. He sells each saree at ₹ 1440 per piece. What amount of profit or loss does he make ? How much percentage of rebate does a customer earn ?

4. A television costs ₹ 14,750. If a customer gets a rebate of 20 % on that, at what amount does the customer get the television ?

5. 10 % rebate is given in a T-shirt shop. Sohan buys 5 T-shirts with ₹ 300 printed price on each. He sells all the T-shirts for ₹ 1485. Does he earn profit or suffer loss ? How much amount ?

Answers

Practice 1

1. (1) ₹ 63 (2) ₹ 44 (3) ₹ 1120 (4) ₹ 204
(5) ₹ 1425 (6) ₹ 21 (7) ₹ 1710 (8) ₹ 716 (9) ₹ 4620

2. ₹ 560 **3.** ₹ 18,144 **4.** ₹ 13,725 **5.** ₹ 8,55,000 **6.** ₹ 62,700

Practice 2

1. ₹ 15,300 **2.** ₹ 4000 **3.** ₹ 7,42,500 **4.** ₹ 8,66,800 **5.** ₹ 7500

Practice 3

1. (1) ₹ 18.75, ₹ 106.25 (2) ₹ 75, ₹ 675 (3) ₹ 2, ₹ 38

2. (1) ₹ 18 (2) ₹ 52 (3) ₹ 48 (4) ₹ 76 (5) ₹ 102

Practice 4

1. (1) Loss ₹ 45, 20 % Rebate (2) Profit ₹ 900, 15 % Rebate

Exercise

1. (1) ₹ 1674 (2) ₹ 770 (3) ₹ 1248

2. (1) ₹ 675 **3.** (1) ₹ 240 Profit, 10 % Rebate

4. ₹ 11,800 **5.** ₹ 135 Profit

Let us understand

The value of a product increases at every step from production to distribution. VAT means Value Added Tax. VAT is such a tax that is charged on the increase of value of the product at every step. In fact VAT is a kind of Sales Tax charged on the sale price of a product.

According to the rules of VAT, a trader has to pay VAT to the seller at the time of buying any product. In the same way VAT is charged from the buyer at the time of selling the product. After this, at the time of calculating the VAT amount to be paid to the government, the trader pays the difference of the amount paid by the trader to the government and the amount charged by the trader.

Example : A trader sells some product at ₹ 60,000 bought at the price of ₹ 50,000. If VAT is 4 %

(1) Find the amount of VAT paid to the government by the trader ?

(2) Find the amount of VAT charged by the trader from the customer ?

(3) Lastly, find the amount of VAT to be paid by the trader to the government.

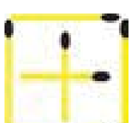
Solution :

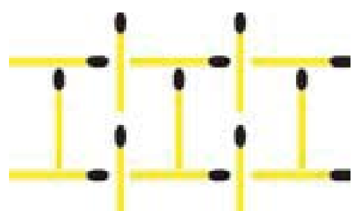
(1) The amount of VAT paid to the government by the trader = 4 % of ₹ 50,000
= ₹ 2000

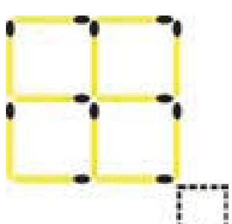
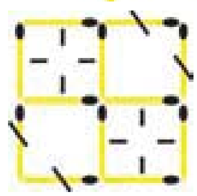
(2) The amount of VAT charged by the trader from the customer = 4 % of ₹ 60,000
= ₹ 2400

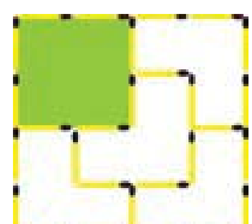
(3) Lastly, the amount of VAT to be paid to the government by the trader
= VAT charged at the time of selling − VAT charged at the time of buying
= ₹ 2400 − ₹ 2000 = ₹ 400

Answers of "Let us understand this" :

1. 

2. 

3. (1) 5 squares (2)  (3) 

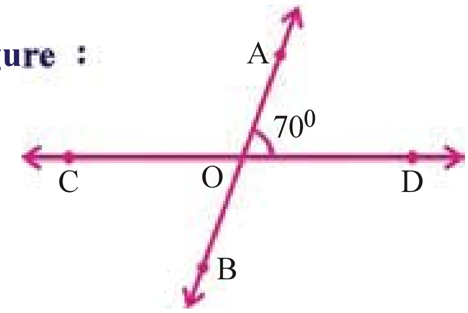
4. 

5 Parallel Lines

Let us remember :

Sr.	Measure of the given angle	Measure of the complementary angle	Measure of the supplementary angle	Measure of the angles of a linear pair	Measure of the vertically opposite angles
1.	75^o	15^o	105^o	105^o	75^o
2.	80^o		100^o		
3.	60^o			120^o	
4.	72^o	18^o			
5.	15^o				15^o

Fill in the blanks after studying the following figure :



(1) $m\angle AOC$ = ...

(2) $m\angle COB$ = ...

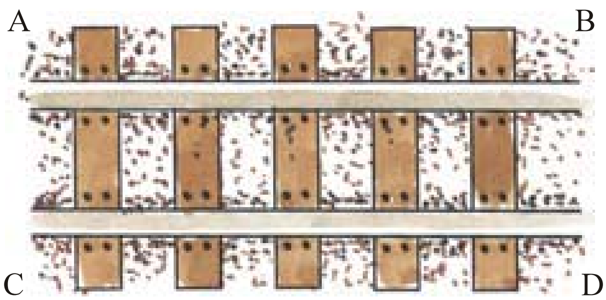
(3) $m\angle BOD$ = ...

(4) Measure of the complementary angle of $m\angle AOD$ is = ...

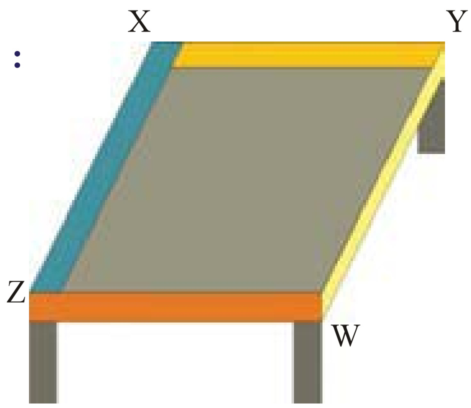
(5) Measure of the supplementary angle of complementary angle of $m\angle COB$ = ...

Let us learn new :

Parallel lines and their characteristic properties :



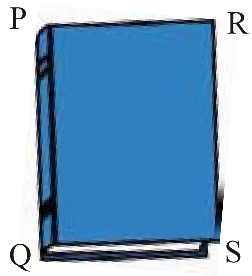
Parts of the railway track



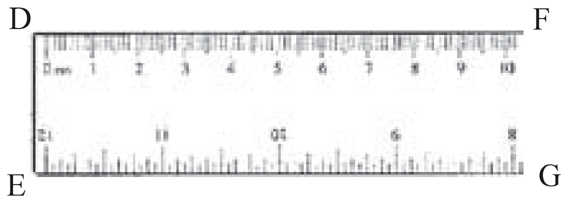
Two opposite edges of the table

5 : Parallel Lines

Two opposite sides of a blackboard



Two opposite sides of a book



Two opposite sides of a scale

What kind of distance is there between the opposite sides in all the above figures ?

Activity 1 :

- Take 1 meter long string.
- Join the two ends and make a loop.
- With the help of two pencils, keep the string stretched up.
- Measure the distance between the two straight lines with the help of scale.

Questions :

(1) Do $\overline{AB}$ and $\overline{CD}$ intersect each other ?

(2) Think and say that does a straight line form the sides of a scale ?

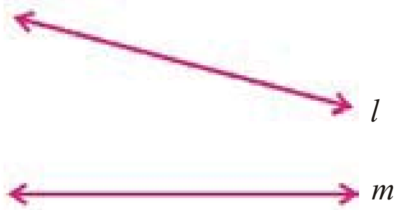
(3) Is the distance between both the lines same ?

(4) Measure the distance between the two lines, with the help of a scale.

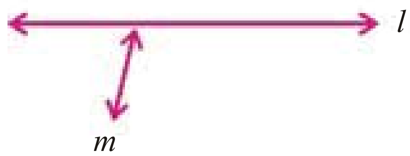
(5) By extending both lines, will it intersect at any one place ?

Study the figures given here and answer the questions based on them :

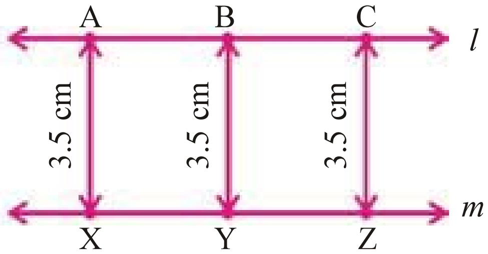
(1)



(2)



(3)



(4)

1. In figure (1), (2) and (3), draw the figure by extending lines *l* and *m* and name the point of intersection.

2. By extending lines *l* and *m* in figure (4), will they intersect each other ? Why ?

> In a plane, two distinct lines which do not intersect and the distance between the lines is same, such lines are known as parallel lines.

In figure (4) line *l* and line *m* are parellel. Symbolically, it is written as $l \parallel m$ and read as line *l* is parallel to line *m*.

- **Activity 2 :** Find out the examples of such things found in our day to day life having opposite sides parallel and write their names :

(1) .... (2) .... (3) ....

(4) .... (5) .... (6) ....

The distance between parallel lines should be found out with the help of set squares :

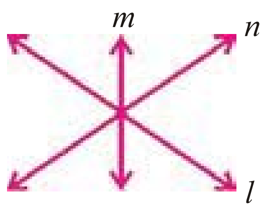
- **Activity 3 :**
  - Take one page from a notebook.
  - Measure the distance between the opposite sides with the help of a scale.
  - Note down the distance everytime.
  - Is the distance same everytime ?
  - Think the opposite sides of the page are parallel or not ?
- **Activity 4 :**
  - Draw two lines which includes the two sides of a scale.
  - Name them as *l* and *m*.
  - Take a point A on line *m*.

- Put the set square on point A and draw a perpendicular line segment.
- Write point X, where it intersects line *l*.
- In the similar way, take another point B on line *m* and draw a perpendicular line-segment using a set square.
- Write point *y* where it intersects line *l*.
- Measure $\overline{AX}$ and $\overline{BY}$ with the help of a scale.

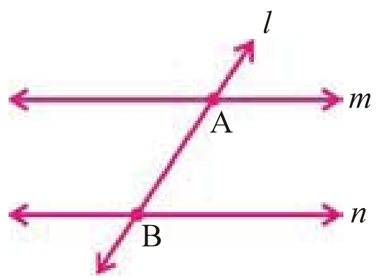
  AX = ... BY = ...

The distance between two parallel lines is the same at every place.

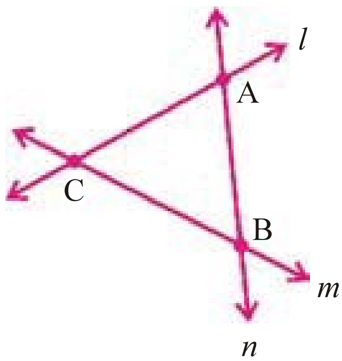
Transversal of two lines :



(5)



(6)



(7)

Study figures (5), (6) and (7), given above and answer the questions given below :

(1) In figure (5), at which point does line *l* intersect the other two lines ?

(2) In figure (6), at which points, does line *l* intersect the other two lines ?

(3) In which figure, the point of intersection is same for all the three lines ? ....

(4) For figure (7), give the answers to the details of the following table.

Line	Which two lines are intersected ?	Point of intersection
l	*m* and *n*	C and A
m		
n		

In figure (6) and (7) line *l* intersects line *n* and line *m* in two different points. Therefore, line *l* is called the transversal of line *m* and line *n*. While in figure (5) line *l* is not the transversal of line *m* and line *n*. In figure (7) each line is the transversal of the other two lines.

Transversal : If a line intersects two other lines in the same plane at two distinct points, it is called a transversal of the two lines.

- **Angles formed by a transversal :**
- **Activity 5 :**
  - Take three straws.
  - Arrange three straws with the help of pins as shown in figure (6).
  - Now, think about the angles formed by them.
  - Think about the point of intersection.
  - Give them names.

Study the figure (8) given here and answer the questions given below :

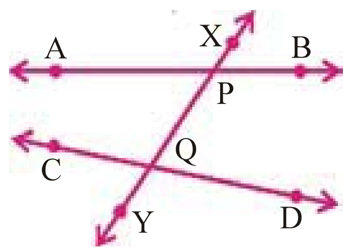
(1) In all, how many lines are there ? ....

(2) Which line is transversal of other lines and at which points does it intersect other lines ? ....

(3) In all, how many angles are formed ? Name them ...., ...

(4) How many angles are formed in the interior of $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$? Name them ...., ...

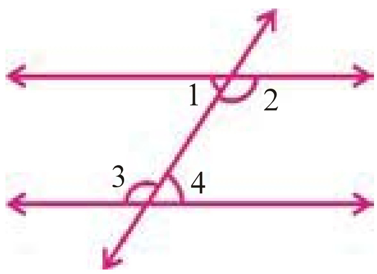
(5) How many angles are formed at the exterior, of $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$? Name them ...., ...



(8)

- **Types of angles formed by a transversal :**

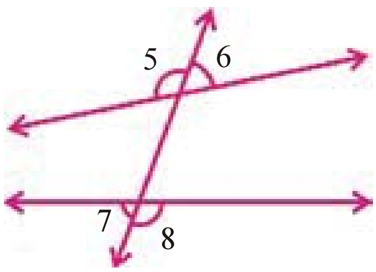
Look and understand them :



$\angle 1$, $\angle 2$, $\angle 3$ and $\angle 4$

are interior angles

(9)



$\angle 5$, $\angle 6$, $\angle 7$ and $\angle 8$

are exterior angles

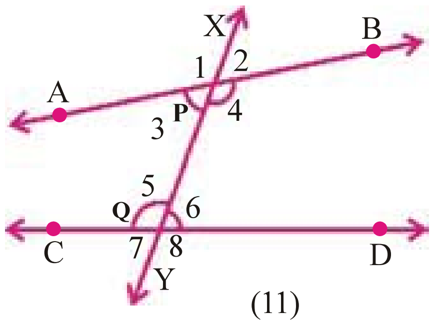
(10)

	Number of angles	Angles
Interior angles of the two lines (fig. (9))1		
Exterior angles of the two lines (fig. (10))		

- **A pair of alternate angles :**

In figure (11), ∠3 and ∠6 are a pair of alternate angles. In the same way ∠4 and ∠5 are a pair of alternate angles.

Thus, we have two pairs of alternate angles.



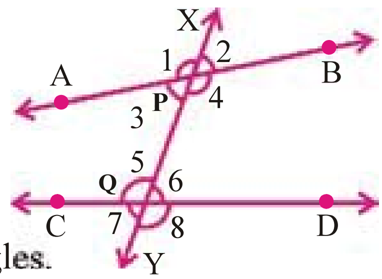
(11)

Figure No.	Angles	Pair of Alternate angles
11	∠3 and ∠6	∠APQ and ∠ PQD
	∠4 and ∠5	∠.......... and ∠..........

There are two pairs of alternate angles.

- **Corresponding angles :**

In figure (12), ∠1 and ∠5
∠2 and ∠6
∠3 and ∠7
∠4 and ∠8 are pairs of corresponding angles.



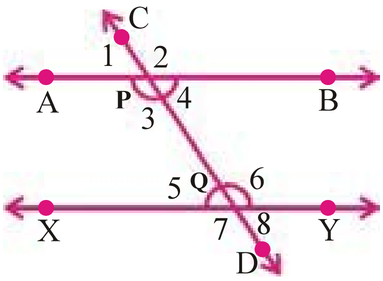
(12)

Thus, we have four pairs of corresponding angles.

Figure No.	Angles	Pair of Corresponding angles
(12)	∠1 and ∠5	∠XPA and ∠ PQC
	∠2 and ∠6	∠...... and ∠......
	∠3 and ∠7	∠...... and ∠......
	∠4 and ∠8	∠...... and ∠......

There are four pairs of corresponding angles.

- **Interior angles on the same side of a transversal :**



(13)

In the adjoining figure (13)

$\angle 4$ and $\angle 6$

$\angle 3$ and $\angle 5$ are the interior angles on the same side of the transversal.

Thus, there are two pairs of interior angles on the same side of the transversal.

Fig. No.	Angles	Name of angles
(13)	$\angle 4$ and $\angle 6$ $\angle 3$ and $\angle 5$	$\angle$BPQ and $\angle$PQY $\angle$...... and $\angle$......

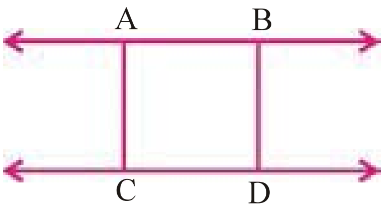
There are two pairs of interior angles on the same side of the transversal.

- **Taking the help of your teacher prepare a Power-Point presentation and observe alternate angles, corresponding angles and angles on the same side of the transversal.**

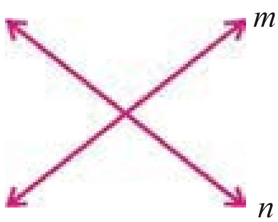
Practice 1

1. In the figures given below, write which lines form a pair of parallel lines and write them in the form of symbols :

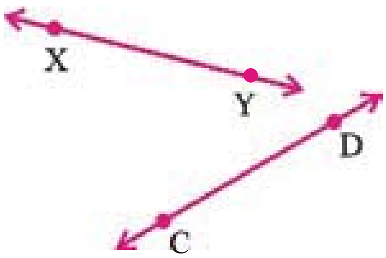
(1)



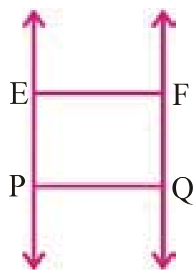
(2)



(3)

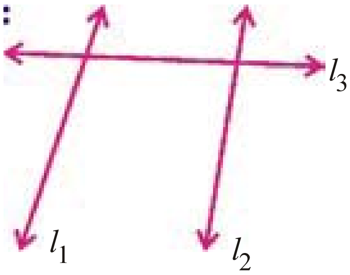


(4)

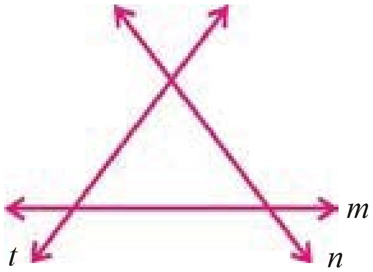


2. In the figure given below, write which line is the transcversal of the other two lines :

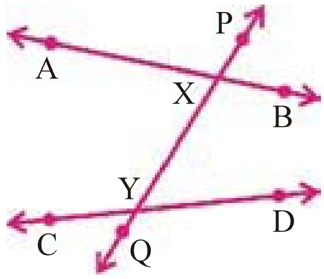
(1)



(2)



3. Answer the following questions, from the figure given below :



(1) Which line is the transversal of other two lines ?

(2) In all, how many angles are formed ?

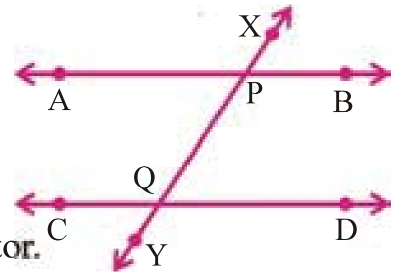
(3) How many pairs of alternate angles are formed ? Which are they ?

(4) How many pairs of corresponding angles are formed ? Which are they ?

(5) How many pairs of interior angles on any one side of the transversal are formed ? Which are they ?

- **Relation between angles formed by a transversal of parallel lines :**

Activity 6 :



- $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$
- $\overleftrightarrow{XY}$ is the transversal of $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$.
- Measure all the angles with the help of a protractor.

Name	Name of the pair of angles	Measure of the angles
Pair of alternate angles	....	....
	....	....
Pair of corresponding angles	....	....
	....	....
	....	....
	....	....
Interior angles on the same side of transversal	....	....
	....	....

Conclusion : (1) The measure of angles of the pair of alternate angles are ....

(2) The measure of angles of the pair of corresponding angles are ....

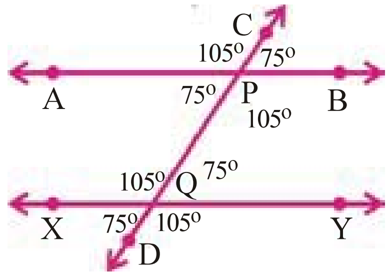
(3) The sum of the measure of both angles in every pair of interior angles on the same side of the transversal is ....

For the angles formed by the transversal of two parallel lines :

- Measures of both angles of every pair of alternate angles are equal.
- Measures of both angles of every pair of corresponding angles are equal.
- The sum of the measure of both angles in every pair of interior angles on the same side of the transversal is 180°. (Both angles of each pair of interior angles on the same side of the transversal are supplementary).

Example 1 : In the figure given below $\overleftrightarrow{AB} \parallel \overleftrightarrow{XY}$ and $\overleftrightarrow{CD}$ intersect $\overleftrightarrow{AB}$ and $\overleftrightarrow{XY}$ at point P and Q respectively.

If $m\angle APC = 105^\circ$, find the measure of the remaining angles.



Solution :

$m\angle APC = 105^\circ$ $\quad \therefore m\angle XQP = 105^\circ$ (corresponding angles)

$m\angle XQP = 105^\circ$ $\quad \therefore m\angle BPQ = 105^\circ$ (alternate angles)

$m\angle BPQ = 105^\circ$ $\quad \therefore m\angle YQD = 105^\circ$ (corresponding angles)

Now, $m\angle BPQ + m\angle YQP = 180^\circ$ (linear pair as they are interior angles on the same side of the transversal)

$105^\circ + m\angle YQP = 180^\circ$

$\therefore$ $m\angle YQP = 180^\circ - 105^\circ$

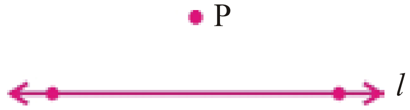
$m\angle YQP = 75^\circ$

$m\angle YQP = 75^\circ$ $\quad \therefore m\angle APQ = 75^\circ$ (alternate angles)

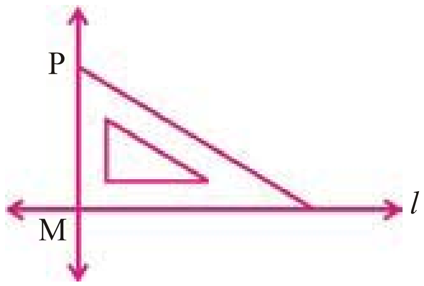
$m\angle APQ = 75^\circ$ $\quad \therefore m\angle XQD = 75^\circ$ (corresponding angles)

$m\angle YQP = 75^\circ$ $\quad \therefore m\angle BPC = 75^\circ$ (corresponding angles)

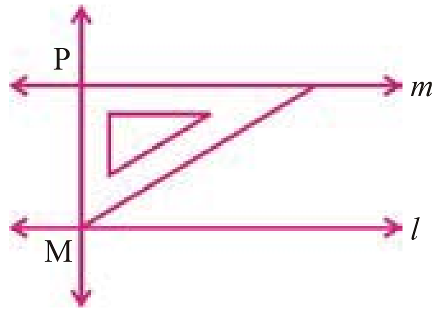
Constructing a line parallel to a given line through a point outside the line :



1. Using a scale, draw a line l in your notebook.
2. Take a point P outside the line l.
3. With the help of set-square, draw a perpendicular from P outside the line l, which intersect the line l at point M.



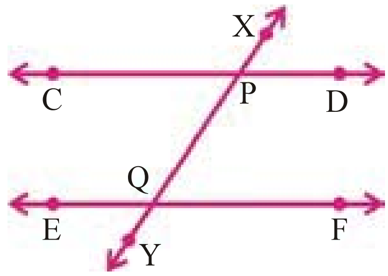
4. With the help of a set-square, draw a perpendicular line m to $\overleftrightarrow{PM}$ from a point P of $\overleftrightarrow{PM}$.
5. It will be $l \parallel m$.



Construction of parallel lines with the help of set squares and ruler is given in teachers book.

Practice 2

1. Fill in the blanks with the help of adjoining figure :



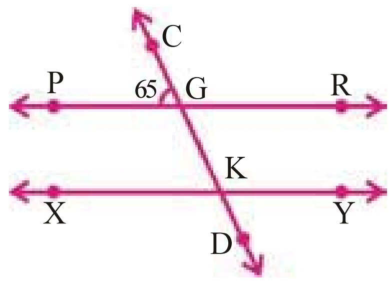
(1) The transversal of $\overleftrightarrow{CD} \parallel \overleftrightarrow{EF}$ is ....

(2) ∠CPX and ∠EQP are pair of ....

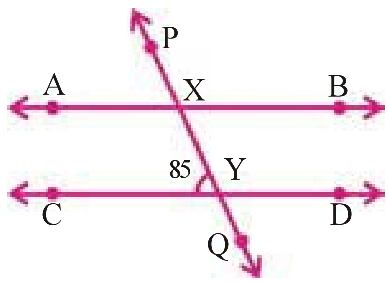
(3) ∠DPQ and ∠.......... are the angles of alternate angle.

(4) ∠......... and ∠PQF are the pair of interior angles on the same side of the transversal.

2. $\overleftrightarrow{PR} \parallel \overleftrightarrow{XY}$ and $\overleftrightarrow{CD}$ is the transversal, if ∠PGC = 65°, find the measure of the remaining angles.



3. In the given figure, $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$. The transversal $\overleftrightarrow{PQ}$ intersects $\overleftrightarrow{AB}$ at point X and $\overleftrightarrow{CD}$ at Y respectively. If ∠XYC = 85°, find the measure of the remaining angles.



Exercise

1. Fill in the blanks :

(1) Line t_1 and t_2 are parallel lines. We write in symbol as ....

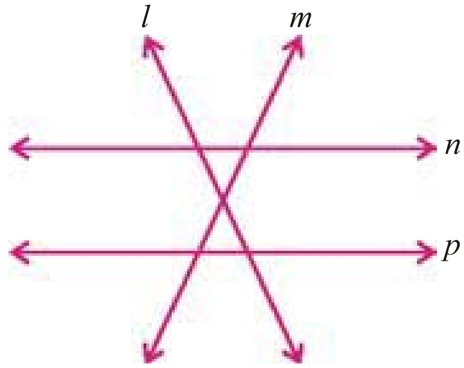
(2) In all .... angles are formed by a transversal of two lines.

(3) .... pairs of alternate angles are formed by the transversal of two lines.

(4) .... pairs of corresponding angles are formed by the transversal of two lines.

(5) The sum of the measure of both angles in every pair of interior angles on the same side of the transversal is ....

2. In the figure given here, state which of the line is the transversal of other two lines :



3. $\overleftrightarrow{JK} \parallel \overleftrightarrow{MN}$. $\overleftrightarrow{AB}$ is the transversal. $\overleftrightarrow{AB}$ intersects $\overleftrightarrow{JK}$ in point O and $\overleftrightarrow{MN}$ in point B. Draw figure and write all the pairs of alternate angles, corresponding angles and interior angles on the same side of the transversal.

4. $\overleftrightarrow{XY} \parallel \overleftrightarrow{MN}$. $\overleftrightarrow{PQ}$ is the transversal. $\overleftrightarrow{PQ}$ intersects $\overleftrightarrow{XY}$ at point A and $\overleftrightarrow{MN}$ at point B. If $\angle NBP = 55^o$, find the measure of the remaining angles.

5. Draw a figure in which $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$. $\overleftrightarrow{XY}$ is a transversal. $\overleftrightarrow{XY}$ intersects $\overleftrightarrow{AB}$ at point P and $\overleftrightarrow{CD}$ at point Q. If $\angle XPA = 120^o$, find the measure of $\angle PQD$ and $\angle BPQ$.

6. For the parallel lines and their transversal if the measure of one of the angles of the corresponding pair is 110^o, then find the measures of all the alternate pairs of angles.

Answers

Practice 1

1. (1) $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$ (2) No (3) No (4) $\overleftrightarrow{EP} \parallel \overleftrightarrow{FQ}$

2. (1) Line l_3 is a transversal of l_1 and l_2.

(2) (i) Line t is a transversal of lines m and n

(ii) Line n is a transversal of lines t and m

(iii) Line m is a transversal of lines t and n

3. (1) $\overleftrightarrow{PQ}$ is a transversal of $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$.

(2) Eight; ∠AXP, ∠PXB, ∠AXY, ∠BXY, ∠XYC, ∠XYD, ∠CYQ, ∠DYQ

(3) Two, (i) ∠AXY and ∠XYD (ii) ∠BXY and ∠XYC

(4) Four, (i) ∠AXY and ∠CYQ (ii) ∠CYX and ∠AXP

(iii) ∠BXY and ∠DYQ (iv) ∠DYX and ∠BXP

(5) Two, (i) ∠AXY and ∠XYC (ii) ∠BXY and ∠XYD

Practice 2

1. (1) $\overleftrightarrow{XY}$ (2) Corresponding angles (3) ∠EQP (4) ∠DPQ

2. ∠CGR = 115°, ∠PGK = 115°, ∠RGK = 65°, ∠GKY = 115°

∠XKG = 65°, ∠XKD = 115°, ∠YKD = 65°

3. ∠AXP = 85°, ∠AXY = 95°, ∠XYD = 95°, ∠QYD = 85°

∠PXB = 95°, ∠BXY = 85°, ∠CYQ = 95°

Exercise

1. (1) $t_1 \parallel t_2$ (2) eight (3) two (4) four (5) 180°

3. Pair of corresponding angles : ∠AOJ and ∠OPM; ∠JOP and ∠MPB

∠AOK and ∠OPN; ∠KOP and ∠NPB

Pair of alternate angles : ∠JOP and ∠OPN; ∠KOP and ∠OPM

Interior angles on the same side of the transversal : ∠JOP and ∠OPM ;

∠KOP and ∠OPN

4. m∠PAY = 55° m∠PAX = 125° m∠XAB = 55° m∠YAB = 125°

m∠ABM = 125° m∠MBQ = 55° m∠NBQ = 125°

5. m∠PQD = 60° m∠BPQ = 120°

6 Polynomial

- **Let us remember :**
- **Read the following events :**

Event 1 : Kevin says to Nilofer that he has 20 marbles more than her. Nirav says that he has 5 marbles more than the total of what Kevin and Nilofer have.

Event 2 : Ramu says to his friend that his father's age is three times his present age. And his grandfather's age is 13 years more than the sum of his and his father's age.

- **Answer the following questions based on the above given events :**

(1) If Nilofer has x marbles, how many marbles does Kevin have ?

(2) If Nilofer has x marbles, how many marbles does Nirav have ?

(3) If the present age of Ramu is taken as x years, what are present age of his father and his grandmother ?

(4) If Ramu's present age is 15 years, what is the present age of his father ? What will be the present age of his grandfather ?

- **Look at the figures given below and answer the questions that follow :**

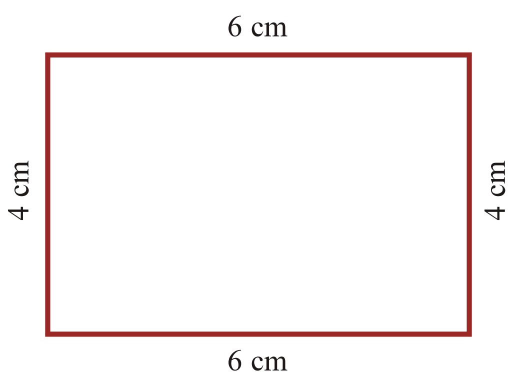


Figure 1

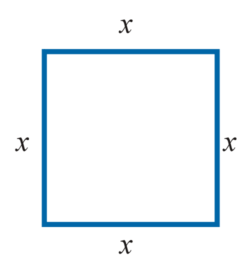


Figure 2

Questions :

(1) What is the perimeter of the rectangle given in figure 1 ?

(2) What did you do to find the perimeter of the rectangle ?

(3) How can we find the perimeter of a square ?

(4) What is the perimeter of the square given in figure 2 ?

- **Classify the following pairs of terms into like and unlike terms :**

(1) $x^2, 3x^2$ (2) $4y^2, 3y$ (3) $3x^2, 3xy$

(4) $-4y^2, 5y^2$ (5) $3x^2y^2, x^2$ (6) $9x^3y, 12x^3y$

- **Let us learn something new :**
- **Addition of a monomial with a monomial :**

See and understand it :

Adding 7 marbles to 3 marbles, there will be 10 marbles.

That is 3 marbles + 7 marbles = 10 marbles

If we use the symbol x for a marble, $3x + 7x = 10x$

Adding 2 tops to 4 tops, there will be 6 tops.

That is 4 tops + 2 tops = 6 tops

If we use the symbol y for a top, $4y + 2y = 6y$

- 3 marbles + 4 tops can be written only as 3 marbles + 4 tops. But it cannot be written as 7 marbles or 7 tops. If we use the symbol x for a marble and y for a top, it can be written as $3x + 4y$.

- Here, $3x$ and $7x$ and $4y$ and $2y$ are like terms. Thus addition can be done for only like terms. $3x$ and $4y$ are unlike terms. Addition of unlike terms is denoted by putting the sign of addition in between them.

Example 1 : Add $2x$, $3x$ and $4x$.

Horizontal method	Vertical method
$2x + 3x + 4x$ $= (2 + 3 + 4)\,x$ $= 9x$	$2x$ $+ 3x$ $+ 4x$ ——— $9x$

Example 2 : Add $5a^2b^2$ and $6a^2b^2$.

Horizontal method	Vertical method
$5a^2b^2 + 6a^2b^2$ $= (5 + 6)\,a^2 \times b^2$ $= 11a^2b^2$	$5a^2b^2$ $+ 6a^2b^2$ ——— $11a^2b^2$

Example 3 : Add $2x^2$ and $3x$.

Here, $2x^2$ and $3x$ are unlike terms. Therefore, the addition of the unlike terms can be written as

Addition $= 2x^2 + 3x$

Example 4 : Add $5ab$, $3ab$ and $4a^2b^2$.

$= \underline{5ab + 3ab} + 4a^2b^2$

$= (5 + 3)\,ab + 4a^2b^2$

$= 8ab + 4a^2b^2$

Practice 1

1. Make pairs of like terms from that given below :

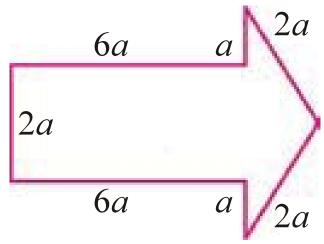
$2x^2$, $3x^2$, $5xy$, $6x^2y^2$, $9x^2y^2$, $7xy$

2. Find the like terms from the given terms and add them :

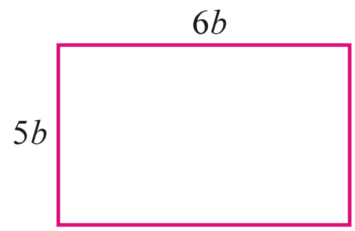
$4xyz$, $2x^2y^2$, $3x^2y^2$, $4x^2$, $9x^2y^2$, $18x^2$, $6xyz$, $10x^2$, $7xyz$

3. Calculate the perimeter of the following figures :

(1)

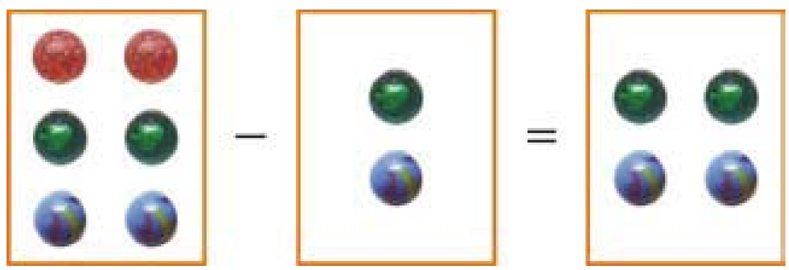


(2)



- **Subtraction of a monomial from a monomial :**

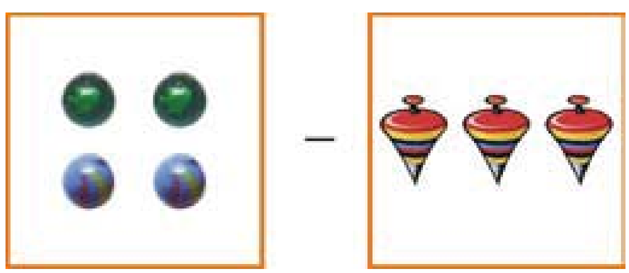
See and understand it :



Subtracting 2 marbles from 6 marbles 4 marbles remain.

That is 6 marbles − 2 marbles = 4 marbles

If we use the symbol x for a marble, then $6x - 2x = 4x$



Here, subtracting 3 tops from 4 marbles can be written as follows :

4 marbles − 3 tops

If we use the symbol x for a marble and y for top, it can be written as $4x - 3y$.

Thus, subtraction can be done for only like terms. For unlike terms, subtraction is denoted by putting the sign of subtraction in between them.

We know that, the number opposite to the number which is to be subtracted is added in subtraction.

- **Subtract 3 from 5 :**

  3 is to be subtracted from 5 i.e. the opposite number of 3 that is (-3) is to be added.

  That is $5 + (-3) = 2$

- In the same way subtracting (-8) from (-6), the opposite number of (-8) that is 8 is to be added.

  That is $(-6) + 8 = 2$

- In the same way, to subtract one polynomial from other polynomial, the opposite polynomial of the polynomial which is to be subtracted is added to the given polynomial. To subtract $3x$ from $5x$, the opposite polynomial of $3x$ i.e. $(-3x)$ is to be added.

  That is $5x + (-3x) = 5x - 3x$.

Example 5 : Subtract $8xy$ from $15xy$.

Horizontal method	Vertical method
$15xy - 8xy$ $= 15 \times xy - 8 \times xy$ $= (15 - 8)\, xy$ $= 7xy$	$15xy$ $- 8xy$ $7xy$

Example 6 : Subtract $-9a^2b^2c^2$ from $16a^2b^2c^2$.

Horizontal method	Vertical method
$16a^2b^2c^2 - (-9a^2b^2c^2)$ $= 16a^2b^2c^2 + 9a^2b^2c^2$ $= (16 + 9)\, a^2b^2c^2$ $= 25a^2b^2c^2$	$16a^2b^2c^2$ $+ 9a^2b^2c^2$ $25a^2b^2c^2$

From example 6, it is understood that subtract is to add the opposite of a given number.

Example 7 : Subtract $7xy$ from $5x^2$.

Here $5x^2$ and $7xy$ are unlike terms, their subtraction can be written as :

$= 5x^2 - 7xy$

Practice 2

1. **Make pairs of like terms :**
   (1) $2x^2, -3y, 6y^2, -3x^2, -4y^2, 8y$ (2) $3x^2y, -xy, 5xy^2, 4x^3, -6xy^2, 5xy, -8x^3, -5x^2y$
2. **Write like terms against the terms given below :**
   (1) $3a^2$ .... (2) $-2y^2z$ .... (3) $-7x$ ....
   (4) $-p^2$ .... (5) $6abc$ .... (6) $11xy$ ....
3. From the pair of like terms in question 1, subtract the second term from the first term.
4. Subtract :
   (1) $4x^2$ and $-6xy^2$ (2) $6x^3$ and $-2x^3$ (3) $9xy$ and $5xy$ (4) $-7x^3$ and $-8x^3y$
   The teacher should check the calculation of Q1 and Q2 alone by the students :

- **Addition of a monomial with a binomial :**

Example 8 : Add $6x$ and $3x + 7$.

Horizontal method	Vertical method
$(6x) + (3x + 7)$ $= \underline{6x + 3x} + 7$ (Taking like terms together) $= (6 + 3)x + 7$ $= 9x + 7$	$6x$ $+ \ 3x + 7$ $9x + 7$

Example 9 : Add $(3a^2b^2 - 4)$ and $5a^2b^2$.

Horizontal method	Vertical method
$= (3a^2b^2 - 4) + (5a^2b^2)$ $= 3a^2b^2 - 4 + 5a^2b^2$ $= \underline{3a^2b^2 + 5a^2b^2} - 4$ $= (3 + 5)a^2b^2 - 4$ $= 8a^2b^2 - 4$	

Example 10 : Add $m^2 - 7$ and 25.

Horizontal method	Vertical method
	$m^2 - 7$ $+ 0 + 25$ $m^2 + 18$

Practice 3

Add :

(1) $2x$ and $2x - 3$ (2) $4m^2 + 7$ and $3m^2$ (3) $-6m - 3$ and 9

(4) $-5n$ and $8n + 7$ (5) $8x^2 + 7$ and $-8x^2$ (6) $3xy - 5$ and $9xy$

Addition of a binomial with a binomial :

Example 11 : Add $6x + 5$ and $2x + 11$.

Horizontal method	Vertical method
$(6x + 5) + (2x + 11)$ $= 6x + 5 + 2x + 11$ $= \underline{6x + 2x} + \underline{5 + 11}$ (Taking like terms together) $= (6 + 2)x + (5 + 11)$ $= 8x + 16$	$6x + 5$ $+ \; 2x + 11$ $8x + 16$

Example 12 : Add $3xy + 4y^2$ and $6xy - 5y^2$.

Horizontal method	Vertical method
$(3xy + 4y^2) + (6xy - 5y^2)$ $= 3xy + 4y^2 + 6xy - 5y^2$ $= \underline{3xy + 6xy} + \underline{4y^2 - 5y^2}$ $= (3 + 6)xy + (4 - 5)y^2$ $= 9xy + (-1)y^2$ $= 9xy - 1y^2$ $= 9xy - y^2$	

Example 13 : Add $9a^2 + 12$ and $-9 - 3a^2$.

Horizontal method	Vertical method
	$9a^2 + 12$ $+ \; -3a^2 - 9$ $6a^2 + 3$

Practice 4

1. Write five binomials here as asked by your teacher :

(1) .... (2) .... (3) .... (4) .... (5) ....

2. Write pairs of binomials here using those given by your teacher :

(1) ...., ...
(2) ...., ...
(3) ...., ...
(4) ...., ...
(5) ...., ...
(6) ...., ...
(7) ...., ...
(8) ...., ...
(9) ...., ...
(10) ...., ...

3. Add the binomials written in question no. 2

4. Add : (1) $4xy + 5x^2$ and $6xy - 2x^2$ (2) $3x + y$ and $3x - 7y$ (3) $3x^2y - 4$ and $6xy^2 + 8$

- **Subtraction of a monomial and a binomial from a binomial :**

Example 14 : Subtract $3m^2$ from $6m^2 - 12$.

Horizontal method	Vertical method
$(6m^2 - 12) - (3m^2)$ $= 6m^2 - 12 - 3m^2$ $= 6m^2 - 3m^2 - 12$ $= (6 - 3)\,m^2 - 12$ $= 3m^2 - 12$	$6m^2 - 12$ $- 3m^2$ ――――― $3m^2 - 12$

Example 15 : Subtract $4abc + 3$ from $5abc - 7$.

Horizontal method	Vertical method
$(5abc - 7) - (4abc + 3)$ $= 5abc - 7 - 4abc - 3$ $= 5abc - 4abc - 7 - 3$ $= (5 - 4)\,abc - 10$ $= 1abc - 10$ $= abc - 10$	

Practice 5

Subtract :

(1) $8p^2 + 5,\ 9p^2 - 7$

(2) $3m + 4n,\ 6n + 5m$

(3) $3p^2,\ 7p^2 - 5$

(4) $16a + 5b,\ -7b$

(5) $-10b + 8,\ -3b$

(6) $7x - 9,\ 15$

(7) $-3x - 5y,\ 7x + 2y$

(8) $abc + xy,\ 3xy - 13abc$

(9) $7,\ a^2 - 10$

(10) $15x^2 + y^2,\ 10x^2 - 2y^2$

- **Addition of a trinomial with a monomial, a binomial and a trinomial :**

Example 16 : Add $10x^2 - 5x + 2$ with $3x^2$.

Horizontal method	Vertical method
$(10x^2 - 5x + 2) + (3x^2)$	$10x^2 - 5x + 2$
$= 10x^2 - 5x + 2 + 3x^2$	$+\ 3x^2 + 0 + 0$
$= 10x^2 + 3x^2 - 5x + 2$	$13x^2 - 5x + 2$
$= (10 + 3)\,x^2 - 5x + 2$	
$= 13x^2 - 5x + 2$	

Example 17 : Add $3m^2 - 2m + 7$ with $6m - 5$.

Horizontal method	Vertical method
$(3m^2 - 2m + 7) + (6m - 5)$	
$= 3m^2 - 2m + 7 + 6m - 5$	
$= 3m^2 - 2m + 6m + 7 - 5$	
$= 3m^2 + 4m + 2$	

Example 18 : Add $3a^2 + 20ab + b^2$ and $2a^2 - 6ab - 5b^2$.

Horizontal method	Vertical method
	$3a^2 + 20ab + b^2$ $+\ 2a^2 - 6ab - 5b^2$ $\overline{5a^2 + 14ab - 4b^2}$

Practice 6

Add :

(1) $2x + 3y + 5$ and $-7x$

(2) $12m^2 - 9m + 7$ and $3m - 8$

(3) $2x^2 + 3x - 5$ and $2x^2 - 4$

(4) $9b - 10a + 15$ and $3a + b + 2$

(5) $17a - 13b - 14$ and $10a - 9b - 15$

(6) $4p^2 - 3p - 10$ and 30

- **Subtraction of a monomial, a binomial and a trinomial with a trinomial :**

Example 19 : Subtract $4m$ from $m^2 + 3m - 7$.

Horizontal method	Vertical method
$(m^2 + 3m - 7) - (4m)$ $= m^2 + 3m - 7 - 4m$ $= m^2 + 3m - 4m - 7$ $= m^2 - 1m - 7$ $= m^2 - m - 7$	$m^2 + 3m - 7$ $-4m$ $\overline{m^2 - m - 7}$

Example 20 : Subtract $8x^2 - 4xy$ from $5x^2 - 4xy + y^2$.

Horizontal method	Vertical method
	$5x^2 - 4xy + y^2$ $+ \quad -8x^2 + 4xy - 0y^2$ $-3x^2 + 0xy + y^2$ $= -3x^2 + y^2$

Example 21 : Subtract $7x^2 - 7x + 3$ from $10x^2 - 5x + 2$.

Horizontal method	Vertical method
$(10x^2 - 5x + 2) - (7x^2 - 7x + 3)$ $= 10x^2 - 5x + 2 - 7x^2 + 7x - 3$ $= 10x^2 - 7x^2 - 5x + 7x + 2 - 3$ $= 3x^2 + 2x - 1$	

Practice 7

Subtract :

(1) $x^2 + 2xy + y^2, \; 10x^2$

(2) $6a^3 + 10b^2 - 25ab, \; -25ab$

(3) $a^2 + b^2 - 7ab, \; 3b^2$

(4) $10x^2 + 6xy + y^2, \; 9x^2 - y^2$

(5) $3abc + 5bc - 6ac, \; -7abc - 9bc$

(6) $2x - 3y + 15, \; 13y + 12$

(7) $-5xy - 8x - 9, \; 7xy - 7x + 6$

(8) $a^2 + b^2 + 2ab, \; 3a^2 - 2ab + 5b^2$

(9) $3x^2 + 3x - 5, \; 2x^2 - 8x - 5$

(10) $3x^2 + 5xy - 9, \; x^2 - 2xy + 5$

(11) $2x^2 - x + 14, \; 5x - 3x^2 + 8$

(12) $9x^2 + 5x - 17, \; 15 - 4x + 3x^2$

Exercise

Simplify :

(1) $6x + 4x$ (2) $-8x - 2x$ (3) $25x^2 - 6x^2$ (4) $8x^3 - (-2x^3)$ (5) $5x^2 + 3y - 2x^2$

(6) $6x + (5 - 3x)$ (7) $12m^2 - 9m + 5m$ (8) $2x^2 + 3x - 5 + 2x - 4$

(9) $12m^2 - m + 5m + 4m^2 + 7m - 10$ (10) $(5x^2 + 3) - (2x^2 - 4x - 7)$

(11) $(9 - 3y) + (x^2 + 5y - 6)$ (12) $(15 + 5x^2 - 10x) + (4x - 2x^2 - 5)$

(13) $(10 - 3x^2 + 4x) + (2x^2 - 8x - 2)$ (14) $(9x^2 - 3x - 6) - (4x + 5 - 2x^2)$

Answers

Practice 1

1. (1) $2x^2$ and $3x^2$ (2) $5xy$ and $7xy$ (3) $6x^2y^2$ and $9x^2y^2$

2. (1) $17xyz$ (2) $14x^2y^2$ (3) $32x^2$ **3.** (1) $20a$ (2) $22b$

Practice 2

1. (1) $2x^2$ and $-3x^2$, $-3y^2$ and $8y$, $6y^2$ and $-4y^2$

(2) $3x^2y$ and $-5x^2y$, $-xy$ and $5xy$, $5xy^2$ and $-6xy^2$, $4x^3$ and $-8x^3$

4. (1) $4x^2y + 6xy^2$ (2) $8x^3$ (3) $4xy$ (4) $-7x^3 + 8x^3y$

Practice 3

(1) $4x - 3$ (2) $7m^2 + 7$ (3) $-6m + 6$ (4) $3n + 7$ (5) 7 (6) $12xy - 5$

Practice 4

4. (1) $10xy + 3x^2$ (2) $8x - 6y$ (3) $9xy^2 + 4$

Practice 5

(1) $-p^2 + 12$ (2) $-2m - 2n$ (3) $-4p^2 + 5$ (4) $16a + 12b$

(5) $-7b + 8$ (6) $7x - 24$ (7) $-10x - 7y$ (8) $14abc - 2xy$

(9) $-a^2 + 17$ (10) $5x^2 + 3y^2$

Practice 6

(1) $-5x + 3y + 5$ (2) $12m^2 - 6m - 1$ (3) $4x^2 + 3x - 9$

(4) $-7a + 10b + 17$ (5) $27a - 22b - 29$ (6) $4p^2 - 3p + 20$

Practice 7

(1) $-9x^2 + 2xy + y^2$ (2) $6a^3 + 10b^2$ (3) $a^2 - 2b^2 - 7ab$

(4) $x^2 + 6xy + 2y^2$ (5) $10abc + 14bc - 6ac$ (6) $2x - 16y + 3$

(7) $-12xy - x - 15$ (8) $-2a^2 - 4b^2 + 4ab$ (9) $x^2 + 11x$

(10) $2x^2 + 7xy - 14$ (11) $5x^2 - 6x + 6$ (12) $6x^2 + 9x - 32$

Exercise

(1) $10x$ (2) $-10x$ (3) $19x^2$ (4) $10x^3$ (5) $3x^2 + 3y$ (6) $3x + 5$

(7) $12m^2 - 4m$ (8) $2x^2 + 5x - 9$ (9) $16m^2 + 11m - 10$ (10) $3x^2 + 4x + 10$

(11) $x^2 + 2y + 3$ (12) $3x^2 - 6x + 10$ (13) $-x^2 - 4x + 8$ (14) $11x^2 - 7x - 11$