

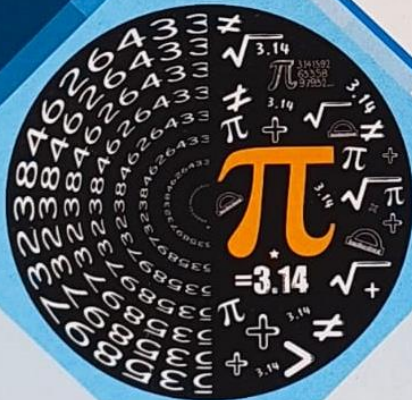
Strictly As Per
BOARDS New Syllabus

My Favorite Guide On

MATHEMATICS - I

गणित भाग - 1

Std 10th - Semi English



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**महाराष्ट्रात
प्रथमच...**

11th आणि 12th (Science) ची पुस्तके
English व Scientific मराठी मधून...

Authors :
Qualified and Experienced Staffs From
PUNE | LATUR PATTERN

TOPIC - 01 LINEAR EQUATION IN TWO VARIABLES

1.1 Linear equation in two variables

- i) An equation which contains two variables and the degree of each term containing variable is one, is called a linear equation in two variables.
- ii) $ax + by + c = 0$ is a general form of a linear equation in two variables; a, b, c are real numbers and a, b are not equal to zero at the same time.
- iii) Ex. $3x - 4y + 12 = 0$ is general form of equation
 $3x = 4y - 12$

Linear equation in two variables (दोन चलातील रेखीय समीकरणे):

- i) ज्या equation मध्ये 2 variable असतात आणि variable असणाऱ्या प्रत्येक term (पद) ची degree (कोटी) ही एक असेल तर, त्या equation ला linear equation in two variables म्हणतात.
- ii) $ax + by + c = 0$ हा linear equation in two variables चा general form (सामान्य रूप) आहे. येथे a, b, c या real number (वास्तव संख्या) आहेत आणि a, b ची किंमत एकाच वेळी zero असत नाही.
- iii) Ex- $3x - 4y + 12 = 0$ हे $3x = 4y - 12$ या equation चे general form आहे.

Activity: Complete the following table

No.	Equation	Is the equation a linear equation in 2 variables?	Reason
1	$4m + 3n = 12$	Yes	Two variables each with degree 1
2	$3x^2 - 7y - 13$	No	The degree of variable x is 2
3	$\sqrt{2}x - \sqrt{5}y = 16$	Yes	Two variables each with degree 1
4	$0x + 6y - 3$	No	Only one variable y

	$= 0$		
5	$0.3x + 0y - 36 = 0$	No	Only one variable x
6	$\frac{4}{x} + \frac{5}{y} = 4$	No	The degree of variables is -1 [This can be reduced to a linear equation by making suitable substitutions]
7	$4xy - 5y - 8 = 0$	No	The degree of xy is 2

Activity (कृती): वरील table मधील प्रत्येक equation वरील व्याख्येनुसार linear equation in two variable आहे का नाही ते ठरवा. यामध्ये variable ची power term ची degree ही फक्त 1 असणे आवश्यक आहे.

1.2 Simultaneous linear equations:

Two linear equations in two variables at the same time, they are called as Simultaneous equations.

1.2 Simultaneous linear equations: (एक सामाईक समीकरणे): जेव्हा two variable मधील दोन linear equation चा एकाच वेळी विचार केला जातो, तेव्हा equation ला simultaneous linear equations म्हणतात.

Ex.1 Solve the following simultaneous equations.

$$1.5x - 3y = 8; \quad 3x + y = 2$$

Solution: Method I: $5x - 3y = 8$ (I)

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

Multiplying both sides of equation (II) by 3.

$$9x + 3y = 6$$
(III)

$$5x - 3y = 8$$
 (I)

Now let us add equations (I) and (III)

$$\begin{array}{r} 5x - 3y = 8 \\ + \quad 9x + 3y = 6 \\ \hline 14x = 14 \end{array}$$

$$\therefore x = 1$$

Substituting $x = 1$ in equation (II)

$$3x + y = 2$$

$$\therefore 3 \times 1 + y = 2$$

$$\therefore 3 + y = 2$$

$$\therefore y = -1$$

Practice Set 1.1**Q.1 Complete the following activity to solve the simultaneous equations.**

$5x + 3y = 9$ (I)
 $2x - 3y = 12$ (II)
 Let's add equations (I) and (II).

$$\begin{array}{r} 5x + 3y = 9 \\ 2x - 3y = 12 \\ \hline \end{array}$$

$$\text{..... } x = \text{.....}$$

$$x = \frac{\dots}{\dots}$$

$$x = \text{.....}$$

Place $x = 3$ in equation (I).

$$5 \times \text{....} + 3y = 9$$

$$3y = 9 - \text{....}$$

$$3y = \text{.....}$$

$$y = \frac{\dots}{3}$$

$$y = \text{....}$$

$\therefore$ Solution is $(x, y) = (\text{....}, \text{.....})$.

Ans: $5x + 3y = 9$ (I)

$2x - 3y = 12$ (II)

Let's add equations (I) and (II).

$$5x + 3y = 9$$

$$2x - 3y = 12$$

$$\boxed{7}x = \boxed{21}$$

$$\therefore x = \frac{\boxed{21}}{\boxed{7}}$$

$$\therefore x = 3$$

Place $x = 3$ in equation (I).

$$5 \times \boxed{3} + 3y = 9$$

$$3y = 9 - \boxed{15}$$

$$3y = -6$$

$$y = \frac{-6}{3}$$

$$y = -2$$

$\therefore$ Solution is $(x, y) = (\boxed{3}, \boxed{-2})$.

Q.2 Solve the following simultaneous equations:

1) $3a + 5b = 26$; $a + 5b = 22$

Solution:

$$3a + 5b = 26 \text{ (I)}$$

$$a + 5b = 22 \text{ (II)}$$

Subtracting equation (II) from equation (I),

$$3a + 5b = 26 \text{ (I)}$$

-

$$a + 5b = 22 \text{ (II)}$$

-

-

$$2a = 4$$

$$\therefore a = 2 \quad \dots \text{ (Divided both the sides by 2)}$$

Substituting $a = 2$ in equation (I),

$$3(2) + 5b = 26$$

$$\therefore 6 + 5b = 26$$

$$\therefore 5b = 26 - 6$$

$$\therefore 5b = 20$$

$$\therefore b = 4$$

Ans. $(a, b) = (2, 4)$ is the solution.

2) $x + 7y = 10$; $3x - 2y = 7$

Solution:

$$x + 7y = 10 \text{ (I)}$$

$$3x - 2y = 7 \text{ (II)}$$

Multiplying equation (I) by 3,

$$3x + 21y = 30 \text{ (III)}$$

Subtracting equation (II) from equation (III),

$$3x + 21y = 30 \text{ (III)}$$

-

$$3x - 2y = 7 \text{ (II)}$$

-

$$\begin{array}{r} - \quad + \quad - \\ \hline 23y = 23 \end{array}$$

$$\therefore y = 1 \quad \dots \text{ (Divided both the sides by 23)}$$

Substituting $y = 1$ in equation (I),

$$x + 7(1) = 10$$

$$\therefore x + 7 = 10$$

$$\therefore x = 10 - 7$$

$$\therefore x = 3$$

Ans. $(x, y) = (3, 1)$ is the solution.

3) $2x - 3y = 9$; $2x + y = 13$

Solution: $2x - 3y = 9 \text{ (I)}$

$$2x + y = 13 \text{ (II)}$$

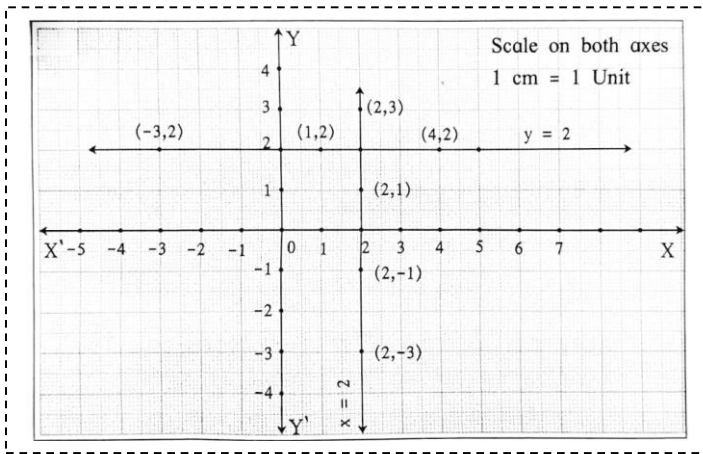
Subtracting equation (I) from equation (II),

$$2x + y = 13 \text{ (II)}$$

$$- 2x - 3y = 9 \text{ (I)}$$

-

$$\begin{array}{r} - \quad + \quad - \\ \hline 4y = 4 \end{array}$$



Steps to follow for drawing a graph of linear equation in two variables:

- Find at least 4 ordered pair for given equation
- Draw X-axis, Y-axis on graph paper and plot the points
- See that all 4 points lie on one line

* Linear equation in two variables चा graph draw करताना खालील steps (पायऱ्या) follow कराव्यात.

- दिलेल्या equation साठी at least (किमान) 4 ordered pair (क्रमित जोड्या) find out कराव्यात.
- x-axis आणि y-axis graph paper वर draw करून point (x, y) चे co-ordinate नुसार ordered pair) plot करावेत.
- सर्व 4 points हे एकाच line वर आहेत का ते पहा आणि त्यातून जाणारी line draw करा. दोन्ही line चा point of intersection हाच त्या दोन equation चे solution असते.

Note:

- Two points are sufficient to represent a line, but if co-ordinates of one of the two points are wrong then you will not get a correct line.
- If you plot three points and if they are non collinear then it is understood that one of the points is wrongly plotted. But it is not easy to identify the incorrect point.
- If we plot four points, it is almost certain that three of them will be collinear.

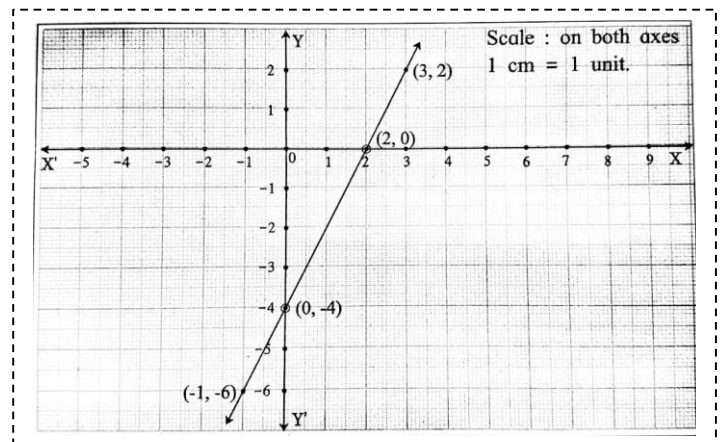
Note (टिप)- solved example आणि practice set 1.2 मधील example सोडवण्यासाठी खालील point लक्षात ठेवावेत.

- Graph काढण्यापूर्वी, scale लिहणे आवश्यक आहे. यासाठी 1 cm = 10 unit याप्रमाणे दोन्ही axis वर scale घ्यावे.
- दिलेल्या equation साठी ordered pair शोधण्यासाठी x आणि y या variable च्या 0, 1, -1, 2, -2, ... या प्रमाणे value ठेवून ordered pair (क्रमित जोड्या) find out कराव्यात.
- Ordered pair मधील x व y चे co-ordinate हे पूर्णांकात येतील याची काळजी घ्यावी. जेणेकरून point plot करता यावा.
- 4 ordered pair, point च्या साहाय्याने graph paper वर plot करावेत. यातून जाणारी एक line draw करावी याप्रमाणे दोन equation साठी separate line draw करावी.
- दोन्ही line साठी त्या line वर equation लिहावीत.
- वरील information काळजीपूर्वक लक्षात ठेवावी आणि त्यानुसार प्रत्येक example मध्ये आवश्यक ते बदल वरील प्रमाणे solution नुसार करावेत.

For Ex.: A linear equation $y = 2$ is also written as $0x + y = 2$. The graph of this line is parallel to X-axis; as for any value of x, y is always 2.

x	1	4	-3
Y	2	2	2
(x, y)	(1, 2)	(4, 2)	(-3, 2)

For Ex.: Similarly equation $x = 2$ is written as $x + 0y = 2$ and its graph is parallel to Y-axis.



Activity (I): Solve the following simultaneous equations by graphical method.

Complete the following tables to get ordered pairs.

$$x - y = 1$$

x	0	1	3	-2
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Let $x = 2$ in the polynomial $x^2 + 5x - 6$

$$x^2 + 5x - 6 = 2^2 + 5 \times 2 - 6$$

$$= 4 + 10 - 6$$

$$= 8 \neq 0$$

$\therefore x = 2$ is not a solution of the equation.

$$x^2 + 5x - 6 = 0$$

For Example - वरील example मध्ये $x^2 + 5x - 6$ या polynomial मध्ये $x = -6$ value put केली असता $x^2 + 5x - 6 = 0$ मिळतो. म्हणून $x = -6$ हे $x^2 + 5x - 6$ चे root आहे. तसेच $x = 2$ ही value $x^2 + 5x - 6$ या polynomial मध्ये ठेवली असता ती 8 मिळते म्हणजे $x^2 + 5x - 6$ ची value zero येत नाही. $\therefore x = 2$ हे $x^2 + 5x - 6 = 0$ चे root नाही.

Activity:

If $x = 5$ is a root of equation $kx^2 - 14x - 5 = 0$ then find the value of k by completing the following activity.

Solution: One of the roots of equation $kx^2 - 14x - 5 = 0$ is 5.

$\therefore$ Now Let $x = 5$ in the equation.

$$k5^2 - 14 \times 5 - 5 = 0$$

$$\therefore 25k - 70 - 5 = 0$$

$$\therefore 25k - 75 = 0$$

$$\therefore 25k = 75$$

$$\therefore k = \frac{75}{25} = 3$$

Activity (कृती) - जर $x = 5$ हे $kx^2 - 14x - 5 = 0$ चे मुळ असेल तर k ची value find out करण्यासाठी खालील activity complete करा. $kx^2 - 14x - 5 = 0$ यामध्ये $x = 5$ ही value ठेवली असता, वरील प्रमाणे k ची value मिळते.

Let's remember

1) $ax^2 + bx + c = 0$ is the general form of equation where a, b, c are real numbers and ' a ' is non-zero.

2. The values of variable which satisfy the equation [or the value for which both the sides of equation are equal] are called solutions or roots of the equation.

Let's remember (हे नेहमी लक्षात ठेवा) -

1) $ax^2 + bx + c = 0$ हे quadratic equation चे general form आहे. येथे a, b, c या real numbers आहेत आणि $a \neq 0$.

2) ज्या value ने equation चे satisfaction (समाधान) होते, त्या value ला quadratic equation चे solution किंवा root म्हणतात.

PRACTICE SET - 2.1

Q.1 Write any two quadratic equations.

Ans: (i) $x^2 - 5x + 4 = 0$ (ii) $5y^2 = 36$.

[Note: This is an open ended question. Students can write any equations in the form

$$ax^2 + bx + c = 0, a \neq 0]$$

Q.1 यामध्ये $ax^2 + bx + c = 0$ या general form मधील कोणतेही दोन equation लिहणे, आवश्यक आहे.

Q.2 Decide which of the following are quadratic equations:

$$(1) x^2 + 5x - 2 = 0$$

Ans: In this equation, x is the only variable with highest index 2.

$\therefore$ The given equation is a quadratic equation.

$$(2) y^2 = 5y - 10$$

Ans: $y^2 = 5y - 10$

$$\therefore y^2 - 5y + 10 = 0$$

In this equation, y is the only variable with highest index 2.

$\therefore$ The given equation is a quadratic equation.

$$(3) y^2 + \frac{1}{y} = 2$$

Ans: $y^2 + \frac{1}{y} = 2$

Multiplying the equation by y ,

$$y^3 + 1 = 2y$$

$$\therefore y^3 - 2y + 1 = 0$$

In this equation, the highest index of variable y is 3 and

6) $1^3, 2^3, 3^3 \dots \dots \dots$

iii) Here in the sequences (1), (2), (3), (5), the similarity is that next term is obtained by adding a particular number to the previous number. Each to these sequences is called an Arithmetic Progression.

iv) Sequence (4) is not an arithmetic progression. In this sequence the next term is obtained by multiplying the previous term by a particular number. This type of sequences is called a Geometric Progression.

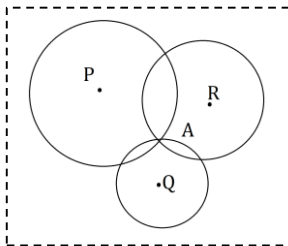
v) Sequence (6) is neither arithmetic progression nor geometric progression.

This year we are going to study arithmetic Progression.

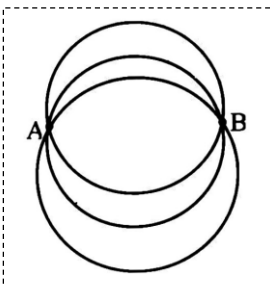
Activity - II खालील प्रत्येक sequence मधील term मध्ये particular property दिसून येते. Ex (1), (2), (3) आणि (5) मध्ये previous term मध्ये particular number add केल्यानंतर next term मिळते, म्हणून हा sequence arithmetic progression आहे. Sequence (4) हा arithmetic progression नाही तो geometric progression (भूमितीय श्रेढी) आहे. Sequence (6) हा arithmetic तसेच geometric progression नाही.

3.1 Circles passing through one, two, three points

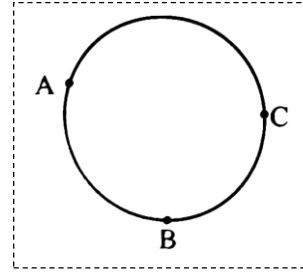
(i) Infinite circles pass through one point.



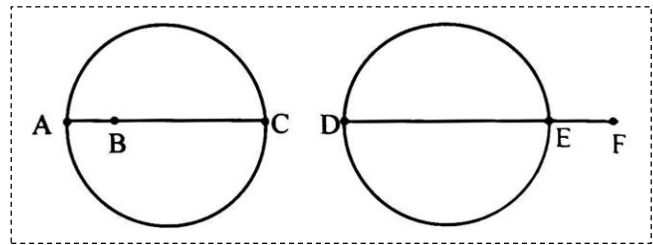
(ii) Infinite circles pass through two distinct points.



(iii) There is a unique circle passing through three non-collinear points.



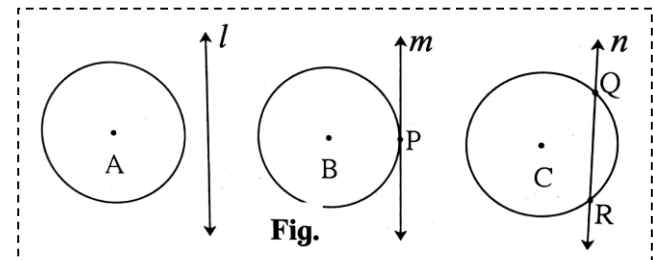
(iv) No circle can pass through 3 collinear points.



3.1 Circles passing through one, two, three points (एका, दोन, तीन बिंदूतून जाणारी वर्तुळे) -

- 1) एकाच point मधुन जाणारी infinite circles (असंख्य वर्तुळे) असतात.
- 2) Two distinct points मधुन जाणारी infinite circles (असंख्य वर्तुळे) असतात.
- 3) Three non-collinear points (तीन नैकरेषीय बिंदू) मधुन जाणारे unique circle असते.
- 4) Three collinear points (तीन एकरेषीय बिंदू) मधुन जाणारे एकही circle नसते.

3.2 Secant and tangent



i) In the figure above, not a single point is common in line l and circle with centre A. Point P is common to

both, line m and circle with centre B. Here, line m is called a tangent of the circle and point P is called the point of contact.

ii) Two points Q and R are common to both, the line n and the circle with centre C.

iii) Q and R are intersecting points of line n and the circle. Line n is called a secant of the circle.

3.2 Secant and tangent (वृत्तछेदिका आणि स्पर्शिका) -

Figure मध्ये, line l व circle यांच्यामध्ये एकही common point (सामाईक बिंदू) नाही.

Line m व circle (वर्तुळ) यांच्यामध्ये point P हा एकच common point (सामाईक बिंदू) आहे. येथे m ही circle ची tangent (स्पर्शिका) आहे व P हा point of contact (स्पर्शबिंदू) आहे असे म्हणतात.

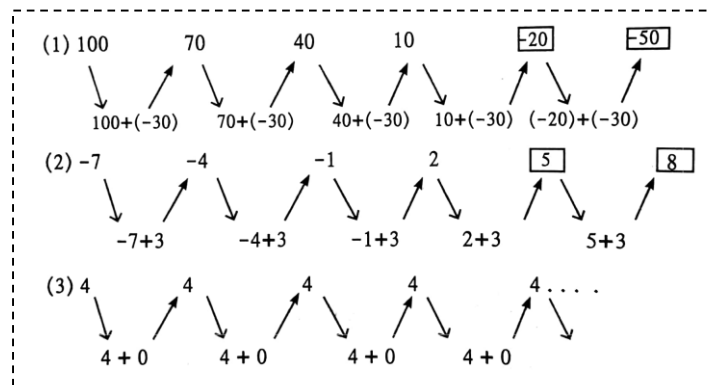
Line n व circle यांना दोन common point आहेत. Q व R हे line व circle यांचे intersecting points आहेत व line n ही secant (वृत्तछेदिका) आहे असे म्हणतात.

3.3 Arithmetic Progression

i) Some sequences are given below. For every sequence write the next three terms.

(1) 100, 70, 40, 10..... (2) -7, -4, -1, 2... (3) 4, 4, 4.....

In the given sequences, observe how the next turn term is obtained?



ii) In each sequence above every term is obtained by adding a particular number in the previous term. The difference between two consecutive terms is constant. The difference in ex. (i) is negative, in ex. (ii) it is positive and in ex. (iii) it is zero.

If the difference between two consecutive terms it is constant then it is called the common difference and generally denoted by later d.

iii) In the given sequence difference between two consecutive terms $(t_{n+1} - t_n)$ is constant then the sequence is called arithmetic progression (A. P.) In this sequence $t_{n+1} - t_n = d$ is the common difference.

iv) In an A.P. if first term is denoted by a and common difference is d then,

$$t_1 = a, t_2 = a + d$$

$$t_3 = (a + d) + d = a + 2d$$

.A.P. having first term as a and common difference d is a, (a + d), (a + 2d), (a + 3d),

3.3 Arithmetic Progression (अंकगणिती श्रेढी) -

i) काही sequence दिले आहेत, प्रत्येक sequence साठी पुढील three terms sequence मधील particular property वरून find out कराव्यात.

ii) वरील तीनही sequence मध्ये, every term ही त्यामध्ये particular number add करून मिळते. तसेच दोन consecutive term मध्ये असणारा difference constant आहे.

Example- (i) मधील difference negative, ex-(ii) मधील difference positive आणि ex-(iii) मधील difference हा zero आहे.

iii) जर दोन consecutive terms मधील difference constant (स्थिर) असेल तर त्याला common difference (सामान्य फरक) म्हणतात आणि तो d या letter ने denote करतात.

दिलेल्या sequence मधील consecutive terms मधील difference हा constant असेल तर त्या sequence ला arithmetic progression (अंकगणिती श्रेढी) म्हणतात.

iv) Arithmetic progression मध्ये, जर first terms a आणि common difference d ने denote केला असेल तर $t_1 = a$, $t_2 = a + d$ आणि $t_3 = a + 2d$ तसेच यापुढील term मिळतात. First term a आणि common difference d असताना a, (a+d), (a+2d) ... ही arithmetic progression असते.

Ex. (i) Arifa saved rupees 100 every month. In one year the total amount saved after every month is as given below.

Solved Examples:

Ex. i) Arati Gas Agency is supplied LPG cylinder to the consumer for taxable value of Rs.545 GST charges is 5%. What is the amount of CGST and SGST in the tax invoice? What is the total amount paid by the consumer? Find the amount of GST to be paid by Arati Gas Agency.

Solution: Rate of GST = 5% $\therefore$ Rate of GST 2.5%, and Rate of SGST = 2.5%

$$\text{CGST} = \frac{2.5}{100} \times 545 = 13.625 = \text{Rs.}13.63$$

$$\therefore \text{SGST} = \text{CGST} = \text{Rs.}13.63$$

Amount paid by consumer = Taxable value + CGST + SGST

$$= 545 + 13.63 + 13.63 \\ = 572.26$$

Arati Gas Agency has to pay CGST = Rs. 13.63. and SGST = Rs. 13.63

$$\therefore \text{Total GST to be paid} = 13.63 \times 2 = \text{Rs.}27.26$$

i) Arati Gas Agency मार्फत customer ला supply करण्यात येणाऱ्या gas cylinder वर 5% GST दराने तो ₹ 545 ला दिला जातो. तर tax invoice मधील CGST व SGST ची रक्कम किती तसेच Arati Gas Agency कडून आकारली जाणारी GST ची रक्कम विचारली आहे.

या उदाहरणामध्ये, GST चा दर 5% आहे. म्हणजे CGST व SGST चा दर समान असणार आहे आणि तो प्रत्येकी 2.5% आहे. यावरून Taxable value च्या साहाय्याने SGST व CGST ची वरील प्रमाणे किंमत काढावी. शेवटी

$\text{GST} = \text{CGST} + \text{SGST}$ या formula नुसार GST ची रक्कम काढावी.

Ex. ii) Courier services agent charges total Rs.590 to courier a parcel from Nashik to Nagpur. In the tax invoice taxable value is Rs.500 on which CGST is Rs.45 and SGST is Rs.45 find the rate of GST charges for the services.

Solution: Total GST = CGST + SGST = 45 + 45 = ₹90

$$\text{Rate of GST} = \frac{90}{500} \times 100 = 18\%$$

$\therefore$ Rate of GST charged by agent is 18%.

ii) उदाहरणामध्ये courier services agent कडून parcel courier करण्यासाठी ₹500 च्या taxable value वर प्रत्येकी ₹45 इतका SGST आणि CGST आकारला जातो. यावरून GST ची रक्कम काढून घ्यावी आणि GST च्या रक्कमेवरून त्याचा Rate वरीलप्रमाणे काढावा.

Ex. iii) Shreekar bought a laptop with 10% discount on printed price. The printed price of that laptop was Rs. 50000. 18% GST was the charged on discounted price. Find the amount of CGST and SGST what amount did Shreekar pay?

Solution: Discount = 10% of 50,000 = Rs. 5000

$$\therefore \text{Taxable value of laptop} = 50,000 - 5000 = \text{Rs.} 45000$$

$$\therefore \text{Rate of GST} = 18\% \text{ (given)} \quad \therefore \text{Rate of CGST} = 9\%$$

$$\therefore \text{CGST} = 9\% \text{ of } 45000 = \frac{9}{100} \times 45000 = 4050.$$

$$\therefore \text{SGST} = \text{Rs.}4050.$$

$$\therefore \text{Amount paid} = 45000 + 4050 + 4050 = \text{Rs.} 53100$$

Ans: Sreekar paid Rs. 53000 for the laptop.

iii) वरील उदाहरणामध्ये, shreekar ने 50000 printed price असणारा laptop 10% discount ने खरेदी केला. Laptop च्या account price वर 18% GST आकारण्यात आला. तर Shreekar ला pay करावी लागणारी CGST व SGST ची किंमत काढा. यासाठी सुरुवातील उदाहरणामध्ये दिल्याप्रमाणे 50000 printed price वरील 10% discount ने Laptop ची किंमत काढून घ्यावी. 45000 price वर 18% GST ची आकारण्यात आला. यामध्ये CGST आणि SGST अनुक्रमे 9% असून त्याचीही किंमत वरीलप्रमाणे काढावी शेवटी. Laptop ची paid करावी लागणारी किंमत काढावी.

Note: उदा: 2 व 3 काळजीपूर्वक अभ्यासा. व्यवहारात तुम्हांला या दोन्ही प्रकारची कर बीजके पाहायला मिळतात, म्हणून दुकानदाराने वस्तूची छापिल किंमत करासह दिली आहे का छापिल किमतीवर कर आकारणार आहे. हे समजून घ्या व त्यानंतर खरेदी करा.

Sample space 'S' किंवा ' Ω ' (हे ग्रीक अक्षर असून उच्चार ओमेगा आहे.) या चिन्हाने set च्या स्वरूपात दर्शवतात. Sample space मधील प्रत्येक elements ला 'sample space' म्हणतात. नमुना अवकाश 'S' मधील एकूण घटकांची संख्या $n(S)$ ने दर्शवतात. जर $n(S)$ finite असेल तर त्याला finite नमुना अवकाश म्हणतात. Finite नमुना अवकाशाची काही उदाहरणे पुढील सारणीत दिलेली आहेत.

S. No.	Random experiment	Sample space	Number of sample points in S
1	One coin is tossed	$S = \{H, T\}$	$n(S) = 2$
2	Two coins are tossed	$S = \{HH, HT, TH, TT\}$	$n(S) = 4$
3	Three coins are tossed	$S = \{HHH, HHT, HTH, THH, HTT, THT, TTH, TTT\}$	$n(S) = 8$
4	A die is thrown	$S = \{1, 2, 3, 4, 5, 6\}$	$n(S) = 6$
5	Two dice are thrown	$S = \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)\}$	$n(S) = 36$
6	A card is drawn from a pack bearing numbers from 1 to 25	$S = \{1, 2, 3, 4, \dots, 25\}$	$n(S) = 25$
7	A card is drawn from a well	Diamond: Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King	

shuffled pack of 52 playing cards.	Spade: Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King Heart: Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King Club: Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King	$n(S) = 52$
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वरील table / chart मधील दिलेल्या सर्व Random experiment (या दृच्छिक प्रयोग) साठी दिलेले Sample space (नमुना अवकाश) व त्यासाठी चे number of sample points (नमुना घटकांची संख्या) लक्षात ठेवावी किंवा आत्मसात करावी.

Note - sample space हे नेहमी curly bracket $\{ \}$ मध्ये लिहावेन.

Let's remember

- The sample space for a coin tossed twice is the same as that of two coins are tossed simultaneously. The same is it true for three coins.
- The sample space for a die rolled twice is the same as two dice are rolled simultaneously.

Let's remember (हे लक्षात ठेवूया)

- A coin tossed twice (एक नाणे दोनदा फेकणे) किंवा two coins are tossed simultaneously (दोन नाणी एकाच वेळी फेकणे) या दोन्ही Random experiment मध्ये sample space (नमुना अवकाश) सारखाच असतो. हेच three coins च्या बाबतीतही true असते.
- A die rolled twice (एक फासा दोनदा फेकणे) किंवा As two dice (दोन फासे) एकाच वेळी फेकणे या दोन्हीसाठी नमुना अवकाश सारखाच असतो.

Practice set - 5.2

Q.1 For each of the following experiments, write the sample space S and the number of sample points $n(S)$:

i) One coin and one die are thrown simultaneously.

Ans: The sample space (for a coin)

$$S = \{H, T\} \quad \therefore n(S) = 2$$

The sample space (for a die)

$$S = \{1, 2, 3, 4, 5, 6\} \quad \therefore n(S) = 6$$

$\therefore$ if a coin is tossed and a die is thrown simultaneously, the sample space

$$S = \{H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6\}$$

$$\therefore n(S) = 12$$

Q.1 खालील प्रत्येक experiment साठी sample space आणि no. of sample points लिहा.

i) यासाठी वरील table मधील one die (फासा) आणि one coin (नाणे) यासाठीची information लिहावी. यावरून दोन्ही एकाच वेळी फेकले असता मिळणारी sample space वरून no. of sample point लिहावेत.

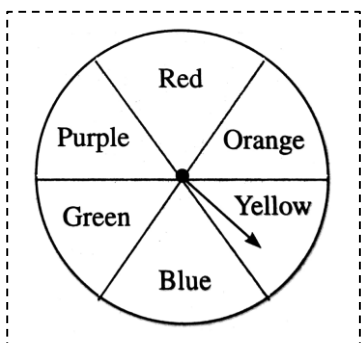
ii) Two-digit numbers are formed using digits 2, 3 and 5 without repeating the digits.

Ans: The two-digit numbers formed using digits 2, 3, 5

$$S = \{23, 25, 32, 35, 52, 53\} \quad \therefore n(S) = 6.$$

ii) यामध्ये अंकाची repetition न होता two digit numbers लिहून sample space लिहावेत. त्यानुसार no. of sample points लिहावेत.

Q.2 The arrow is rotated and it stops randomly on the disc. Find out on which colour it may stop.



Ans: There are six colours on the disc. The arrow can stop on any of the colours.

$$\therefore S = \{\text{Red, Orange, Yellow, Blue, Green, Purple}\}$$

$$\therefore n(S) = 6.$$

Q.2 Disc वरील सर्व colour हे sample space म्हणून लिहावेत व त्यानुसार no. of sample point लिहावेत.

Q.3 In the month of March 2019, find the days on which the date is a multiple of 5.

MARCH-2019						
M	T	W	T	F	S	S
				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

Ans: Multiples of 5 are dates 5, 10, 15, 20, 25, 30.

$S = \{\text{Tuesday, Sunday, Friday, Wednesday, Monday, Saturday}\}$

$$\therefore n(S) = 6.$$

Q.3 सुरुवातीला March 2019 मधील 5 च्या multiple मधील dates (तारीख) लिहावेत. त्या dates ला असणारे days हे sample space म्हणून लिहावेत आणि त्यानुसार एकुण sample point ची संख्या लिहावी.

5.6 Probability of an event (घटना संभाव्यता):

i) Mathematical language मध्ये एखाद्या expected event (अपेक्षित घटना) ची possibility (शक्यता) दर्शवणाऱ्या संख्येला probability (संभाव्यता) असे म्हणतात. ती पुढील सूत्र वापरून fraction or percentage (संख्येने किंवा शतमान) मध्ये दर्शवतात.

ii) एखाद्या random experiment साठी sample space S असेल आणि A ही त्या experiment संबंधी expected event असेल, तर त्या घटनेची probability ' $P(A)$ ' अशी दर्शवतात आणि वरील सूत्राने ठरवतात.

Solved examples

Ex.1 Find the probability of the following, when one coin is tossed.

i) Getting head ii) getting tail

Solution: Let 'S' be a sample space.

$$S = \{H, T\} \quad n(S) = 2$$

i) Let event A be getting head.

$$A = \{H\} \quad \therefore n(A) = 1 \quad P(A) = \frac{n(A)}{n(S)} = \frac{1}{2}$$

ii) Let event B be getting tail.

$$B = \{T\} \quad \therefore n(B) = 1 \quad P(B) = \frac{n(B)}{n(S)} = \frac{1}{2}$$

1) खालील event साठी probability find out करा. यासाठी one coin toss केली असता मिळणाऱ्या sample space आणि no. of sample point लिहावेत.

प्रत्येक event साठी condition नुसार वरील sample space वरून event चे sample space आणि no. of sample point लिहावेत. दिलेल्या event ची probability find out करण्यासाठी

$$P(A) = \frac{n(A)}{n(S)} \text{ या formula चा use करावा.}$$

यामध्ये प्रत्येक event नुसार P(A) म्हणजे n(A) बदलत राहतो.

Ex.2 If one die is rolled then find the probability of each of the following events.

i) Number on the upper face is prime

ii) Number on the upper face is even.

Solution: 'S' is the sample space.

$$S = \{1, 2, 3, 4, 5, 6\} \quad \therefore n(S) = 6$$

i) Event A: Prime number on the upper face.

$$A = \{2, 3, 5\} \quad \therefore n(A) = 3$$

$$P(A) = \frac{n(A)}{n(S)} \quad \therefore P(A) = \frac{3}{6} = \frac{1}{2}$$

ii) Event B: Even number on the upper face.

$$A = \{2, 4, 6\} \quad \therefore n(B) = 3$$

$$P(B) = \frac{n(B)}{n(S)} \quad \therefore P(B) = \frac{3}{6} = \frac{1}{2}$$

2) One die rolled केली असता मिळणाऱ्या sample space लिहावेत. त्यानुसार प्रत्येक event चे sample space आणि no. of

sample point लिहावेत. वरील सूत्राचा उपयोग करून प्रत्येक event ची probability find out करावी.

Ex.3 A card is drawn from a well shuffled pack of 52 playing cards. Find the probability of each event. The card drawn is (i) a red card (ii) a face card.

Solution: 'S' is a sample space $n(S) = 52$

Event A: Cards drawn is a red card.

Total red cards = 13 hearts + 13 diamonds = 26

$$\therefore n(A) = 26 \quad P(A) = \frac{n(A)}{n(S)} \quad \therefore P(A) = \frac{26}{52} = \frac{1}{2}$$

Event B: Card drawn is a face card.

Total face card 12 = 12

$$\therefore n(B) = 12 \quad P(B) = \frac{n(B)}{n(S)} \quad \therefore P(B) = \frac{12}{52} = \frac{3}{13}$$

3) 52 well shuffled playing card साठी $n(S) = 52$ लिहावे. प्रत्येक event च्या condition नुसार त्या event साठी sample space व no. of sample point लिहावेत. सूत्राचा use करून प्रत्येक event ची probability find out करावी.

Ex.4 A box contains 5 strawberry chocolates, 6 coffee chocolates and 2 peppermint chocolates. Find the probability of each of the following events, if one of the chocolate is picked from the box at random.

i) it is a coffee chocolate.

ii) it is a peppermint chocolate.

Solution: Sample space is 'S' and

$$n(S) = 5 + 6 + 2 = 13$$

Event A: it is coffee chocolate.

$$\therefore n(A) = 6 \quad P(A) = \frac{n(A)}{n(S)} \quad \therefore P(A) = \frac{6}{13}$$

Event B: It is peppermint chocolate.

$$\therefore n(B) = 2 \quad P(B) = \frac{n(B)}{n(S)} \quad \therefore P(B) = \frac{2}{13}$$

4) Box मध्ये असणाऱ्या 5 strawberry chocolates, 6 coffee chocolates आणि दोन peppermint chocolates वरून sample space म्हणजे $n(S) = 5+6+2=13$ लिहावा.

Event मधील condition नुसार sample space आणि no. of Sample points लिहावेत.

6.3.1 Direct method:

Direct method is the shortest and the simplest of the three methods used to compute the mean. The following steps are involved in this method.

Step 1: Prepare a table containing four columns.

Step 2: In column 1, write the given classes and in column 2, write the corresponding class mark (x_i).

Step 3: In column 3, write the frequencies (f_i) of the given classes and in column 4, write the product $f_i x_i$ for each class. Find $\sum f_i$ and $\sum f_i x_i$.

Step 4: Calculate the mean $\bar{X}$ by using the formula:

$$\bar{X} = \frac{\sum_{i=1}^N f_i x_i}{N} = \frac{\sum_{i=1}^N f_i x_i}{\sum f_i}$$

6.3.1 Direct method (सरळ पद्धती) -

(१) Table मध्ये दाखवल्याप्रमाणे उभे column घेतले.

(२) पहिल्या column मध्ये class (वर्ग) लिहिले.

(३) Second column मध्ये classmark (वर्गमध्य) x_i लिहिला.

(४) Third column मध्ये त्या class च्या कामगारांची frequency (f_i) लिहिली.

(५) Fourth column मध्ये प्रत्येक class साठी ($x_i \times f_i$) हा product लिहिला.

(६) नंतर $= \sum_{i=1}^N x_i f_i$ लिहिले.

(७) Formula वापरून मध्य काढला.

Solved examples:

Ex.i) The following table shows the frequency distribution of the time required for each worker to complete a work. From the table find the mean time required to complete the job for a worker.

Time (Hrs.) for each to complete the work	15-19	20-24	25-29	30-34	35-39
No. of workers	10	15	12	8	5

Solution:

i) Vertical column are drawn as shown in the table

ii) Classes are written in the first column.

iii) The class mark x_i is in the second column.

iv) In the third column, the number of workers, that is frequency (f_i) is written

v) In the fourth column, the product ($x_i \times f_i$) for each class is written.

vi) Then $\sum_{i=1}^N x_i f_i$ is written.

vii) The mean is found using the formula

Class (Time hours.)	Class mark (x_i)	Frequency (No. of Workers) (f_i)	Class mark $\times$ frequency ($x_i f_i$)
15-19	17	10	170
20-24	22	15	330
25-29	27	12	324
30-34	32	8	256
35-39	37	5	185
Total		$N = \sum f_i = 50$	$\sum x_i f_i = 1265$

$$\text{Mean} = \bar{X} = \frac{\sum x_i f_i}{N} = \frac{1265}{50} = 25.3 \quad \because \sum f_i = N.$$

The mean time required to complete the work for a worker = **25.3.hrs.** (Approx)

Ex. i) वरील table मध्ये प्रत्येक worker ला work complete करण्यासाठी लागणारा time याची frequency distribution दिले आहे.

ii) याठिकाणी work complete करण्यासाठी लागणारा time हा class म्हणून घ्यावा. दिलेल्या class वरून त्या class चा class mark (वर्गमध्य) (x_i) second column मध्ये लिहावा

iii) Number of workers हे frequency (वारंवारता) f_i या column मध्ये लिहावा. आणि शेवटी column मध्ये class mark आणि frequency यांचा product लिहावा.

iv) Column (3) मधील No. of workers ची total $N = \sum f_i$ नुसार लिहावी, आणि column-4 मधील $x_i f_i$ ची total $\sum x_i f_i$ शेवटी लिहून घ्यावी. दिलेल्या माहितीचा mean काढण्यासाठी सूत्राचा उपयोग करून वरीलप्रमाणे शेवटी उत्तर लिहावे.

6.6 Pictorial representation of statistical data:

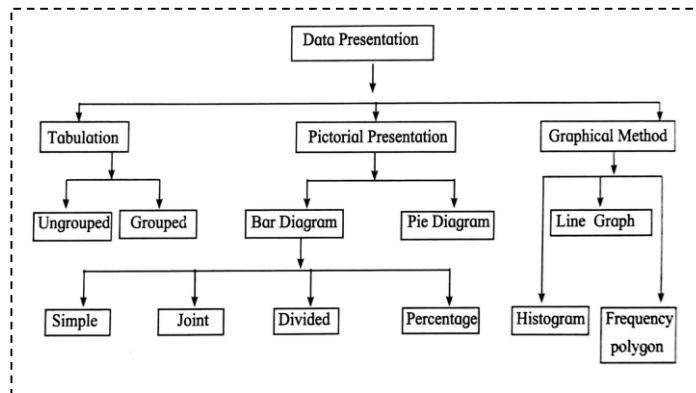
Tabular representation of numerical data does not quickly reveal some aspects of the data. If the data is represented in pictorial or graphical form then it can be easily understood.

Pictorial representation of statistical data (सांख्यिक सामग्रीचे चित्ररूप सादरीकरण) -

Numerical data (सांख्यिक माहिती) चा mean, median, mode यांवरून किंवा data analysis (माहितीचे विश्लेषण) करून त्याचा उपयोग काही विशिष्ट inference (निष्कर्ष) मिळवण्यासाठी होतो.

Presentation of data

Pictorial and graphical representation is attractive methods of data interpretation. The following tree chart shows different methods of data interpretation.



Presentation of data (सामग्रीचे सादरीकरण) -

Pictorial and graphical (चित्ररूप व आलेखरूप) सादरीकरण हे data चे अर्थबोध होण्यासाठी वापरले जाणारे लक्षवेधी प्रकार आहेत. data interpretation (सामग्री सादरीकरण) च्या विविध पद्धती दर्शवणारी tree chart (शाखाकृती) वर दाखवली आहे.

6.6.1 Histogram:

Histogram is a series of adjacent rectangles erected on X-axis with base as classes. The height of each rectangle is proportional to the corresponding class frequency.

Following steps are involved to draw a histogram:

Step 1: Make the classes continuous (extended) if they are not continuous.

Step 2: Show the extended classes on the X-axis with proper scale.

Step 3: Take frequencies on the Y-axis by using a proper scale.

Step 4: Draw rectangles on the X-axis with each class as base and heights proportional to the corresponding frequencies.

Histogram (आयतालेख) काढण्याची कृती -

- 1) Class continues (सलग वर्ग) नसल्यास ते सलग करून घ्यावेत. अशा वर्गांना वर्धित वर्ग (extended class intervals) म्हणतात.
- 2) हे extended class intervals (वर्धित वर्ग) X- अक्षावर proper scale (योग्य प्रमाण) घेऊन दर्शवा.
- 3) Y- axis वर frequency proper scale (योग्य प्रमाण) घेऊन दर्शवा.
- 4) X- अक्षावर प्रत्येक extended class intervals (वर्धित वर्ग) हा base घेऊन त्यावर rectangle काढा. Rectangle ची height corresponding (संगत) frequency एवढी घ्या.

Note:

On the X-axis, a mark '—┐' is called the kink mark shown between the origin and the first class. It means, there are no observations up to the first class. The mark can be used on Y-axis also, if required. This enables us to draw a graph of optimum size.

लक्षात घ्या:

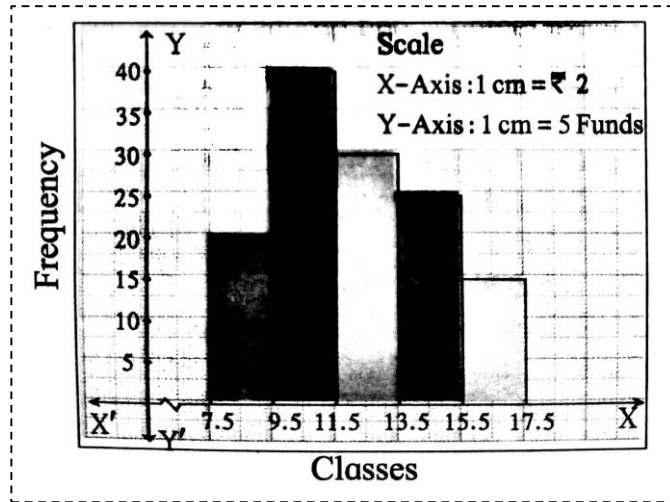
X-axis वर origin (आरंभबिंदू) आणि first class यांच्यामध्ये '—┐' अशी खूण आहे. (या खुणेस अक्षसंकोच, kink mark, असे म्हणतात.) याचा अर्थ origin पासून first class पर्यंत कोणतीही observations (निरीक्षण) नाहीत. त्यामुळे X- axis ची घडी घातल्यासारखी ही खूण आहे. आवश्यकतेनुसार Y- अक्षावरही ही खूण वापरतात. त्यामुळे योग्य आकाराचा आलेख काढता येतो.

Solved Examples:

Ex.1) The table below shows the net asset value (NAV) per unit of mutual funds of some companies. Draw histogram representing the information.

NAV(Rs.)	8 - 9	10 - 11	12 - 13	14 - 15	16 - 17
No. of mutual funds	20	40	30	25	15

Solution: The given classes are not continuous. Let's make the classes continuous.



Continuous Classes	Frequency
7.5 - 9.5	20
9.5 - 11.5	40
11.5 - 13.5	30
13.5 - 15.5	25
15.5 - 17.5	15

Ex. i) काही companies मधील mutual fund च्या unit ची NAV ची रक्कम आणि mutual fund ची संख्या दिली आहे ही information चा histogram Draw करायचा आहे.

ii) NAV च्या रक्कमेचा class contineous नाही, तो contineous करण्यासाठी upper limit class मध्ये 0.5 add करणे आणि lower limit class मधून 0.5 वजा करणे यानुसार सर्व class contineous करून लिहावेत.

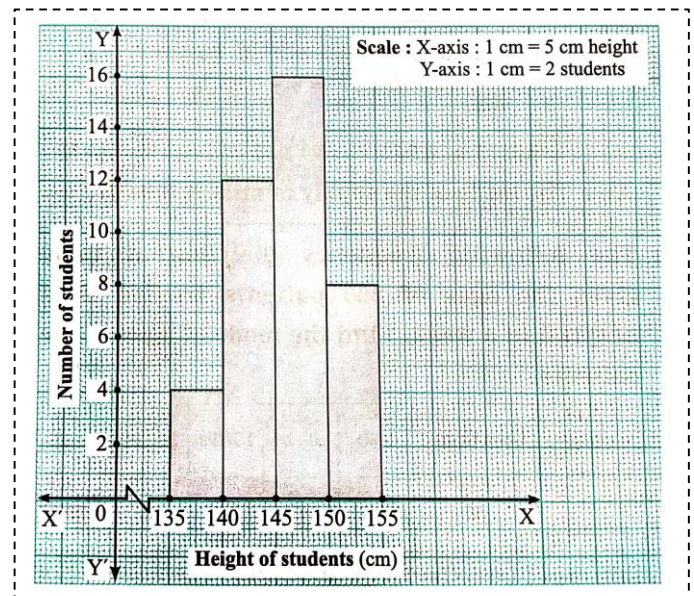
iii) Histogram काढताना class ची माहिती X आणि frequency ही Y axis वर घ्यावी त्यानुसार Histogram draw करावा. Scale हे वरच्या right corner मध्ये लिहावे. यामध्ये X व Y axis वरील माहिती 1cm याप्रमाणे लिहावी.

Practice set - 6.4

Q.1 Draw histogram of the following data:

Height of students (cm)	135-140	140-145	145-150	150-155
No. of students	4	12	16	8

Solution:

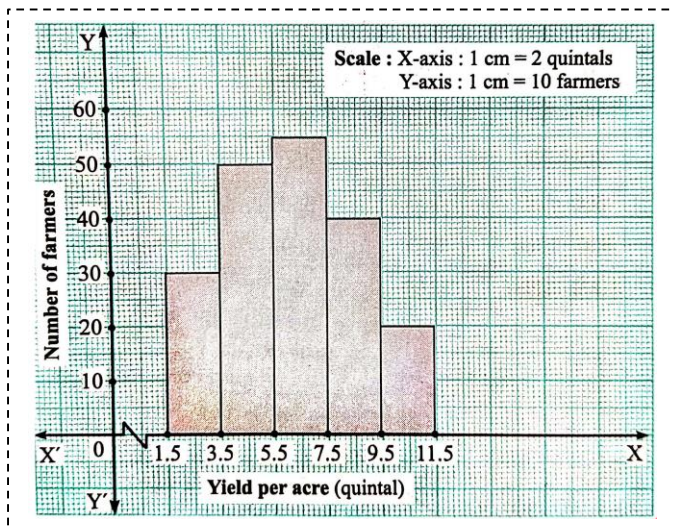


Q.2 The table below shows that yield of Jowar per acre. Show the data by histogram.

Yield per acre (quintal)	2-3	4-5	6-7	8-9	10-11
No. of farmers	30	50	55	40	20

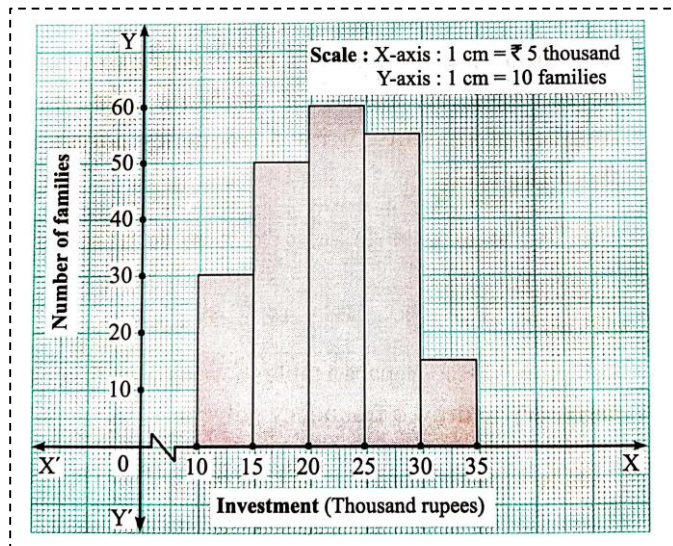
Solution: Here, the classes are not continuous. We make the classes continuous.

Yield per acre (quintal)	Continuous Classes	Number of farmers
2-3	1.5-3.5	30
4-5	3.5-5.5	50
6-7	5.5-7.5	55
8-9	7.5-9.5	40
10-11	9.5-11.5	20



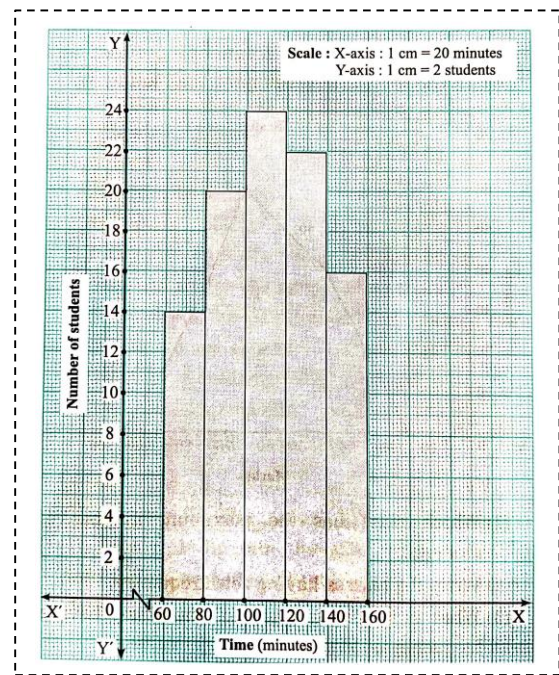
Q.3 In the following table, the investment made by 210 families is shown. Present it in the form of histogram.

Investment (Thousand rupees)	10-15	15-20	20-25	25-30	30-35
No. of families	30	50	60	55	15



Q.4 Time allotted for the preparation of an examination by some students is shown in the table draw a histogram to show the information.

Time (minutes)	60-80	80-100	100-120	120-140	140-160
No. of students	14	20	24	22	16



i) यामधील सर्व example साठी यापूर्वी explain केलेली method आणि solved example मधील explanation नुसार Histogram draw करावेत.

ii) Class contineous नसतील तर ते contineous करून घ्यावेत.

iii) Scale काळजीपूर्वक लिहण्याचा प्रयत्न करावा.

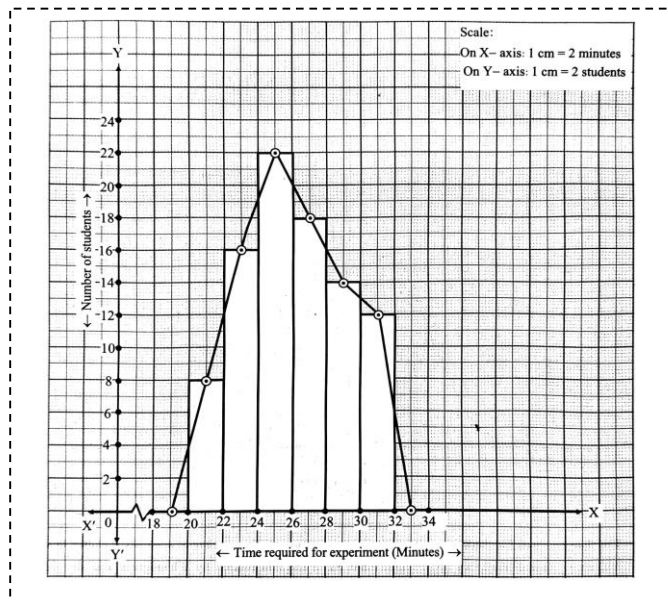
Q.11 The time required for student to do a science experiment and the number of students is shown in the following grouped frequency distribution table. Show the information by a histogram and also by a frequency polygon.

Time required experiment (minutes)	20-22	22-24	24-26	26-28	28-30	30-32
No. of student	8	16	22	18	14	12

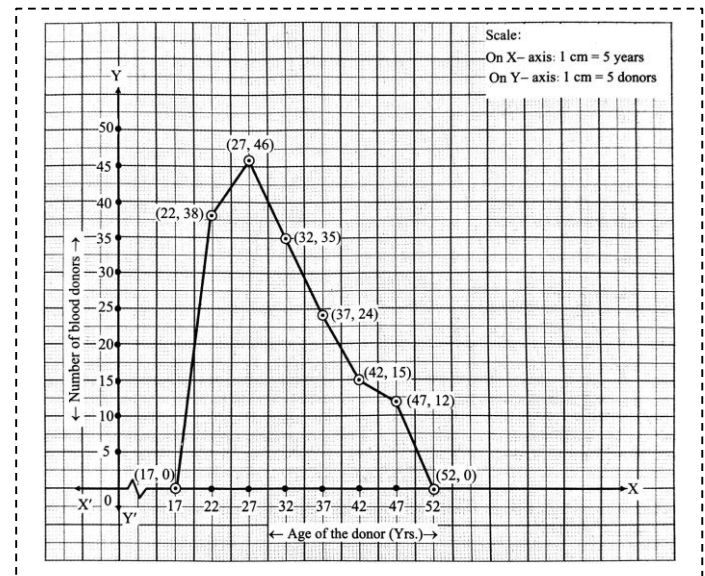
Solution:

Class Time required for experiment (minutes)	Class mark	Frequency (No. of students)	Coordinates of points
18-20	19	0	(19, 0)
20-22	21	8	(21, 8)
22-24	23	16	(23, 16)
24-26	25	22	(25, 22)

26-28	27	18	(27, 18)
28-30	29	14	(29, 14)
30-32	31	12	(31, 12)
32-34	33	0	(33, 0)



35-39	34.5-39.5	37	24	(37, 24)
40-44	39.5-44.5	42	15	(42, 15)
45-49	44.5-49.5	47	12	(47, 12)
50-54	49.5-54.5	52	0	(52, 0)



12) Draw a frequency polygon for the following group frequency distribution table.

Age of the donor (year)	20-24	25-29	30-34	35-39	40-44	45-49
No. of blood donor	38	46	35	24	15	12

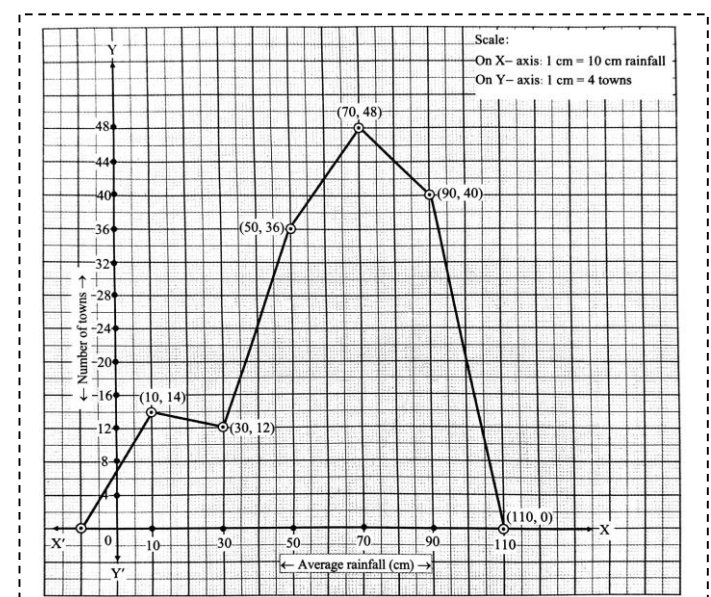
Solution:

Original class Age of blood donor (Yrs)	continuous classes	Class mark	Frequency (No. of workers)	Coordinates of points
15-19	14.5-19.5	17	0	(17, 0)
20-24	19.5-24.5	22	38	(22, 38)
25-29	24.5-29.5	27	46	(27, 46)
30-34	29.5-34.5	32	35	(32, 35)

Q.13 The following table shows the average rainfall in 150 towns. Show the information by a frequency polygon.

Average rainfall (cm)	0-20	20-40	40-60	60-80	80-100
No. of Towns	14	12	36	48	40

Solution:



Q.10 ते Q.13- frequency polygon draw करण्यासाठी यापुर्वी explain केलेली method आणि solved example तसेच practice set मधील example च्या explanation वरून सर्व example solve करावीत.

Practice set - 6.6

Q.1 The age group and number of persons, who donated blood in a blood donation camp is given below. Draw a pie diagram from it.

Age group (years)	20-25	25-30	30-35	35-40
No. of persons	80	60	36	25

Solution: Total number of persons

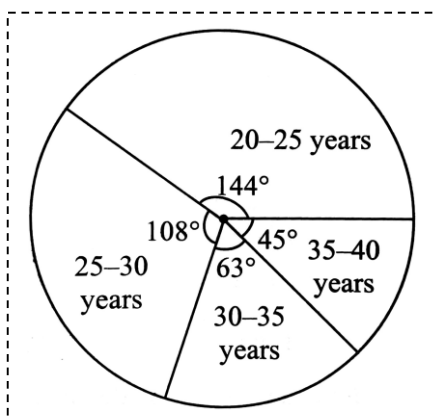
$$= 80 + 60 + 35 + 25 = 200$$

∴ Measure of Central angle θ

$$= \frac{\text{No. of scores in the components}}{\text{Total no. of scores}} \times 360^\circ$$

Age group (Yrs)	No. of persons	Measure of the central angle (θ)
20-25	80	$\frac{80}{200} \times 360^\circ = 144^\circ$
25-30	60	$\frac{60}{200} \times 360^\circ = 108^\circ$
30-35	35	$\frac{35}{200} \times 360^\circ = 63^\circ$
35-40	25	$\frac{25}{200} \times 360^\circ = 45^\circ$
Total	200	360°

On the basis of the table, the pie diagram is drawn below.



Q.2 The marks obtained by a student in different subjects are shown. Draw a pie diagram showing the information.

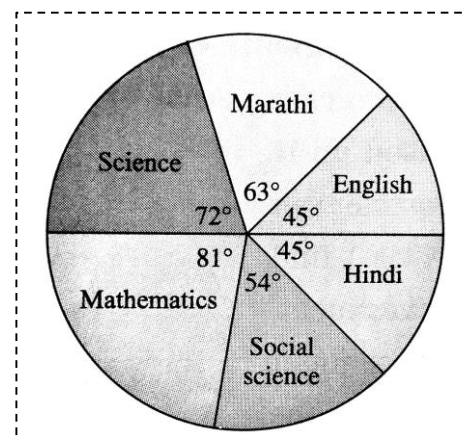
Subject	English	Marathi	Science	Mathematics	Social science	Hindi
Marks	50	70	80	90	60	50

Solution: Total marks obtained

$$50 + 70 + 80 + 90 + 60 + 50 = 400$$

Subject	Marks	Measure of the central angle (θ)
English	50	$\frac{50}{400} \times 360^\circ = 45^\circ$
Marathi	70	$\frac{70}{400} \times 360^\circ = 63^\circ$
Science	80	$\frac{80}{400} \times 360^\circ = 72^\circ$
Mathematics	90	$\frac{90}{400} \times 360^\circ = 81^\circ$
Social science	60	$\frac{60}{400} \times 360^\circ = 54^\circ$
Hindi	50	$\frac{50}{400} \times 360^\circ = 45^\circ$
Total	400	360°

On the basis of the table, the pie diagram is drawn below:



Q.3 In a tree plantation programme, the number of trees planted by students of different classes is

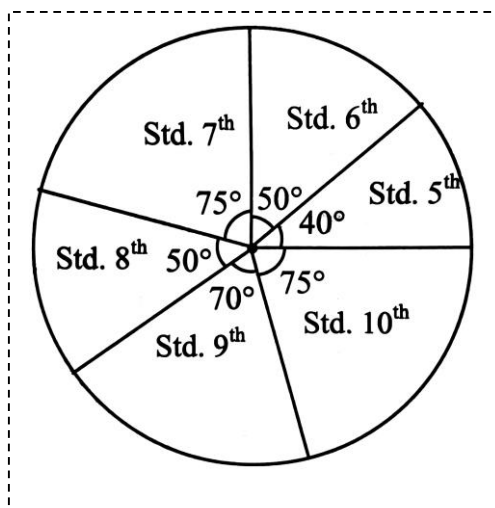
given in the following table. Draw a pie diagram showing the information.

Standard	5 th	6 th	7 th	8 th	9 th	10 th
No. of trees	40	50	75	50	70	75

Solution: Total no. of trees planted =
 $40 + 50 + 75 + 50 + 70 + 75 = 360^\circ$

Standard	No. of trees	Measure of the central angle (θ)
5 th	40	$\frac{40}{360} \times 360^\circ = 40^\circ$
6 th	50	$\frac{50}{360} \times 360^\circ = 50^\circ$
7 th	75	$\frac{75}{360} \times 360^\circ = 75^\circ$
8 th	50	$\frac{50}{360} \times 360^\circ = 50^\circ$
9 th	70	$\frac{70}{360} \times 360^\circ = 70^\circ$
10 th	75	$\frac{75}{360} \times 360^\circ = 75^\circ$
Total	360	360°

On the basis of the table the field diagram is drawn.



Q.4 The following table shows the percentage of demand for different fruits registered with a fruit vendor. Show the information by pie diagram.

Fruits	Mango	Sweet lime	Apple	Chiko	Orange
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Percent age of demand	30	15	25	20	10
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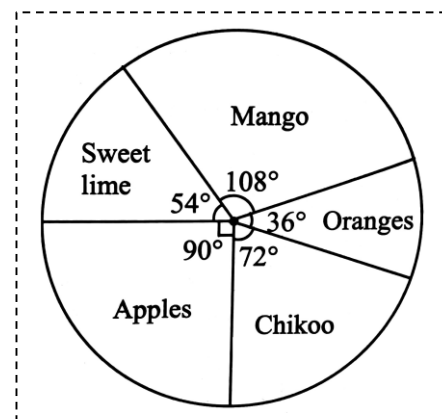
Solution: Total percentage
 $= 30 + 15 + 25 + 20 + 10 = 100\%$

Measure of central angle

$$(\theta) = \frac{\text{Percentage of componets}}{100} \times 360^\circ$$

Fruits	Percentage demand	Measure of the central angle (θ)
Mango	30	$\frac{30}{100} \times 360^\circ = 108^\circ$
Sweet lime	15	$\frac{15}{100} \times 360^\circ = 54^\circ$
Apples	25	$\frac{25}{100} \times 360^\circ = 90^\circ$
Chikoo	20	$\frac{20}{100} \times 360^\circ = 72^\circ$
Oranges	10	$\frac{10}{100} \times 360^\circ = 36^\circ$
Total	100	360°

on the basis of the table the pea diagram is Grand willow below.



Q.1 ते Q.4 साठी - दिलेल्या संबंधीत 'घटकांची संख्या आणि total number यारून central angle च्या formula चा use करून प्रत्येक संबंधीत घटकाचा central angle find out करावा आणि त्यानुसार pie-diagram काढण्याचा प्रयत्न करावा.

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