Solution

ALGEBRA

Class 10 - Mathematics - I

1. (i) Choose the correct alternative from given :

   i. **(d)** $x(x+5)=4$

   Explanation:

   $x(x+5)=4$

   $\therefore x^2+5x-4=0$

   Here, x is the only variable and maximum index of the variable is 2.

   $a=1,\ b=5, c=-4$ are real numbers and $a \neq 0$.

   ii. **(a)** 3

   Explanation:

   Substituting x = 1 in 4x + 5y = 19, we get

   $4(1)+5y=19$

   $\therefore 5y=19-4=15$

   $\therefore y=\frac{15}{5}=3$

   iii. **(c)** 3.5

   Explanation:

   $t_n=a+(n-1)d$

   $=3.5+(n-1)0$

   $=3.5+0$

   $=3.5$

   iv. **(d)** 15

   Explanation:

   15

   (ii)

   i.
   $$\begin{array}{r} 15x+17y=21 \\ +\ 17x+15y=11 \\ \hline 32x+32y=32 \end{array}$$

   $\therefore \boldsymbol{x}+\boldsymbol{y}=1$ ...[Dividing both sides by 32]

   ii. $t_n=3n-2$

   $\therefore t_1=3(1)-2$

   $=3-2=1$

   iii. Rate of CGST $=9\%$

   But, rate of SGST $=$ rate of CGST

   $\therefore$ Rate of SGST $=9\%$

   Rate of GST = Rate of SGST + Rate of CGST

   $=9\%+9\%$

   $\therefore$ Rate of GST $=18\%$

   iv. **(c)** 10

   Explanation:

   $P(A)=\frac{n(A)}{n(S)}$

   $\therefore \frac{1}{5}=\frac{2}{n(S)}$

   $\therefore n(S)=10$

2. (i) Complete the following activities and rewrite it (any two) :

   i. The first n even natural numbers are $2,4,6,\ldots,2n$.

   The above sequence is an A.P.

   $t_1=$ first term $=2, t_n=$ last term $=2n$

   $S_n=\frac{n}{2}(t_1+t_n)$

$= \frac{n}{2}(2 + 2n)$

$= \frac{n}{2} \times 2(1 + n) = n(n + 1)$

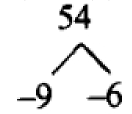
$\therefore$ The sum of first n even natural numbers is $n(n + 1)$.

ii. $x^2 - 15x + 54 = 0$

$\therefore x^2 - 9x - 6x + 54 = 0$

$\therefore x(x - 9) - 6(x - 9) = 0$

$\therefore (x - 9)(x - 6) = 0$



$-9 \times -6 = +54$

$-9 - 6 = -15$

By using the property, if the product of two numbers is zero, then at least one of them is zero, we get

$x - 9 = 0$ or $x - 6 = 0$

$\therefore x = 9$ or $x = 6$

$\therefore$ The roots of the given quadratic equation are 9 and 6.

iii. Two coins are tossed simultaneously.

$\therefore$ Sample space is

$S = \{\boxed{HH}, HT, TH, \boxed{TT}\}$

Event A: To get at least one head.

$\therefore A = \{\boxed{HH}, HT, TH\}$

Event B : To get no head.

$\therefore B = \{\boxed{TT}\}$

(ii) Solve the following subquestions (any four) :

i. The given simultaneous equations are

$3x + 5y = 26$ ...(i)

$x + 5y = 22$ ...(ii)

Equations (i) and (ii) are in $ax + by = c$ form.

$D_x = \begin{vmatrix} 26 & 5 \\ 22 & 5 \end{vmatrix} = (26 \times 5) - (22 \times 5)$

$= 130 - 110$

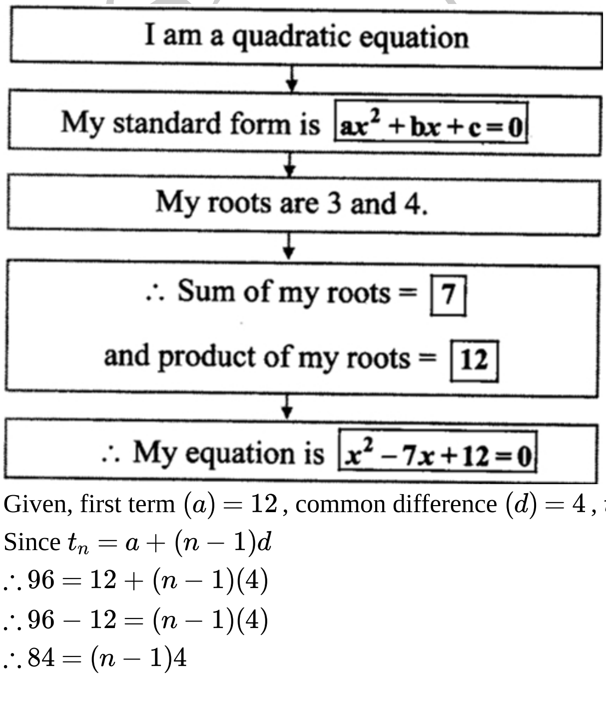
= 20

$D_y = \begin{vmatrix} 3 & 26 \\ 1 & 22 \end{vmatrix} = (3 \times 22) - (1 \times 26)$

$= 66 - 26$

$= 40$

ii.



iii. Given, first term $(a) = 12$, common difference $(d) = 4$, $t_n = 96$

Since $t_n = a + (n - 1)d$

$\therefore 96 = 12 + (n - 1)(4)$

$\therefore 96 - 12 = (n - 1)(4)$

$\therefore 84 = (n - 1)4$

$\therefore n-1=\frac{84}{4}$

$\therefore n-1=21$

$\therefore n=21+1=22$

iv. If two coins are tossed simultaneously,

$S=\{HH, HT, TH, TT\}$

i. Event A : at least getting one head.

$\therefore A=\{HH, HT, TH\}$

ii. Event B : to get no head.

$B=\{TT\}$

v. $\text{Mean}(\overline{X})=\frac{\sum x_i f_i}{N}=\frac{1265}{50}=25.3$

3. (i) Complete the following activity and rewrite it (any one) :

i.

Class **No. of Mangoes**	**Frequency** **(No. of trees)**	**Cumulative frequency** **(less than)**
$50-100$	33	33
$100-150$	30	$63 \rightarrow cf$
$150-200$	$90 \rightarrow f$	153
$200-250$	80	233
$250-300$	17	250
Total	250	-

Here, total frequency $=\Sigma f_i=N=250$

$\therefore \frac{N}{2}=\frac{250}{2}=125$

Cumulative frequency which is just greater than (or equal) to 125 is 153.

$\therefore$ The median class is $150-200$.

Now, $L=150, f=90, cf=63, h=50$

$\therefore \text{Median}=L+\left[\frac{\frac{N}{2}-cf}{f}\right] h=150+\left(\frac{125-63}{90}\right) 50 \;=150+34.4=184.4 \approx 184$

$\therefore$ The median of the given data is 184 mangoes (approx.)

ii. $FV=₹100;$ Number of shares $=150$

Market value $=₹120$

i. i. Sum investment $=MV\times$ No. of Shares

$=\boxed{120}\times\boxed{150}$

$\therefore$ Sum investment $=₹18,000$

ii. Dividend per share $=FV\times$ Rate of dividend

$=\boxed{100}\times\frac{\boxed{7}}{100}=₹7$

$\therefore$ Total dividend received $=150\times 7$

$=\boxed{1050}$

iii. Rate of return $=\frac{\text{Dividend income}}{\text{Sum invested}}\times 100$

$=\frac{1,050}{18,000}\times 100=\boxed{5.83\%}$

(ii) Solve the following subquestions (any two) :

i. $3m^2-m-10=0$

Comparing the above equation with $am^2+bm+c=0$, we get

$a=3, b=-1, c=-10$

$\therefore b^2-4ac=(-1)^2-4\times 3\times(-10)$

$=1+120$

$=121$

$m=\frac{-b\pm\sqrt{b^2-4ac}}{2a}=\frac{-(-1)\pm\sqrt{121}}{2(3)}=\frac{1\pm 11}{6}$

$\therefore m=\frac{1+11}{6}$ or $m=\frac{1-11}{6}$

$\therefore m=\frac{12}{6}$ or $m=\frac{-10}{6}$

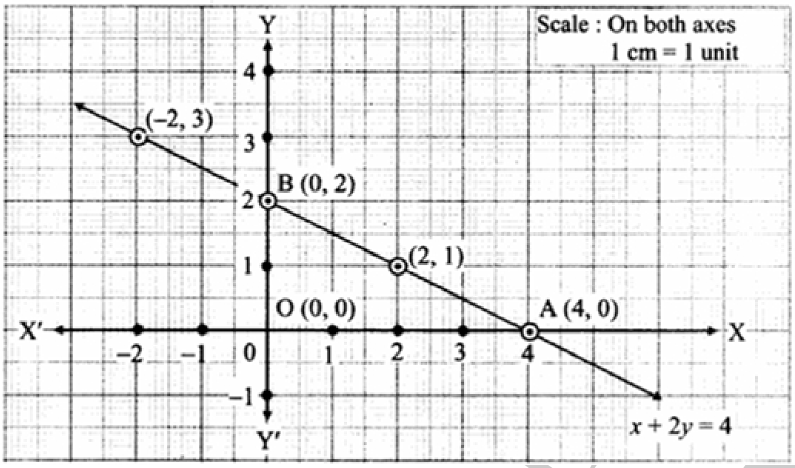
$\therefore m=2$ or $m=\frac{-5}{3}$

$\therefore$ The roots of the given quadratic equation are 2 and $-\frac{5}{3}$.

ii. $x+2y=4$

$\therefore y=\frac{4-x}{2}$

x	-2	0	2	4
y	3	2	1	0
(x,y)	$(-2,3)$	$(0,2)$	$(2,1)$	$(4,0)$



From the graph, we get $\triangle OAB$, where OB is the height and OA is the base.

Area of triangle $=\frac{1}{2}\times$ base $\times$ height

$=\frac{1}{2}\times l(OA)\times l(OB)$

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

$=4$ sq. units

iii. Printed price of dress $=$ ₹2000,

Rate of discount $=5\%$

Amount of discount $=5\%$ of Printed price

$=\frac{5}{100}\times 2000$

$=$ ₹100

Taxable value $=$ Printed price - Discount

$=2000-100$

$=$ ₹1900

Rate of GST $=5\%$

$\therefore$ GST $=5\%$ of taxable value

$=\frac{5}{100}\times 1900$

$\therefore$ GST $=$ ₹ 95

$\therefore$ Purchase price of the dress $=$ Taxable value + GST

$=1900+95$

$=$ ₹1995

$\therefore$ The purchase price of the dress for the customer is ₹ 1995.

iv. Let the 2 red balloons be R_1, R_2,

3 blue balloons be B_1, B_2, B_3, and

4 green balloons be G_1, G_2, G_3, G_4.

$\therefore$ Sample space

$S=\{R_1, R_2,\ B_1,\ B_2,\ B_3, G_1, G_2, G_3, G_4\}$

$\therefore n(S)=9$

i. Let A be the event that Pranali gets a red balloon.

$\therefore A=\{R_1, R_2\}$

$\therefore n(A)=2$

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

$\therefore P(A) = \frac{2}{9}$

ii. Let B be the event that Pranali gets a blue balloon.

$\therefore B = \{B_1, B_2, B_3\}$

$\therefore n(B) = 3$

$\therefore P(B) = \frac{n(B)}{n(S)} = \frac{3}{9}$

$\therefore P(B) = \frac{1}{3}$

iii. Let C be the event that Pranali gets a green balloon.

$\therefore C = \{G_1, G_2, G_3, G_4\}$

$\therefore n(C) = 4$

$\therefore P(C) = \frac{n(C)}{n(S)}$

$\therefore P(C) = \frac{4}{9}$

4. Solve the following subquestions (any two) :

(i) Let the initial speed of the train be $x\ km/hr$.

$\therefore$ New speed is $(x+12) km/hr$.

Time to cover $240\ km = \frac{\text{distance}}{\text{speed}} = \frac{240}{x}$ hours

New time after increasing speed $= \frac{240}{x+12}$ hours

According to the given condition,

$\frac{240}{x+12} = \frac{240}{x} - 1$

$\therefore \frac{240}{x} - \frac{240}{x+12} = 1$

$\therefore \frac{1}{x} - \frac{1}{x+12} = \frac{1}{240} \ldots$ [Dividing both sides by 240]

$\therefore \frac{x+12-x}{x(x+12)} = \frac{1}{240}$

$\therefore \frac{12}{x^2+12x} = \frac{1}{240}$

$\therefore x^2 + 12x = 2880$

$\therefore x^2 + 12x - 2880 = 0$

$\therefore x^2 + 60x - 48x - 2880 = 0$

$\therefore x(x+60) - 48(x+60) = 0$

− 2880

60   − 48

60 × (−48) = − 2880

60 − 48 = 12

$\therefore (x+60)(x-48) = 0$

$\therefore x + 60 = 0$ or $x - 48 = 0$

$\therefore x = -60$ or $x = 48$

But, speed cannot be negative.

$\therefore x \neq -60$

$\therefore$ The initial speed of the train is $48\ km/hr$.

(ii) Total number of students $= 180$

$\therefore 25 + x + 30 + 2x + 65 = 180$

$\therefore 3x + 120 = 180$

$\therefore 3x = 180 - 120$

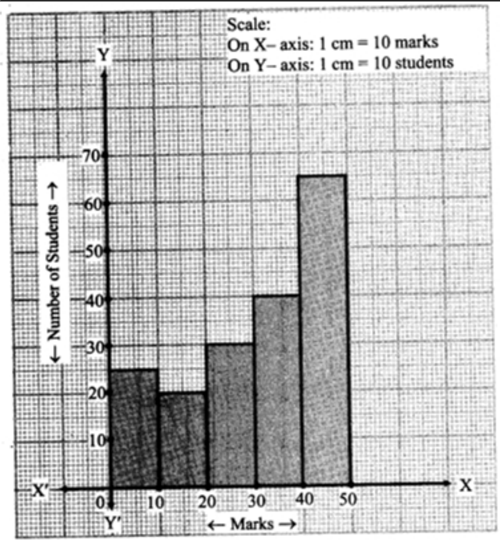
$\therefore 3x = 60$

$\therefore x = \frac{60}{3}$

$\therefore x = 20$

Marks	Number of Students
$0 - 10$	25
$10 - 20$	$x = 20$

$20-30$	30
$30-40$	$2x=2\times 20=40$
$40-50$	65



(iii) The amounts invested by Kavita everyday in the month of February 2020 are as follows:

$20, 40, 60, \ldots$

The above sequence is an A.P.

$\therefore a=20, d=40-20=20$,

$n=29$ ...[$\because$ 2020 is a leap year]

$S_n=\frac{n}{2}[2a+(n-1)d]$

$\therefore S_{29}=\frac{29}{2}[2(20)+(29-1)20]$

$=\frac{29}{2}(40+28\times 20)$

$=\frac{29}{2}(40+560)$

$=\frac{29}{2}(600)$

$=29\times 300$

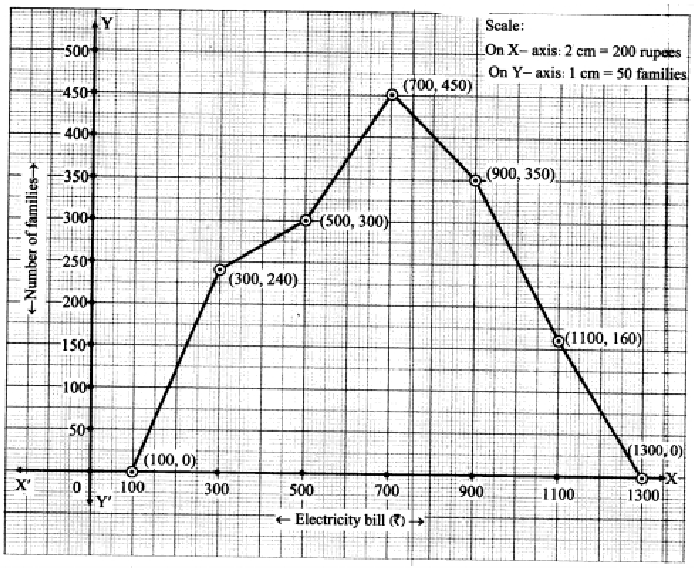
$\therefore S_{29}=8700$

$\therefore$ Kavita's total savings in the month of February 2020 is ₹ 8700.

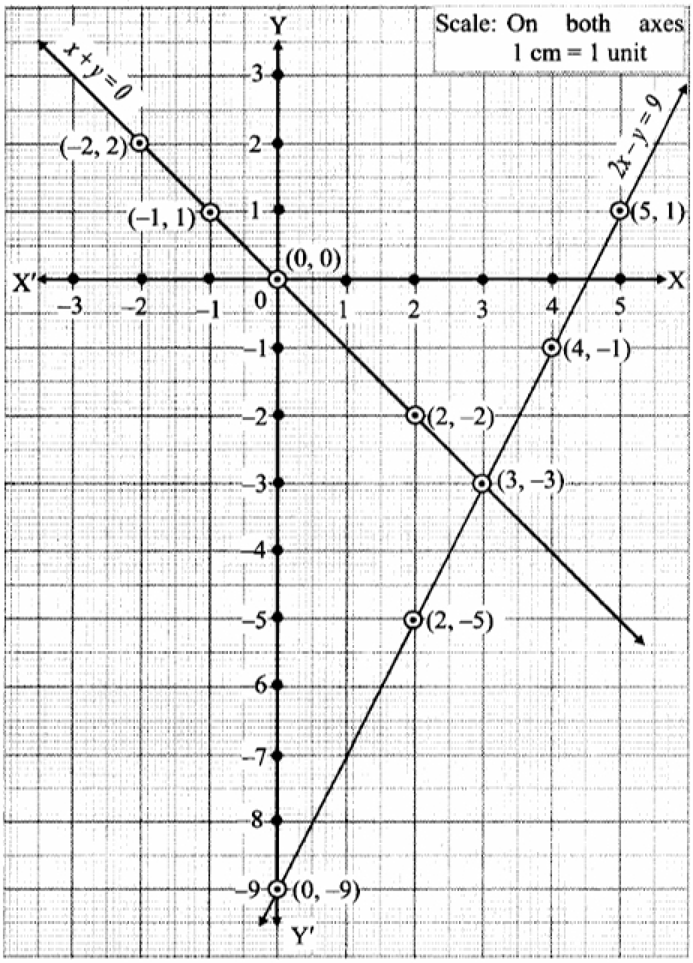
5. Solve the following subquestions (any one) :

(i)

Class Electricity bill (₹)	$0-200$	$200-400$	$400-600$	$000-800$	$800-1000$	$1000-1200$	$1200-1400$
Class mark	100	300	500	700	900	1100	1300
Frequency (Families)	0	240	300	450	350	160	0
Co-ordinates of points	$(100,0)$	$(300,240)$	$(500,300)$	$(700,450)$	$(900,350)$	$(1100,160)$	$(1300,0)$



(ii)



The given simultaneous equations are $x + y = 0$

$\therefore y = -x$

x	0	2	-2	-1
y	0	-2	2	1
(x, y)	$(0, 0)$	$(2, -2)$	$(-2, 2)$	$(-1, 1)$

$2x - y = 9$

$\therefore y = 2x - 9$

x	0	2	5	4
y	-9	-5	1	-1
(x, y)	$(0, -9)$	$(2, -5)$	$(5, 1)$	$(4, -1)$

The two lines intersect at point $(3, -3)$.
$\therefore x = 3$ and $y = -3$ is the solution of the simultaneous equations $x + y = 0$ and $2x - y = 9$.