MH - 1 (X) Mathematics
2022-23

Maximum Marks: **40**
Time allowed: **2 Hours**

Note:-
(i) All questions are compulsory
(ii) Use of a calculator is not allowed.
(iii) The numbers to the right of the questions indicate full marks.
(iv) In case of MCQs [Q. No. 1(A)] only the first attempt will be evaluated and will be given credit.
(v) For every MCQ, four alternatives (A), (B), (C), (D) of answers are given. Alternative of correct answer is to be written in front of the sub question number.

Question 1

A. Choose the correct answer and write the alphabet of it in front of the sub-question number: **[4]**

(i) To draw the graph of $4x + 5y = 19$, find y when $x = 1$:
(A) 4
(B) 3
(C) 2
(D) -3

Answer: (C) 3

Explanation:
$4x + 5y = 19$
When $x = 1$, then y will be

$4(1) + 5y = 19$
$\Rightarrow 4 + 5y = 19$

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

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

Hence, the correct answer is 3. Option (C)

(ii) Out of the following equations, which one is not a quadratic equation?

(A) $x^2 + 4x = 11 + x^2$

(B) $x^2 = 4x$

(C) $5x^2 = 90$

(D) $2x - x^2 = x^2 + 5$

Answer: (A) $x^2 + 4x = 11 + x^2$

Explanation:

Option A: $x^2 + 4x = 11 + x^2 \Rightarrow 4x = 11$

$Thus,\ x^2 + 4x = 11 + x^2\ is\ not\ a\ quadratic\ equation.$

Option B: $x^2 = 4x$ can be written as $x^2 - 4x + 0 = 0$ So, $x^2 - 4x$ is a quadratic equation.

Option C: $5x^2 = 90$ can be written as $5x^2 - 90 + 0 = 0$ So, $5x^2 - 90 + 0 = 0$ is a quadratic equation.

Option D: $2x - x^2 = x^2 + 5$ can be written as $2x^2 - 2x + 5 = 0$. So, it also forms a quadratic equation.

Hence, the correct answer is $x^2 + 4x = 11 + x^2$. Option (A)

(iii) For the given A.P. $a = 3.5, d = 0$, then $t_n =$

(A) 0
(B) 3.5
(C) 103.5
(D) 104.5

Answer: (B) 3.5

Explanation:

$a = 3.5, d = 0$

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

$= 3.5 + (n - 1)0$

$= 3.5 + 0 \quad = 3.5$

(iv) If $n(A) = 2, P(A) = \frac{1}{5}$, thèn $n(S) = ?$

(A) 10

(B) $\frac{5}{2}$

(C) $\frac{2}{5}$

(D) $\frac{1}{3}$

Answer: (A) 10

Explanation:

We know that n(A) = 2 and P(A) = $\frac{1}{5}$. We can use the formula:

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

where P(A) is the probability of A, n(A) is the number of elements in A, and n(S) is the number of elements in the sample space S.

Substituting the given values, we get:

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

Multiplying both sides by n(S), we get:

n(S) × $\frac{1}{5}$ = 2

n(S) = 2 × 5 = 10

Therefore, the answer is (A) 10.

B. Solve the following sub question: **[4]**

(i) Find the value of the following determinant:

$$\begin{vmatrix} 4 & 3 \\ 2 & 7 \end{vmatrix}$$

Answer: 22

Explanation:

$|A| = \begin{vmatrix} 4 & 3 \\ 2 & 7 \end{vmatrix}$

$|A| = (4\times7) - (3\times2)$

$|A| = 28 - 6$

$|A| = 22$

(ii) Find the common difference of the following AP:
2, 4, 6, 8, ….

Answer: 2

Explanation:

Common Difference = $a_2 - a_1$

= 4 – 2

= 2

Therefore, the common difference of the given AP is 2.

(iii) On certain article if rate of CGST is 9%, then what is the rate of SGST ?

Explanation:

Given:

Rate of CGST = 9%

Rate of SGST = Rate of CGST = 9%

(iv) If one coin is tossed, write the sample space 'S'.

Explanation:
Sample space (S) = {H, T}

Question 2

A. Complete any two given activities and rewrite it: **[4]**

(i) Complete the following activity, find the value of x:
5x + 3y = 9 ..... (I)
2x – 3y = 12 ..... (II)

Answer: x = 3
Explanation:
Given equations are
5x + 3y = 9 ..... (I)
2x – 3y = 12 ..... (II)

Add equations (I) and (II),
5x + 3y = 9 ..... (I)
2x – 3y = 12 ..... (II)

7x = 21

$x = \frac{21}{7}$
x = 3

(ii) Complete the following activity to determine the nature of the roots of the quadratic equation $x^2 + 2x - 9 = 0$:

Answer: Roots of the given equation are real and unequal.

Explanation:

Compare $x^2 + 2x - 9 = 0$ with $ax^2 + bx + c = 0$

a = 1, b = 2, c = -9

$b^2 - 4ac = 2^2 - 4(1)(-9)$

= 4 + 36

= 40

$b^2 - 4ac > 0$

Therefore, the roots of the equation are real and unequal.

(iii) Complete the following table using given information :

Sr. No.	FV	Share is at	MV
1.	₹100	Par	□
2.	□	Premium ₹ 500	₹575
3.	₹10	□	₹5
4.	₹200	Discount ₹ 50	□

Answer: ₹ 100, ₹ 75, Discount ₹ 5, ₹ 150

Explanation:

(1) When share is at par, MV (Market value) = FV (Face value)

$\therefore MV = FV = ₹100$

(2) $FV = MV$ - Premium $= ₹\ 575 - ₹\ 500 = ₹\ 75$

(3) $FV = ₹10$ and $MV = ₹5$

Since $MV < FV$, so the share is at discount.

Discount $= FV - MV = ₹10 - ₹5 = ₹\ 5$

(4) Discount $= FV - MV$

$50 = 200 - MV$

$MV = ₹150$

The complete table is given below:

Sr.No	FV	Share is at	MV
(1)	₹ 100	par	₹ 100
(2)	₹ 75	premium ₹ 500	₹ 575
(3)	₹10	Discount ₹ 5	₹ 5
4.	₹200	Discount ₹ 50	₹ 150

B. Solve the following sub-questions (any four) **[8]**

(i) Solve the following simultaneous equations:
x + y = 4 ; 2x – y = 2

Answer: x = 2 and y = 2
Explanation:
Adding the equations,
x + y = 4
2x – y = 2
_____
3x = 6
_____
x = 6/3
x = 2
Now, substitute x in x + y = 4,
2 + y = 4
y = 4 – 2
y = 2
Therefore, x = 2 and y = 2

(ii) Write the following equation in the form $ax^2 + bx + c = 0$, then write the values of a, b and c:
$2y = 10 - y^2$

Answer: a = 1, b = 2, c = -10
Explanation:

$2y = 10 - y^2$

$y^2 + 2y - 10 = 0$

Now, compare the above equation with $ax^2 + bx + c = 0$,
Therefore, a = 1, b = 2, c = -10

(iii) Write an A.P. whose first term is a = 10 and common difference d = 5.

Answer: 10, 15, 20, …
Explanation:
Given that, a = 10 and d = 5
Then AP is,
a, a+d, a+2d, …
= 10, (10+5), (10+10), …
= 10, 15, 20, …

Therefore, A.P is 10, 15, 20, …

(iv) Courier service agent charged total ₹ 590 to courier a parcel from Nashik to Nagpur. In the tax invoice taxable value is ₹ 500 on which CGST is ₹45 and SGST is ₹45. Find the rate of GST charged for this service.

Answer:18%

Explanation:
Total $GST = CGST + SGST = 45 + 45 = ₹90.$
Rate of GST $= \frac{90}{500} \times 100 = 18\%$
∴ Rate of GST charged by agent is 18%.

(v) Observe the following table and find Mean :
Assumed mean $A = 300$

Class	**Class**	$d_i = x_i - A$	**Frequency**	**Frequency ×**
	mark	$d_i = x_i - 300$	f_i	Deviation
	x_i			$f_i d_i$
$200 - 240$	220	-80	5	-400
$240 - 280$	260	-40	10	-400
$280 - 320$	$300 \rightarrow A$	0	15	0
$320 - 360$	340	40	12	480
$360 - 400$	380	80	8	640
Total			$\Sigma f_i = 50$	$\Sigma f_i d_i = 320$

Answer: 306.4

Explanation:

$$Mean\ \bar{x} = A + \frac{\Sigma f_i d_i}{\Sigma f_i} = 300 + \frac{320}{50} = 300 + 6.4 = 306.4$$

Question 3. A. Complete any one activity and rewrite it: **[3]**

(i) Form a 'Road Safety Committee' of two, from 2 boys (B_1, B_2) and 2 girls (G_1, G_2).

Complete the following activity to write the sample space:

(a) Committee of 2 boys =……..

(b) Committee of 2 girls =……

(c) Committee of one boy and one girl = $\{B_1G_1, B_1G_2, \square, \square\}$

(d) ∴ Sample space $(S) = \{(B_1B_2), (B_1G_1), \square, \square(B_2G_2), (G_1G_2)\}$

Explanation:

(a) Committee of 2 boys $= B_1, B_2$

(b) Committee of 2 girls $= G_1, G_2$

(c) Committee of one boy and one girl $= (B_1, G_1), (B_1, G_2), (B_2, G_1), (B_2, G_2)$

(d) Sample space $= \{(B_1, B_2), (G_1, G_2), (B_1, G_1), (B_1, G_2), (B_2, G_1), (B_2, G_2)\}$

or $n(S) = 6$

(ii) Fill in the boxes with the help of given information:

Tax invoice of services provided (Sample)

Food Junction, Khed – Shivapur, Pune
Invoice no. 58
Mob no. 7588580000, email- ahar.khed@yahoo.com

GSTIN: 27AAAAA5555B1ZA Invoice Date 25 Feb., 2020

SAC	Food Items	Qty	Rate (in Rs.)	Taxable amount	CGST		SGST	
9963	Coffee	1	20	20.00	2.5%	Rs.0.50	2.5%	
9963	Masala Tea	1	10	10.00		Rs.0.25	2.5%	
9963	Masala Dosa	2	60		2.5%		2.5%	Rs. 3.00
			Total	150.00				R. 3.75

Grand Total	= Rs. 157.50

Explanation:

a) Coffee:

2.5% of 20 = $\frac{2.5}{100} \times 20$

$= 0.50$

So, SGST = Rs. 0.50

b) Masala Tea

CGST:

$x\%\ of\ 10 = 0.25$

$\frac{x}{100} \times 10 = 0.25$

$x = 2.5$

So, CGST = 2.5%

SGST:

$2.5\%\ of\ 10 = y$

$\frac{2.5}{100} \times 10 = y$

$y = 0.25$

So, SGST = Rs. 0.25

c) Masala Dosa

Taxable amount = Rate x Qty

= 60 x 2 = Rs. 120

CGST:

2.5% of 120 = $\frac{2.5}{100} \times 120$

= Rs. 3

So, CGST = Rs. 3

Therefore, Total CGST is Rs. 3.75

Tax invoice of services provided (Sample)

Food Junction, Khed – Shivapur, Pune
Invoice no. 58
Mob no. 7588580000, email- ahar.khed@yahoo.com

GSTIN: 27AAAAA5555B1ZA Invoice Date 25 Feb., 2020

SAC	Food Items	Qty	Rate (in Rs.)	Taxable amount	CGST		SGST	
9963	Coffee	1	20	20.00	2.5%	Rs.0.50	2.5%	Rs.0.50
9963	Masala Tea	1	10	10.00	2.5%	Rs.0.25	2.5%	Rs.0.25
9963	Masala Dosa	2	60	120.00	2.5%	Rs.3.00	2.5%	Rs. 3.00
			Total	150.00		Rs.3.75		R. 3.75

B. Solve the following sub-questions (any two) : **[6]**

(i) Solve the following simultaneous equations using Cramer's rule:

$$4m + 6n = 54;\ 3m + 2n = 28$$

Answer: $(6, 5)$

Explanation:

$4m + 6n = 54; 3m + 2n = 28$

$D = \begin{vmatrix} 4 & 6 \\ 3 & 2 \end{vmatrix} = 4 \times 2 - 6 \times 3 = 8 - 18 = -10$

$D_m = \begin{vmatrix} 54 & 6 \\ 28 & 2 \end{vmatrix} = 54 \times 2 - 6 \times 28 = 108 - 168 = -60$

$D_n = \begin{vmatrix} 4 & 54 \\ 3 & 28 \end{vmatrix} = 4 \times 28 - 54 \times 3 = 112 - 162 = -50$

$m = \frac{D_m}{D} = \frac{-60}{-10} = 6$

$n = \frac{D_n}{D} = \frac{-50}{-10} = 5$

$(m, n) = (6,5)$

(ii) Solve the following quadratic equation by formula method:

$$x^2 + 10x + 2 = 0$$

Answer: $-5 + \sqrt{23}$ and $-5 - \sqrt{23}$

Explanation:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Where, a = 1, b = 10, and c = 2

$x = \frac{-10 \pm \sqrt{10^2 - 4(1)(2)}}{2(1)}$

$x = \frac{-10 \pm \sqrt{100 - 8}}{2}$

$x = \frac{-10 \pm \sqrt{92}}{2}$

$x = \frac{-10 \pm 2\sqrt{23}}{2}$

$x = \frac{2(-5 \pm \sqrt{23})}{2}$

$x = -5 \pm \sqrt{23}$

Therefore, the roots of the given quadratic equation are
$-5+\sqrt{23}$ and $-5-\sqrt{23}$

(iii) A two-digit number is formed with digits $2, 3, 5, 7, 9$ without repetition. What is the probability of the following events?
Event A: The number formed in an odd number.
Event B: The number formed is a multiple of 5.

Answer: $\frac{4}{5}$ and $\frac{1}{5}$

Explanation:

Digits are
$\{22, 23, 25, 27, 29, 32, 33, 35, 37, 39, 52, 53, 55, 57, 59, 72, 73, 75, 77, 79, 92, 93, 95, 97, 99\}$
∴ Total digits are 25
Odd numbers are 20
∴ probability that an odd number is formed is

$\frac{20}{25}=\frac{4}{5}$
a multiple of 5
Numbers which are multiple of 5 are

$\{25, 35, 55, 75, 95\}$
∴ probability of multiple of 5 is

$\frac{5}{25}=\frac{1}{5}$

(iv) The frequency distribution table shows the number of the mango tree, in a grove and their yield of mangoes. Find the median data:

No. of Mangoes	No. of Trees

$50 - 100$	33
$100 - 150$	30
$150 - 200$	90
$200 - 250$	80
$250 - 300$	17

Answer: 184 mangoes

Explanation:

$Class\ \ (Number\ o$	$Frequency\ \ (N$	$Cumulative\ frequency$
$50 - 100$	33	33
$100 - 150$	30	63
$150 - 200$	90	153
(Median Class)	80	233
$200 - 250$	17	250
$250 - 300$	$N = 250$	

From the above table, we get

L (Lower class limit of the median class) $= 150$

N (Sum of frequencies) $= 250$

h (Class interval of the median class) $= 50$

f (Frequency of the median class) $= 90$

cf (Cumulative frequency of the class preceding the median class) $= 63$

Now, Median $= L + \left(\frac{\frac{N}{2} - cf}{f}\right) \times h$

$= 150 + \left(\frac{\frac{250}{2} - 63}{90}\right) \times 50 = 150 + 34.44$

$= 184.44$ mangoes
$= 184$ mangoes
Hence, the median of data is 184 mangoes.

Question 4. Solve the following sub-questions (any two): [8]

(i) If the first term of an A.P. is p, second term is q and last term is r, then show that sum of all terms is $(q + r - 2p) \times \frac{(p+r)}{2(q-p)}$.

Explanation: $Given\ First\ term,\ a = p\ Common\ difference\ d = q - p$

$According\ to\ the\ question,\ r = p + (n-1)(q-p)$

$\frac{r-p}{q-p} = n - 1$

$\frac{r-p}{q-p} + 1 = n$

$\frac{r-p+q-p}{q-p} = n$

$\frac{r+q-2p}{q-p} = n$

We know -

$S_n = \frac{n}{2}[2a + (n-1)d]$
$S_n = \frac{r+q-2p}{2(q-p)}\left[2p + \left(\frac{r-p}{q-p}\right)\cdot(q-p)\right]$
$S_n = \frac{r+q-2p}{2(q-p)}[2p + r - p]$
$S_n = \frac{r+q-2p}{2(q-p)}[r + p]$
$S_n = [q + r - 2p) \times \frac{(p+r)}{2(q-p)}$
Hence proved.

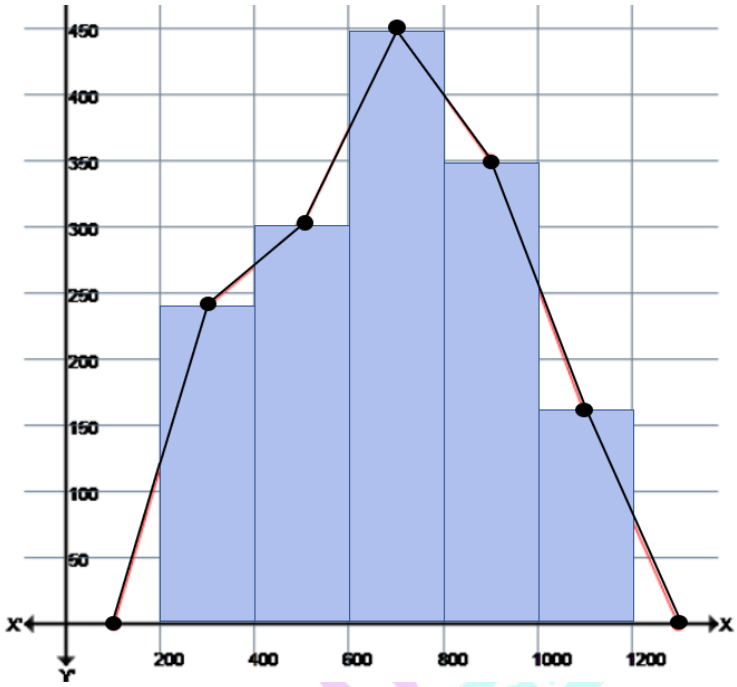
(ii) Show the following data by a frequency polygon:

Electricity bill (₹)	Families
200 – 400	240
400 – 600	300
600 – 800	450
800 – 1000	350
1000 – 1200	160

Explanation:

To draw frequency Polygon, we first prepare the following table

Class	Mid	Frequency
0 – 200	100	0
200 – 400	300	240
400 – 600	500	300
600 – 800	700	450
800 – 1000	900	350
1000 – 1200	1100	160
1200 – 1400	1300	0



(iii) The sum of the squares of five consecutive natural numbers is 1455. Find the numbers.

Explanation:

Let the five consecutive integers be $n, n+1, n+2, n+3, n+4$ then,

$n^2 + (n+1)^2 + (n+2)^2 + (n+3)^2 + (n+4)^2 = 1455$

$5n^2 + 20n + 30 - 1455 = 0$

$5n^2 + 20n - 1425 = 0$

$n^2 + 4n - 285 = 0$

$n = \frac{-4 \pm \sqrt{16+1140}}{2} = \frac{-4 \pm 34}{2} = 15, -17$

Hence, the numbers are $15, 16, 17, 18, 19$

Question 5

Solve the following sub-questions (anyone): **[3]**

(i) Draw the graph of the equation $x + 2y = 4$. Find the area of the triangle formed by the line intersecting to X-axis and Y-axis.

Answer: 4 square units

Explanation:
To graph the equation x + 2y = 4, we can solve for y to get it in slope-intercept form:

x + 2y = 4

2y = -x + 4

y = (-1/2)x + 2

Now we can plot this line on a coordinate plane by finding the y-intercept of 2 and then using the slope of -1/2 to find additional points. We can also find the x-intercept by setting y = 0 and solving for x:

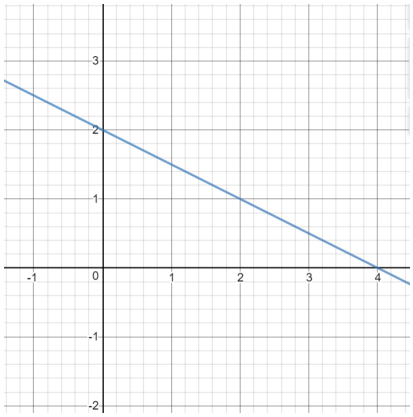
0 = (-1/2)x + 2

x = 4

So, the x-intercept is (4, 0). We can plot this point and draw a line through it with the slope we found:

To find the area of the triangle formed by this line and the x and y axes, we need to find the x- and y-intercepts of the line. We already found the x-intercept to be (4, 0), and to find the y-intercept we can set x = 0 and solve for y:

So, the y-intercept is (0, 2). We can now draw the triangle formed by the x- and y-intercepts and the point (0, 0):



The base of the triangle is the x-intercept, which has a length of 4. The height of the triangle is the y-coordinate of the y-intercept, which is 2. Therefore, the area of the triangle is:

A = (1/2)bh

A = (1/2)(4)(2)

A = 4

So, the area of the triangle formed by the line x + 2y = 4 and the x and y axes is 4 square units.

(ii) A survey was conducted for 180 people in a city. 70 ate Pizza, 60 ate burgers and 50 ate chips. Draw a pie diagram for the given information.

Explanation:
Total number of people $= 180$

Converting the number of people prefer various food items into components part of 360°

Central angle of a component $= \frac{Value\ of\ the\ component}{Total\ value} \times 360^{\circ}$

Item	No. of people	Central angle
Pizza	70	$\frac{70}{180} \times 360^\circ = 140^\circ$
Burgers	60	$\frac{60}{180} \times 360^\circ = 120^\circ$
Chips	50	$\frac{50}{180} \times 360^\circ = 100^\circ$
Total	180	360°

Food items preferred by people: