Q.1. (A) Choose the *correct* answer and write the alphabet of it in front of the sub-question number. [4]

(1) To draw the graph of $4x + 5y = 19$, find y when $x = 1$:

    (a) 4   (b) 3   (c) 2   (d) –3   [1]

(2) 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) $2x - x^2 = x^2 + 5$ [1]

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

    (a) 0   (b) 3.5   (c) 103.5   (d) 104.5   [1]

(4) If $n(A) = 2$, $P(A) = \dfrac{1}{5}$, then $n(S) = ?$

    (a) 10   (b) $\dfrac{5}{2}$ (c) $\dfrac{2}{5}$ (d) $\dfrac{1}{3}$ [1]

Ans. (1) – (b), (2) – (a), (3) – (b), (4) – (a)

Q.1. (B) Solve the following sub-questions. [4]

(1) Find the value of the following determinant:

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

Solution:

$$\begin{vmatrix} 4 & 3 \\ 2 & 7 \end{vmatrix} = 4 \times 7 - 3 \times 2 \qquad [1/2]$$

$$= 28 - 6$$

$$= 22 \qquad [1/2]\,[1]$$

Ans. 22

(2) Find the common difference of the following A.P.:

$$2, 4, 6, 8, ...$$

Solution:

Given A.P.: 2, 4, 6, 8, ...   [1/2]

∴ $t_1 = 2$, $t_2 = 4$, $t_3 = 6$, $t_4 = 8$

$d = t_2 - t_1 = 4 - 2 = 2$

$d = t_3 - t_2 = 6 - 4 = 2$

$d = t_4 - t_3 = 8 - 6 = 2$ [1/2] [1]

Ans. The commen difference is 2.

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

Solution:

CGST = SGST

Ans. ∴   If CGST = 9%, then SGST = 9%   [1]

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

Solution:

One coin is tossed.

Ans. ∴   S = {H, T}   [1]

Q.2. (A) Complete any *two* given activities and rewrite them. [4]

(1)   Complete the following activity; find the value of *x*:

Solution:

$5x + 3y = 9$ .... (I)

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

Add equations (I) and (II)

$$5x + 3y = \quad 9$$
$$+ \quad 2x - 3y = \quad 12$$
$$\overline{\qquad\qquad\qquad}$$
$$7x \qquad = \boxed{21}$$ [1/2]

∴ x = $\dfrac{\boxed{21}}{\boxed{7}}$ [1/2]
                                                              [1/2]

∴ x = $\boxed{3}$ [1/2] [2]

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

Solution:

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

$a = 1, b = 2, c = \boxed{-9}$ [1/2]

∴ $b^2 - 4ac = (2)^2 - 4 \times \boxed{1} \times \boxed{-9}$ [1]

$\Delta = 4 + \boxed{36} = 40$ [1/2] [2]

∴ $b^2 - 4ac > 0$

∴   The roots of the equation are real and unequal.

(3)   Complete the following table using given information:

Sr. No.	FV	Share is at	MV	
1.	₹100	Par	$\boxed{₹100}$	[1/2]
2.	$\boxed{₹75}$	Premium ₹500	₹575	[1/2]
3.	₹10	$\boxed{\text{Discount } ₹5}$	₹5	[1/2]
4.	₹200	Discount ₹50	$\boxed{₹150}$	[1/2] [2]

Q.2. (B) Solve the following sub-questions. (Any *four*)   **[8]**

(1)   Solve the following simultaneous equations:

$$x + y = 4, \ 2x - y = 2$$

Solution:

Add equations (I) and (II):   [1/2]

$x \ + \ y \ = \ 4$ ...(I)

$2x \ - \ y \ = \ 2$ ...(II)

$\overline{3x \ \ \ \ \ \ = \ 6}$

∴ $x \ = \ \dfrac{6}{3}$

∴ $x \ = \ 2$ [1/2]

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

$2 \ + \ y \ = \ 4$ [1/2]

∴ $y \ = \ 4 \ - \ 2$

∴ $y \ = \ 2$ [1/2] [2]

Ans. (2, 2) is the solution of the given equations.

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

$$2y = 10 - y^2$$

Solution:

$$2y = 10 - y^2$$

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

Comparing with $ax^2 + bx + c = 0$,   [1/2]

Ans. $a = 1, \quad b = 2, \quad c = -10$ [1½] [2]

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

Solution:

$a = 10$ and $d = 5$ (given)

Now, $t_1 = a = 10$ [1/2]

$t_2 = t_1 + d = 10 + 5\ = 15$ [1/2]

$t_3 = t_2 + d = 15 + 5\ = 20$

$t_4 = t_3 + d = 20 + 5\ = 25$ [1/2]

Ans. The required A.P. is 10, 15, 20, 25, ...   [1/2] [2]

(4) 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.

Solution:

Taxable value = ₹500, CGST = SGST = ₹45

$\text{GST} = \text{CGST} + \text{SGST}$ [1/2]

$= 45 + 45$

$= ₹90$ [1/2]

$\text{Rate of GST} = \dfrac{90}{500} \times 100$ [1/2]

$= 18\%$

Ans. The rate of GST charged for this service is 18%.   [1/2] [2]

(5)   Observe the following table and find mean:

Assumed mean A = 300

Class	Class mark x_i	$d_i = x_i - A$ $d_i = x_i - 300$	Frequency f_i	Frequency × Deviation $f_i d_i$
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			$\sum f_i = 50$	$\sum f_i d_i = 320$

Solution:

$A = 300, \sum f_i = 50, \sum f_i d_i = 320$

$$\bar{d} = \frac{\sum f_i d_i}{\sum f_i} = \frac{320}{50}$$ [1/2]

$$= 6.4$$ [1/2]

$$\text{Mean} = A + \bar{d}$$ [1/2]

$$= 300 + 6.4$$

Ans. $= 306.4$ [1/2] [2]

Q.3. (A) Complete any *one* activity and rewrite it.   [3]

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

Solution:

Complete the following activity to write the sample space:

(a)   Committee of 2 boys = {$\boxed{B_1, B_2}$}   [1/2]

(b)   Committee of 2 girls = {$\boxed{G_1, G_2}$}   [1/2]

(c)   Committee of one boy and one girl
      = {$\boxed{B_1, G_1}$, $\boxed{B_1, G_2}$, $\boxed{B_2, G_1}$, $\boxed{B_2, G_2}$}   [1]

(d)   ∴ Sample space (S) =
      {(B_1, B_2), (B_1, G_1), $\boxed{B_1, G_2}$, $\boxed{B_2, G_1}$, (B_2, G_2), (G_1, G_2)}
                                                                [1] [3]

(2) 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 ₹)	Taxable amount	CGST		SGST	
9963	Coffee	1	20	₹ 20.00	2.5%	₹ 0.50	2.5%	₹ 0.50
9963	Masala Tea	1	10	₹ 10.00	2.5%	₹ 0.25	2.5%	₹ 0.25
9963	Masala Dosa	2	60	₹ 120	2.5%	₹ 3	2.5%	₹ 3.00
			Total	₹ 150.00		₹ 3.75		₹ 3.75
						Grand Total	= ₹ 157.50	

Note: 1/2 mark for each box. [3]

Q.3. (B) Solve the following sub-questions. (Any *two*) [6]

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

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

Solution:

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

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

$$= 8 - 18$$
$$= -10 \qquad\qquad [1/2]$$

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

$$= 108 - 168$$
$$= -60 \qquad\qquad [1/2]$$

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

$$= 112 - 162$$

$$= -50 \qquad [1/2]$$

By Cramer's rule,

$$m = \frac{D_m}{D} = \frac{-60}{-10} = 6 \qquad [1/2]$$

$$n = \frac{D_n}{D} = \frac{-50}{-10} = 5 \qquad [1/2]$$

Ans. $\therefore$ (6, 5) is the solution of the given equations. [1/2] [3]

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

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

Solution:

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

Comparing with $ax^2 + bx + c = 0$,

$a = 1, b = 10, c = 2$ [1/2]

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad [1/2]$$

$$\therefore x = \frac{-10 \pm \sqrt{(10)^2 - 4 \times 1 \times 2}}{2 \times 1} \qquad [1/2]$$

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

$$= \frac{-10 \pm \sqrt{92}}{2} \qquad [1/2]$$

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

$$= \frac{2(-5 \pm \sqrt{23})}{2} \qquad [1/2]$$

Ans. $\therefore$ $x = -5 + \sqrt{23}$ or $x = -5 - \sqrt{23}$ [1/2] [3]

(3) 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 is an odd number.

Event B: The number formed is a multiple of 5.

Solution:

S = {23, 25, 27, 29, 32, 35, 37, 39, 52, 53, 57, 59, 72, 73, 75, 79, 92, 93, 95, 97}   [1/2]

∴ $n(S) = 20$ [1/2]

Event A: The number formed is an odd number.

∴ A = {23, 25, 27, 29, 35, 37, 39, 53, 57, 59, 73, 75, 79, 93, 95, 97}

∴ $n(A) = 16$ [1/2]

$P(A) = \dfrac{n(A)}{n(S)} = \dfrac{16}{20} = \dfrac{4}{5}$ [1/2]

Event B: The number formed is a multiple of 5.

∴ B = {25, 35, 75, 95}

∴ $n(B) = 4$ [1/2]

$P(B) = \dfrac{n(B)}{n(S)} = \dfrac{4}{20} = \dfrac{1}{5}$ [1/2] [3]

Ans. $P(A) = \dfrac{4}{5}$ and $P(B) = \dfrac{1}{5}$

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

No. of Mangoes	No. of Trees
50–100	33
100–150	30
150–200	90
200–250	80
250–300	17

Solution:

No. of Mangoes	No. of Trees	*c.f.* less than type
50–100	33	33
100–150	30	$63 \rightarrow c.f.$
150–200	$90 \rightarrow f$	153
200–250	80	233
250–300	17	250

[1]

$\dfrac{N}{2} = \dfrac{250}{2} = 125$

$L = 150$, $f = 90$, $c.f. = 63$, $h = 50$ [1/2]

$$\text{Median} = L + \left[\dfrac{\dfrac{N}{2} - c.f.}{f} \right] \times h \qquad\qquad [1/2]$$

$$= 150 + \left[\dfrac{125 - 63}{90} \right] \times 50 \qquad\qquad [1/2]$$

$$= 150 + \dfrac{62}{90} \times 50$$

$$= 150 + \dfrac{310}{9}$$

$$= 150 + 34.44$$

Ans. $= 184.44$ mangoes   [1/2] [3]

Q.4. Solve the following sub-questions. (Any *two*)   [8]

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

Solution:

$t_1 = p$, $t_2 = q$, $t_n = r$ (Given)   [1/2]

$d = t_2 - t_1 = (q - p)$

$$t_n = a + (n-1)d \qquad [1/2]$$

$$\therefore \quad r = p + (n-1)(q-p) \qquad [1/2]$$

$$\therefore \quad (n-1) = \frac{(r-p)}{(q-p)}$$

$$\therefore \quad n = \frac{(r-p)}{(q-p)} + 1$$

$$\therefore \quad n = \frac{(r-p) + (q-p)}{(q-p)}$$

$$\therefore \quad n = \frac{r-p+q-p}{(q-p)}$$

$$\therefore \quad n = \frac{q+r-2p}{(q-p)} \qquad [1/2]$$

$$S_n = \frac{n}{2}[t_1 + t_n] \qquad [1/2]$$

$$= \frac{\frac{(q+r-2p)}{(q-p)}}{2} \times (p+r) \qquad [1]$$

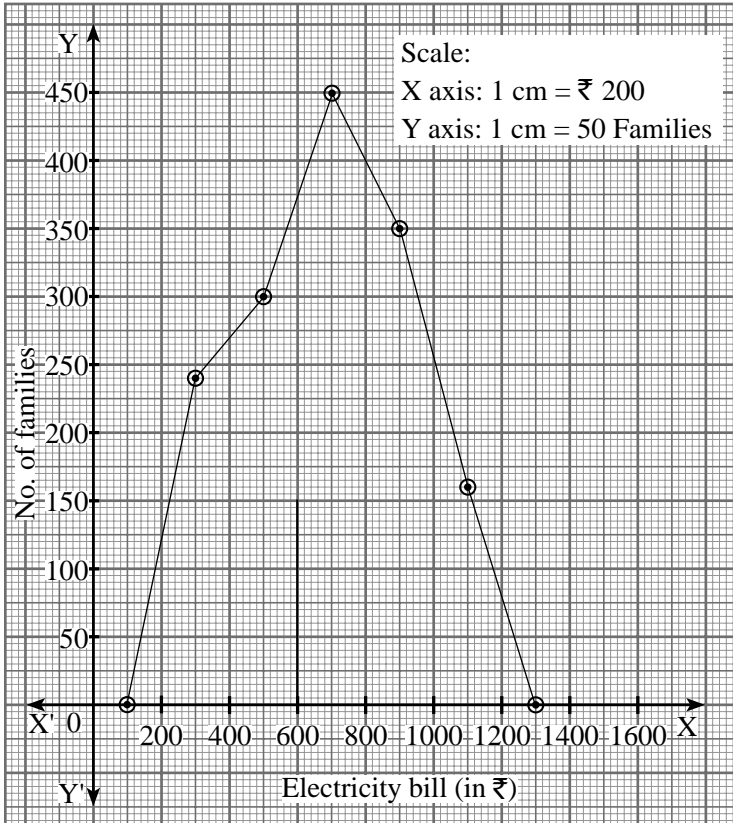$$= \frac{(q+r-2p)}{(q-p)} \times \frac{1}{2} \times (p+r)$$

$$= (q+r-2p) \times \frac{(p+r)}{2(q-p)} \qquad [1/2] \; [4]$$

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

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

Solution:

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

Scale:
X axis: 1 cm = ₹ 200
Y axis: 1 cm = 50 Families

No. of families

Electricity bill (in ₹)

- For each column 1/2 Mark   [1½ + 1/2]
- For correct scale and axes   [1/2]
- For frequency polygon   [1½] [4]

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

Solution:

Let the numbers be $a - 1, a, a + 1, a + 2, a + 3$ [1/2]

$\therefore$ $(a - 1)^2 + a^2 + (a + 1)^2 + (a + 2)^2 + (a + 3)^2 = 1455$

(as per given condition)   [1/2]

$\therefore$ $a^2 - 2a + 1 + a^2 + a^2 + 2a + 1 + a^2 + 4a + 4 + a^2 + 6a + 9 = 1455$

[1/2]

$\therefore$ $5a^2 + 10a + 15 = 1455$

$\therefore$ $5a^2 + 10a + 15 - 1455 = 0$

$\therefore$ $5a^2 + 10a - 1440 = 0$

$\therefore$ $a^2 + 2a - 288 = 0$ [1/2]

$\therefore$ $a^2 - 16a + 18a - 288 = 0$

$\therefore$ $a(a - 16) + 18 (a - 16) = 0$

$\therefore$ $(a - 16) (a + 18) = 0$ [1/2]

$\therefore$ $a - 16 = 0$ or $a + 18 = 0$ [1/2]

$\therefore$ $a = 16$ or $a = -18$

But a natural number cannot be negative.   [1/2]

$\therefore$ $a = 16$

$\therefore$ $a - 1 = 15$

and $a + 1 = 17$

$a + 2 = 18$

$a + 3 = 19$

Ans. The required numbers are 15, 16, 17, 18, 19.   [1/2] [4]

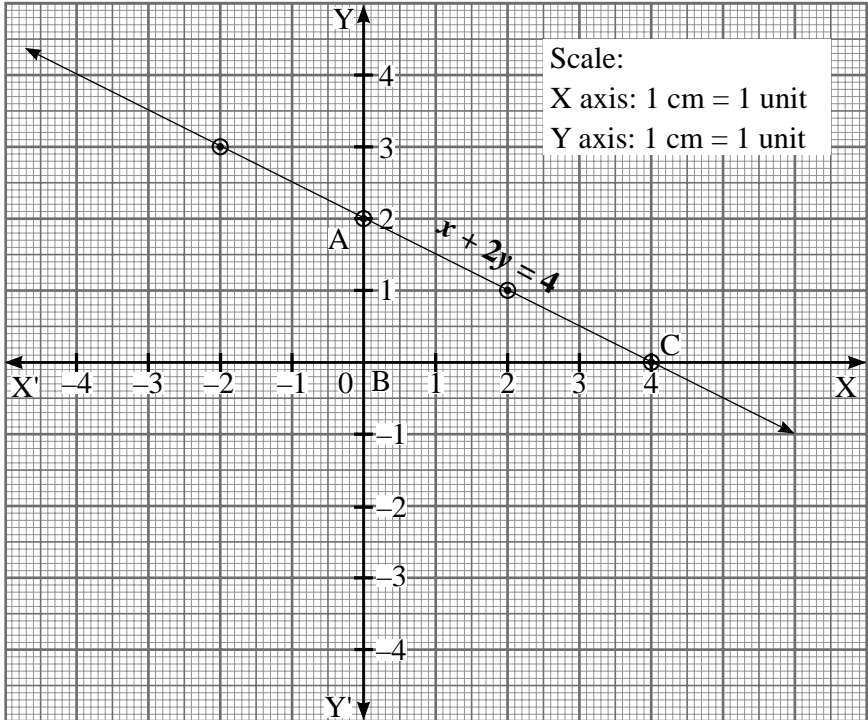**Q.5. Solve the following sub-questions. (Any *one*)**   **[3]**

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

Solution:

$x + 2y = 4$

$\therefore$ $x = 4 - 2y$

x	2	0	–2
y	1	2	3
x, y	(2, 1)	(0, 2)	(–2, 3)

Let ∆ABC be formed by the line intersecting the X-axis and Y-axis.

Base BC = 4 units and height AB = 2 units

$$A(\triangle ABC) = \frac{1}{2} \times BC \times AB$$

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

$$= 4 \text{ sq. units}$$

Ans. Area of the triangle is 4 sq. units.

- To prepare a table   [1/2]
- Draw correct line of the given equation   [1]
- For finding the area of the triangle by any method   [1]
- Area of triangle = 4 sq. units   [1/2] [3]

(2) 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.

Solution:

θ for the people who ate pizza $= \dfrac{\text{No. of people who ate pizza}}{\text{Total no. of people}} \times 360°$

$$= \dfrac{70}{180} \times 360°$$

$$= 70 \times 2°$$

$$= 140° \qquad\qquad [1/2]$$

θ for the people who ate burgers $= \dfrac{\text{No. of people who ate burgers}}{\text{Total no. of people}} \times 360°$

$$= \dfrac{60}{180} \times 360°$$

$$= 60 \times 2°$$

$$= 120° \qquad\qquad [1/2]$$

θ for the people who ate chips $= \dfrac{\text{No. of people who ate chips}}{\text{Total no. of people}} \times 360°$

$$= \dfrac{50}{180} \times 360°$$

$$= 50 \times 2°$$

$$= 100° \qquad\qquad [1/2]$$

Pie diagram [1½] [3]

★★★