



BJNP

Learning with the Speed of Mumbai and the Tradition of Kota



Max Marks: 40

Time: 2 HRS

Date: 00.00.2022

Seat No.

(SSC)ALGEBRA : SAMPLE PAPER 1(Sol)

Q.1 A. Choose the correct alternative for each of the following sub question (4)

i. Which of the following is linear Equation In two variable?

- a) $\frac{x}{3} + \frac{5}{y} = 6$ b) $2x^2 - 3y = 8 - 3y$
c) $x + 2y = 5 - 3y$ d) $3x^2 + y$

ii. Which of the following Quadratic Equation has roots -3 and -5?

- a) $x^2 - 8x + 15 = 0$ b) $x^2 - 8x - 15 = 0$
c) $x^2 + 8x + 15 = 0$ d) $x^2 + 8x - 15 = 0$

iii. Find d of an A.P. whose and second terms are -3 and -4 respectively.

- a) 7 b) -1
c) -7 d) -3

iv. In how many ways a Card can be drawn from a well shuffled pack of playing cards.

- a) 4 b) 1
c) 26 d) 52

B. Solve the following Subquestion (4)

i. What is the class width of the class 10-15.

Ans. The class width of the class 10-15 is 5.

ii. If the rate of GST on laptop is 28%. What is the rate of SGST on it?

Ans. Rate of GST on laptop is 28%

$$\begin{aligned} \text{Rate of SGST} &= \frac{1}{2} \times \text{Rate of GST} \\ &= 14\% \end{aligned}$$

iii. For the Equation $a + 2b = 7$, find a when $b = 4$.

Ans. Given Equation is $a + 2b = 7$

Substituting $b = 4$ in given equation

We get

$$a + 2(4) = 7$$

$$a + 8 = 7$$

$$a = 7 - 8$$

$$a = -1$$

$\therefore a = -1$ when $b = 4$

iv. Write the given quadratic equation in standard form.

$$m(m-6) = 9$$

Ans. $m(m - 6) = 9$

$$\therefore m^2 - 6m = 9$$

$$\therefore m^2 - 6m - 9 = 0$$

$\therefore m^2 + (-6)m + (-9) = 0$ is the quadratic equation in the standard form.

Q.2 A. Complete any two of the following activities.

(4)

- i. For an A.P, If $t_1 = 1$ and $t_n = 149$ then Complete the following activity to find S_n .

Activity:

Here $t_1 = 1, t_n = 149$

$S_n?$

$$S_n = \frac{n}{2} [t_1 + t_n] \dots\dots\dots \text{formula}$$

$$= \frac{n}{2} \times 150$$

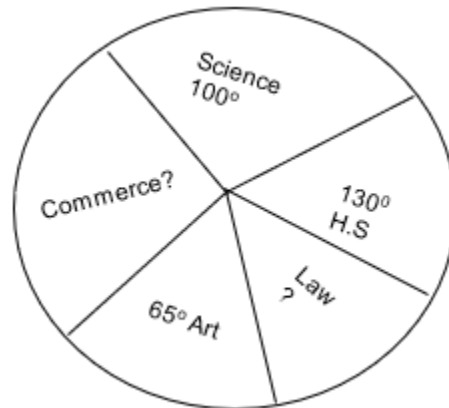
$$= 75n$$

- ii. Complete the following table using given information.

Sr. No	FV	Share is at	MV
i	Rs 10	Premium of Rs7	Rs 17
ii	Rs 25	Discount of Rs 9	Rs 16
iii	Rs 5	At par	Rs5

- iii. For a particular college admission, 3600 student's were given admission altogether. This Information is given in the table and the pie diagram. Complete the following activity based on it.

Faculty	No. of students	Measure of central angle
Science	1000	100°
Commerce	1200	120°
Arts	650	65°
Law	450	45°
Home science	300	30°
Total	3600	360°



B. Solve any four of the following Sub question

(8)

- i. Solve : $2x + y = 21; 2x - 3y = -3$

Ans. $2x + y = 21 \dots\dots\dots(1)$

$2x - 3y = -3 \dots\dots\dots(2)$

Subtracting Equation 2 from 1

$$2x + y = 21$$

$$2x - 3y = -3$$

$$\underline{(-) \quad (+) \quad (+)}$$

$$4y = 24$$

$$y = \frac{24}{4}$$

$$y = 6$$

Substituting $y = 6$ in equation i

$$2x + y = 21$$

$$2x + 6 = 21$$

$$2x = 21 - 6$$

$$2x = 15$$

$$x = \frac{15}{2}$$

$\therefore (x, y) = (\frac{15}{2}, 6)$ s the solution.

ii. Determine the nature of roots of the quadratic equation: $x^2 - 4x + 4 = 0$.

Ans. Give quadratic equation is $x^2 - 4x + 4 = 0$
Comparing the given equation with $ax^2 + bx + c = 0$
We get,

$$a = 1, b = -4, c = 4$$

$$\begin{aligned} \text{Consider } b^2 - 4ac &= (-4)^2 - 4(1)(4) \\ &= 16 - 16 \\ &= 0 \end{aligned}$$

$\therefore b^2 - 4ac = 0$, equation have real and equal roots

iii. Find the 18th term of the A.P. 7,13,19,25,...

Ans. The given A.P. is 7,13,19,25, ...
Here First term (a) = 7
Common difference (d) = 13 - 7
= 6

We have

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

$$\begin{aligned} t_{18} &= 7 + (18-1)6 \dots \text{On substituting the values} \\ &= 7 + (17)6 \\ &= 7 + 102 \\ &= 109 \end{aligned}$$

\therefore 18th term of the given A.P is 109.

iv. Market value of a share is Rs 200. If the brokerage rate is 0.3% then find the purchase value of the share.

Ans. Market value (MV) = Rs 200
Rate of Brokerage = 0.3%

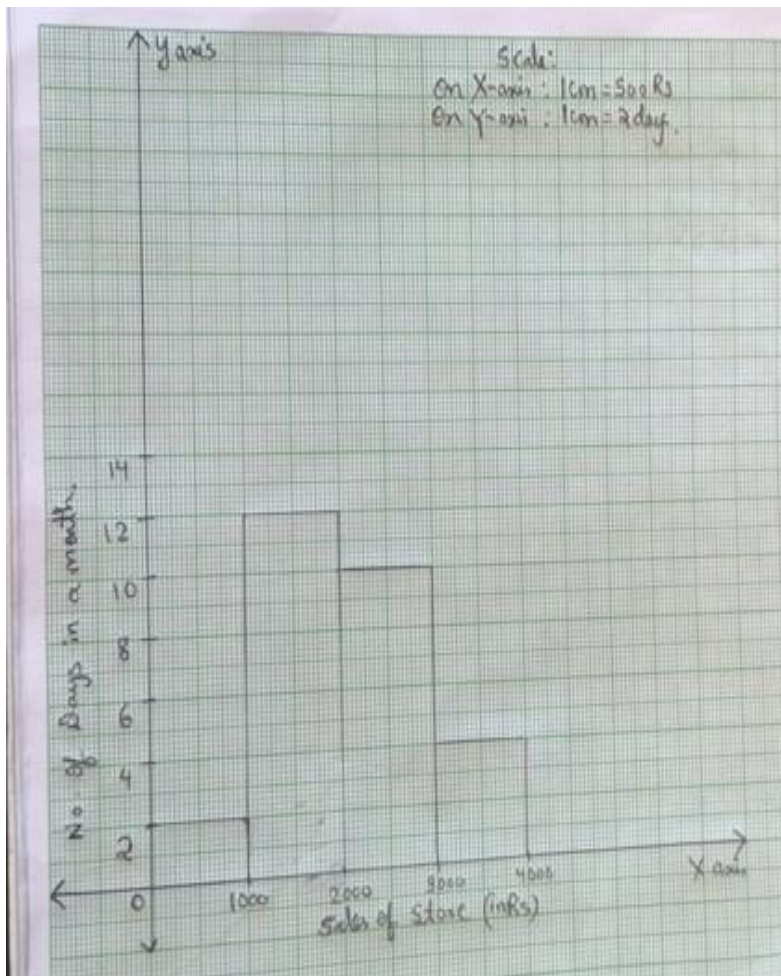
$$\begin{aligned} \text{Amount of Brokerage} &= \text{Rate of brokerage} \times \text{MV} \\ &= 0.3\% \text{ of } 200 \\ &= \frac{0.3}{100} \times 200 \\ &= 0.3 \times 2 \\ &= 0.6 \text{ Rs.} \end{aligned}$$

$$\begin{aligned} \therefore \text{purchase value of share} &= \text{MV} + \text{Brokerage amount} \\ &= 200 + 0.6 \\ &= 200.60 \text{ Rs.} \end{aligned}$$

v. Draw the histogram to represent the following data.

Daily Sales of Store (in Rs)	0-1000	1000-2000	2000-3000	3000-4000
Number of Days in a month	2	12	10	4

Ans.



Q.3 A. Complete any one of the following activity. (3)

- i. Complete the following activity to solve the given word problem.
Sum of square of two Consecutive even natural number is 244. Then find those numbers activity:

Activity : let the first even natural number be x ,

Therefore its consecutive even natural number will be $x + 2$

By the given Condition

$$x^2 + (x+2)^2 = 244$$

$$x^2 + x^2 + 4x + 4 = 244 = 0$$

$$2x^2 + 4x - 240 = 0$$

$$x^2 + 2x - 120 = 0$$

$$x^2 + 12x - 10x - 120 = 0$$

$$x(x+12) - 10(x+12) = 0$$

$$(x+12)(x-10) = 0$$

$$x = -12 \text{ or } x = 10$$

But natural number cannot be negative

$x = -12$ is not possible

Therefore first even natural number is $x = 10$

$$\begin{aligned} \text{Second Even Consecutive natural number} &= x + 2 \\ &= 10 + 2 \\ &= 12 \end{aligned}$$

- ii. A box contains 5 strawberry chocolates, 6 Coffee Chocolates and 2 peppermint chocolates. If one of the chocolates is picked from the box at randomly. Find the probability of the following event by

Completing the activity.

- i) Event A: It is a coffee chocolate
 - ii) Event B: It is a peppermint chocolate.
- Activity : let 's' is the sample space.

$$\therefore n(s) = 5+6+2=13$$

- i) Event A : It is a coffee chocolate

$$\therefore n(A) = \boxed{6}$$

$$\therefore P(A) = \frac{n(A)}{n(s)} \dots\dots\dots\text{formula}$$

$$P(A) = \frac{6}{13}$$

- ii) Event B: It is a Peppermint Chocolate.

$$\therefore n(B) = \boxed{2}$$

$$\therefore P(B) = \frac{n(B)}{n(s)} \dots\dots\dots\text{formula}$$

$$P(B) = \frac{2}{13}$$

B. Solve any two of the following sub question

(6)

- i. Solve the following simultaneous Equation using Cramer's rule: $4x + 3y - 4 = 0$; $6x = 8 - 5y$

Ans. $4x + 3y - 4 = 0$

$$4x + 3y = 4 \quad \dots i$$

Also,

$$6x = 8 - 5y$$

$$6x + 5y = 8 \quad \dots ii$$

On comparing equation I and ii with $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$ respectively.

We get , $a_1=4, b_1=3, c_1=4$

$a_2=6, b_2=5, c_2=8$

$$\begin{aligned} \text{Now, } D &= \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix} \\ &= \begin{vmatrix} 4 & 3 \\ 6 & 5 \end{vmatrix} \\ &= (4 \times 5) - (3 \times 6) \\ &= 20 - 18 \\ &= 2 \end{aligned}$$

$$\begin{aligned} Dx &= \begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix} \\ &= \begin{vmatrix} 4 & 3 \\ 8 & 5 \end{vmatrix} \\ &= (4 \times 5) - (8 \times 3) \\ &= 20 - 24 \\ &= -4 \end{aligned}$$

$$\begin{aligned} Dy &= \begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix} \\ &= \begin{vmatrix} 4 & 4 \\ 6 & 8 \end{vmatrix} \\ &= (4 \times 8) - (6 \times 4) \\ &= 32 - 24 \\ &= 8 \end{aligned}$$

By Cramer's rule

$$x = \frac{Dx}{D} = \frac{-4}{2} = -2, y = \frac{Dy}{D} = \frac{8}{2} = 4$$

∴ (x,y) = (-2,4) is the solutions of the given equation.

ii. Solve the following Quadratic Equation by Completing Square method. $2y^2 + 5y + 1 = 0$

Ans. Given quadratic equation is $2y^2 + 5y + 1 = 0$

$$2y^2 + 5y + 1 = 0$$

Dividing the above equation by 2

$$\frac{2y^2}{2} + \frac{5y}{2} + \frac{1}{2} = 0$$

$$\therefore y^2 + \frac{5}{2}y + \frac{1}{2} = 0$$

$$\therefore y^2 + \frac{5}{2}y + \frac{25}{16} - \frac{25}{16} - \frac{1}{2} = 0$$

$$\therefore \left(y + \frac{5}{4}\right)^2 - \frac{25}{16} - \frac{1 \times 8}{2 \times 8} = 0$$

$$\therefore \left(y + \frac{5}{4}\right)^2 - \frac{33}{16} = 0$$

$$\therefore \left(y + \frac{5}{4}\right)^2 = \frac{33}{16}$$

$$\therefore y + \frac{5}{4} = \frac{\sqrt{33}}{4} \text{ or } y + \frac{5}{4} = -\frac{\sqrt{33}}{4}$$

$$\therefore y = \frac{\sqrt{33}}{4} - \frac{5}{4} \text{ or } y = -\frac{\sqrt{33}}{4} - \frac{5}{4}$$

$$y = \frac{\sqrt{33}-5}{4} \text{ or } y = \frac{-(\sqrt{33}+5)}{4}$$

iii. Mr. Rohit is retailer .He paid GST of Rs 6500 at the time of purchase. He collected GST of Rs 8000 at the time of sale.(i) find his input tax and output tax. (ii) What is his input tax credit? (iii) Find his payable GST (iv) Hence find payable CGST and payable SGST.

Ans. Mr Rohit's payable GST means GST to be paid to the government by Mr . Rohit.

i. Output tax (tax collected at the time of sale) = ₹ 8000.

ii. Input tax (tax paid at the time of purchase) = ₹6500.

$$\therefore \text{ITC} = ₹ 6500$$

iii. GST payable = Output tax – ITC

$$= ₹ 8000 - ₹ 6500$$

$$= ₹ 1500$$

iv. ∴ Payable CGST = $\frac{1500}{2} = ₹750$ and payable

$$\text{SGST} = ₹ 750$$

iv. The Measurements (In mm) of the diameter of the head of the screw are given below:

Diameter(in mm)	33-35	36-38	39-41	42-44	45-47
Number of screw	10	19	23	21	27

Calculate the mean diameter of the head of the screw by 'Assumed Mean Method'?

Ans. Let us take the assumed mean = 40

Class Diameter (in mm)	Class Mark x_i	$d_i = x_i - A$ $d_i = x_i - 40$	Frequency × (No. of screw)	Frequency × Deviation $f_i d_i$
33-35	34	-6	10	-60
36-38	37	-3	19	-7
39-41	40	0	23	0
42-44	43	3	21	63
45-47	46	6	27	162
Total			$\sum f_i = 100$	$\sum f_i d_i = 108$

$$\bar{d} = \frac{\sum f_i d_i}{\sum f_i} = \frac{108}{100} = 1.08$$

$$\begin{aligned} \text{Mean, } \bar{X} &= A + \bar{d} \\ &= 40 + 1.08 \\ &= 41.08 \end{aligned}$$

The mean diameter of the head of the screw is 41.08mm

Q.4 Solve any two of the following sub question

(8)

- i. A bag contains in all 80 balls. Some of them are white , some are blue and some are red The number of white balls is 12 times the number of blue balls. The number of red balls is less than the number of while balls but more than the number of blue balls. If one balls is selected at random from the bag, what is the probability that it is red?

Ans. Let the number of blue balls be x.

Then the number of white ball is 12x.

But it is given that total no. of balls is 80.

$$\therefore \text{The number of red balls} = (80 - 13x)$$

As per the given condition

No of white ball > No of red balls > No of blue balls.

$$\therefore 12x > (80 - 13x) > 7x$$

Consider,

$$12x > 80 - 13x$$

$$\therefore 12x + 13x > 80$$

$$\therefore 25x > 80$$

$$\therefore x > \frac{80}{25}$$

$$\therefore x > 3\frac{1}{5} \quad \dots(i)$$

Now consider,

$$80 - 13x > x$$

$$\therefore 80 > x + 13x$$

$$\therefore 80 > 14x$$

$$\therefore \frac{80}{14} > x$$

$$\therefore 5\frac{5}{7} > x$$

$$\text{ie. } x < 5\frac{5}{7} \quad \dots(ii)$$

from i & ii $x > 3\frac{1}{5}$ but less than $5\frac{5}{7}$.

$$\therefore x = 4$$

$$\begin{aligned} \text{The no. of red balls} &= 80 - 13x \\ &= 80 - 13 \times 4 \\ &= 80 - 52 \\ &= 28. \end{aligned}$$

\therefore No. of red balls is 28.

$$\begin{aligned} P(R) &= \frac{n(R)}{n(S)} \\ &= \frac{28}{80} \\ &= \frac{7}{20} \end{aligned}$$

The probability that the ball selected at random is red is $\frac{7}{20}$

- ii. When the son will be as old his father today, the sum of their ages will be 126. When the father was as old as his son today, the sum of their ages then was 38. Find their present ages.

Ans. Let the present age of father be x years and that of his son be y years.

After $(x - y)$ years son's age will be x years' i.e. he will be as old his father.

After $(x - y)$ years father's age will be $x + (x - y)$ years.

From the first condition,

$$x + x + (x - y) = 126$$

$$\text{i.e. } 3x - y = 126 \quad \dots(1)$$

$(x - y)$ years ago father's age was y year's

i.e. the father was y old as his son today.

$(x - y)$ years ago, sons age was

$$y - (x - y) = (2y - x) \text{ years.}$$

$$y - (x - y) = (2y - x) \text{ years.}$$

From the second condition,

$$y + 2y - x = 38$$

$$\text{i.e. } -x + 3y = 38 \quad \dots(2)$$

Multiplying equation (2) by 3,

$$-3x + 9y = 114$$

$$\underline{3x - y = 126}$$

$$8y = 240$$

$$\therefore y = 30$$

Substituting $y = 30$ in equation (1)

$$3x - 30 = 126$$

$$\therefore 3x = 156$$

$$\therefore x = 52$$

The present ages of father and son are 52 years and 30 years respectively.

- iii. The following table shows the ages of person who visited a museum on a certain day. Find the median age of the person visiting the museum.

Age (years)	No of person
Less than 10	33
Less than 20	10
Less than 30	22
Less than 40	40
Less than 50	54
Less than 60	71

Ans. The given cumulative frequency tables is of the 'less than' form, so, we will have to decide the true class limit first. We know that class limit first. we know that, the 'less than' cumulative frequency is associated with the upper class limits. The upper class limit of the first class is 10. The age of any person is a positive number, so the first class must be 0-10. The upper class limit of the next class is 20, so the second class must be 10-20. In this way, make the classes of interval 10. In this way the last class is 50-60. So the given table can now be rewritten as follows.

Age (years)	Class	No. of person (Frequency)	Cumulative frequency less than.
Less than 10	0-10	3	3
Less than 20	10-20	$10 - 3 = 7$	10
Less than 30	20-30	$22 - 10 = 12$	$22 \rightarrow cf$
Less than 40	30-40	$40 - 22 = 18 \rightarrow f$	40
Less than 50	40-50	$54 - 40 = 14$	54
Less than 60	50-60	$71 - 54 = 17$	71

Here $N = 71$

$$\therefore \frac{N}{2} = 35.5 \text{ and } h = 10$$

The number 35.5 is the class 30-40, hence it is the median class.

$\therefore cf = 22, L = 30, f = 18.$

$$\text{Median} = L + \left[\frac{\frac{N}{2} - cf}{f} \right] \times h$$

$$= 30 + [35.5 - 22] \times \frac{10}{18}$$

$$= 30 + (13.5) \times \frac{10}{18}$$

$$= 30 + 7.5$$

$$= 37.5$$

\therefore The median age of the persons visiting the museum is 37.5 years.

Q.5 Solve any 1 of the following sub question (3)

1. Construct a word problem on quadratic equation, such that one of its answer is 6 (year, natural number, rupee, etc.) Also solve it.

Ans. **Word Problem:**

Abha is 4 years younger than Sneha and sum of squares of their ages is 40. Find the present age of Sneha.

Solution:

Let Sneha's age be x years.

From the first condition, Abha's age is $(x-4)$ years

from the second condition, $x^2 + (x-4)^2 = 40$

$$\therefore x^2 + x^2 - 8x + 16 = 40$$

$$\therefore 2x^2 - 8x + 16 - 40 = 0$$

$$\therefore 2x^2 - 8x - 24 = 0$$

$$\therefore x^2 - 4x - 12 = 0 \quad \dots(\text{Dividing by } 2)$$

$$\therefore x^2 - 6x + 2x - 12 = 0$$

$$\therefore x(x-6) + 2(x-6) = 0$$

$$\therefore (x-6)(x+2) = 0$$

$$\therefore x-6 = 0 \text{ or } x+2 = 0$$

$$\therefore x = 6 \text{ or } x = -2$$

$x = -2$ is unacceptable

Since age cannot be negative.

$$\therefore x = 6.$$

The present age of Sneha is 6 years.

2. i. Write an A.P. in which $a = 10$ and d is any natural number

ii. Find the sum of the first ten terms using formula

iii. Can -80 be a term of this A.P.? Justify

Ans. i. $a = 10$

Let $d = 2$ (as 2 is a natural number)

$$\therefore t_2 = a + d$$

$$= 10 + 2$$

$$= 12$$

$$t_3 = t_2 + d$$

$$= 12 + 2$$

$$= 14$$

$$t_4 = t_3 + d$$

$$= 14 + 2$$

$$= 16$$

\therefore A.P is $= 10, 12, 14, 16, \dots$

ii. Here $a = 10$, $d = 2$

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

$$\begin{aligned} S_{10} &= \frac{10}{2} [2(10) + (10-1)2] \\ &= 5 [20 + 16] \\ &= 5 [36] \\ &= 180 \end{aligned}$$

iii. -70 Cannot be a term in this A.P

Justification: Here, the value of a and d are natural number.
so all the terms of this A.P. will be natural number and
-70 is not a natural number.
