SSC   **MARCH 2020**

MATHEMATICS
ALGEBRA – PART I

Time allowed: 2 hours   **Maximum marks: 40**

General Instructions:
- (i) All questions are compulsory.
- (ii) Use of calculator is not allowed.
- (iii) The numbers to the right of the questions indicate full marks.
- (iv) In case MCQ's Q. No. 1(A) only the first attempt will be evaluated and will be given credit.
- (v) For every MCQ, the correct alternative (A), (B), (C) or (D) of answers with sub question number is:

1. (A) For every sub question 4 alternative answers are given. Choose the correct answer and write the alphabet of it: **[4]**

(i) In the formal of GSTIN there are _____ alpha-numerals.
(A) 15   (B) 10   (C) 16   (D) 9

Answer: Answer is not given due to change in reduced syllabus.

(ii) From the following equations, which one is the quadratic equation?
(A) $\frac{5}{x} - 3 = x^2$ (B) $x(x + 5) = 4$ (C) $n - 1 = 2n$ (D) $\frac{1}{x^2}(x + 2) = x$

Answer: (B) $x(x + 5) = 4$

(iii) For simultaneous equations in variables x and y, if $D_x = 49, D_y = -63, D = 7$, then what is the value of x?
(A) 7   (B) -7   (C) $\frac{1}{7}$ (D) $-\frac{1}{7}$

Answer: (A) 7

(iv) If if $n(A) = 2, P(A) = \frac{1}{5}$, then $n(S) =$?
(A) $\frac{2}{5}$ (B) $\frac{5}{2}$ (C) 10   (D) $\frac{1}{3}$

Answer: (C) 10

1. (B) Solve the following sub questions: **[4]**

(i) Find second and third term of an A. P. whose first term is -2 and common difference is -2.

Answer: Given,
First term, $a = -2$
Common difference, $d = -2$
We know that Second term $= a + d$

$$= -2 + (-2)$$
$$= -4$$

And   Third Term $= a + 2d$
$$= -2 + 2(-2)$$
$$= -2 - 4$$
$$= -6$$

∴ Second term is -4 and third term is -6.

(ii) Pawan Medicals supplies medicines. On some medicines the rate of GST is 12%, then what is the rate of CGST and SGST?

Answer: Answer is not given due to the change in reduced syllabus.

(iii) Find the values of a and b from the quadratic equation $2x^2 - 5x + 7 = 0$.

Answer: The given quadratic equation is
$2x^2 - 5x + 7 = 0$.
Comparing the given quadratic equation with
$ax^2 + bx + c = 0$
∴ The Values of $a = 2$ and $b = -5$

(iv) If $15x + 17y = 21$ and $17x + 15y = 11$, then find the value of $x + y$.

Answer: The given equations are
$$15x + 17y = 21 \quad ....(1)$$
$$17x + 15y = 11 \quad ....(2)$$
Adding equations (1) and (2)
$$15x + 17y = 21$$
$$+17x + 15y = 11$$
$$\overline{\qquad\qquad\qquad}$$
$$32x + 32y = 32$$
Dividing both sides by 32, we get
$$x + y = 1$$

2. (A) Complete and write any two activities from the following: **[4]**

(i) Complete the following table to draw the graph of $2x - 6y = 3$:

X	-5	☐
Y	☐	0
(x, y)	☐	☐

Solution:

X	-5	$\dfrac{3}{2}$
Y	$-\dfrac{13}{6}$	0
(x, y)	$-5, -\dfrac{13}{6}$	$\dfrac{3}{2}, 0$

(ii) First term and common difference of an A.P. are 6 and 3 respectively. Find S_{27}.

Solution:
First term $= a = 6$, common difference $= d = 3$, $S_{27} =?$

$$S_{27} =?$$
$$S_n = \frac{n}{2}[\text{_____} + (n-1)d] - \text{Formula}$$
$$S_{27} = \frac{27}{2}[12 + (27-1)\text{\_\_\_\_}]$$
$$= \frac{27}{2} \times [\text{_____}]$$
$$= 27 \times 45$$
$$\therefore S_{27} = \text{_____}$$

Solution:
First term $= a = 6$, common difference $= d = 3$,

$$S_{27} =?$$
$$S_n = \frac{n}{2}[2a + (n-1)d] - \text{Formula}$$
$$S_{27} = \frac{27}{2}[12 + (27-1)3]$$
$$= \frac{27}{2} \times [90]$$
$$= 27 \times 45$$
$$S_{27} = 1215$$

(iii) A Card is drawn from a well shuffled pack of 52 playing cards. Find the probability of the event, the card drawn is a red card.

Solution:
Suppose 'S' is sample space.
$\therefore n(S) = 52$
Event A: Card drawn is a red Card.
$\therefore$ Total Red Cards $= $ ____ hearts $+$ 13 diamonds
$\therefore n(A) = $ _____
$\therefore p(A) = \dfrac{\quad}{n(S)} - \text{Formula}$
$\therefore p(A) = \dfrac{26}{52}$
$\therefore p(A) = $ _____

Solution:
Suppose 'S' is sample space.

$\therefore$ n(S) = 52

Event A: Card drawn is a red Card.

$\therefore$ Total Red Cards = 13 hearts + 13 diamonds

$\therefore$ n(A) = 26

$\therefore$ p(A) = $\frac{n(A)}{n(S)}$ − Formula

$\therefore$ p(A) = $\frac{26}{52}$

$\therefore$ p(A) = $\frac{1}{2}$

2. (B) Solve any four sub questions from the following: [4]

(i) Find the value of the determinant:

$$\begin{vmatrix} \frac{7}{5} & \frac{5}{3} \\ \frac{3}{2} & \frac{1}{2} \end{vmatrix}$$

Solution:

$$\begin{vmatrix} \frac{7}{5} & \frac{5}{3} \\ \frac{3}{2} & \frac{1}{2} \end{vmatrix} = \frac{7}{10} - \frac{5}{2}$$

$$= \frac{7 - 5(5)}{10}$$

$$= \frac{-18}{10}$$

$$= \frac{-9}{5}$$

(ii) Solve the quadratic equation by factorisation method: $x^2 - 15x + 54 = 0$.

Solution: The given quadratic equation is

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

$\Rightarrow x^2 - x - 6x + 54 = 0$

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

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

$\Rightarrow (x - 9) = 0$ or $((x - 6) = 0$

$\therefore$ x = 9 or x = 6

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

(iii) Decide whether the following sequence is an A.P. if so, find the 20th term of the progression:

-12, -5, 2, 9, 16, 23, 30, …………….

Solution: Here a = t_1 = first term = $-12, t_2 = -5$,

Common difference = d = $t_2 - t_1$

d = $-5 - (-12)$

$= -5 + 12$

$\therefore$ d = 7

We know that, $t_n = a + (n - 1)d$

Here, n = 20, a = −12, d = 7

$$t_{20} = -12 + (20 - 1)7$$
$$= -12 + 133$$
$$t_{20} = 121$$

∴ 20th term of the progression is 121.

(iv) A two-digit number is formed with digits 2, 3, 5, 7, 9 without repetition. What is the probability that the number formed is an odd number?

Solution: Simple space S: to form two-digit number from 2, 3, 5, 7, 9

∴ S = [23, 25, 27, 29, 32, 35, 37, 39, 52, 53, 27, 59, 72, 73, 75, 79, 92, 93, 95, 97]

∴ n(S) = 20

Event A: Number formed is an even number are such that whose unit place is 0, 2, 4, 6, 8. One of these numbers should be in even number.

In the given numbers 2, 3, 5, 7, 9 only 2 is the even number whose unit place is 2.

∴ Sample space of even numbers = [32, 52, 72, 92]

∴ n (Even numbers) = 4

∴ n (Odd numbers) = n(S) − 4

$$= 20 - 4$$
$$= 16$$

∴ n(A) = 16

$$p(A) = \frac{n(A)}{n(S)}$$
$$= \frac{16}{20} = \frac{4}{5}$$

(v) If L = 10, $f_1 = 70$, $f_0 = 58$, $f_2 = 42$, h = 2, then find the mode by using formula.

Solution: Answer is not given due to the change in reduced syllabus.

3. (A) Complete and write any one activity from the following: [3]

(i)

Age group (in years)	No. of persons	Measure of Central Angle
20 − 25	80	$\dfrac{}{200} \times 360° = \underline{}$
25 − 30	60	$\dfrac{60}{200} \times 360° = \underline{}$
30 − 35	35	$\dfrac{35}{200} \times \underline{} = 63$
35 − 40	25	$\dfrac{25}{200} \times 360° = \underline{}$
Total	200	$\underline{}$

Solution: Answer is not given due to the change in reduced syllabus.

(ii) Shri Shantilal has purchased 150 shares of EV ₹100, for MV of ₹120, company has paid dividend at 7%, then to find the rate of return on his investment, complete the following activity:

Solution: Answer is not given due to change in reduced syllabus.

3. (B) Attempt any two sub questions from the following: [6]

(i) A balloon vendor has 2 red, 3 blue and 4 green balloons. He wants to choose one of them at random to give it to Pranali. What is the probability of the event that Pranali gets:
    1. a red balloon.   **2. a blue balloon.**

Solution: Available balloons are 2 red, 3 blue and 4 green.
Sample space S: one balloon to be choose on random basis,
$\therefore n(S) = 2 + 3 + 4 = 9$
1.   Event A: Probability that a red balloon is chosen.
$\therefore n(A) = 2$
$\therefore p(A) = \frac{n(A)}{n(S)}$
$p(A) = \frac{2}{9}$
2.   Event B: Probability that a blue balloon is chosen.
$\therefore n(B) = 3$
$\therefore p(B) = \frac{n(B)}{n(S)}$
$\frac{3}{9} = \frac{1}{3}$
$\therefore p(B) = \frac{1}{3}$
Probability that a red balloon is chosen is $\frac{2}{9}$ and probability that a blue balloon is chosen is $\frac{1}{3}$.

(ii) The denominator of fraction is 4 more than twice its numerator. Denominator becomes 12 times the numerator, if both the numerator and the denominator are reduced by 6, find the fraction.

Solution: Suppose numerator is x, then denominator will be $2x + 4$
$\therefore$ Fraction is $\frac{x}{2x+4}$
According to the given information we can write,
$\frac{x-6}{(2x+4)-6} = \frac{1}{12}$
$\therefore \frac{x-6}{2x-2} = \frac{1}{12}$
$\therefore 12(x - 6) = 2x - 2$
$\therefore 12x - 72 = 2x - 2$
$\therefore 12x - 2x - 72 + 2 = 0$
$\therefore 10x - 70 = 0$
$\therefore x = \frac{70}{10} = 7$
$\therefore x = 7$

But fractions

$$\frac{x}{2x+4} = \frac{7}{2(7)+4}$$
$$= \frac{7}{14+4} = \frac{7}{18}$$

∴ The faction is $\frac{7}{18}$.

(iii) A milk center sold milk to 50 customers. The table below gives the number of customers and the milk they purchased. Find the mean of the milk sold by direct method:

Milk sold (liter)	No. of customers
1 – 2	17
2 – 3	13
3 – 4	10
4 – 5	7
5 – 6	3

Solution: Answer is not given due to the change in reduced syllabus.

(iv) In an A.P. sum of three consecutive terms is 27 and their products is 504. Find the terms. (Assume that three consecutive terms in an A.P. are $a - d, a, a + d$.)

Solution:
Assume that the three consecutive terms are $a - d, a,$ and $a + d$
According to first condition,
$(a - d) + a + (a + d) = 27$
∴ $3a = 27$
∴ $a = 9$
According to second condition,
$(a - d)(a)(a + d) = 504$
Putting the value of $a = 9$ in above equation, we get
∴ $(9 - d)(9)(9 + d) = 504$
∴ $(9^2 - d^2) \times 9 = 504$
∴ $(81 - d^2) = 56$
∴ $81 - d^2 = 56$
∴ $d^2 = 81 - 56$
∴ $d^2 = 25$
∴ $d = 5$
∴ First term $= a - d = (9 - 5) = 4$
  Second term $= a = 9$
Third term $= a + d = 9 + 5 = 14$
∴ the three terms are $4, 9, 14$.

4. Attempt any two sub questions from the following: [8]

(i) Represent the following data by histogram :

Price of Sugar (per kg in ₹)	Number of weeks
18 − 20	4
20 − 22	8
22 − 24	22
24 − 26	12
26 − 28	6
28 − 30	8

Solution: Answer is not given due to the change in reduced syllabus.

(ii) One person borrows ₹4, 000 and agrees to repay with a total interest of ₹500 in 10 installments. Each installment being less than the preceding installment by ₹10. What should be the first and the last installments?

Solution: Number of installments, n = 10
Let the first installment be ₹A
As per the given data each further installment is less than the preceding one by ₹10.
∴ These installments are in A.P.
∴ First term = a
And common difference, d = −10
Here the negative sign indicates that the next term of A.P. is less than that the preceding term.
∴ Repayment of loan is a below:
∴ S_n = Loan + Total interest
∴ S_n = 4000 + 500
∴ S_n = 4500
Here $n = 10$
We know that, $S_n = \frac{n}{2}[2a + (n-1)d]$
∴ $4500 = \frac{10}{2}[2a + (10-1)(-10)]$
∴ $4500 = 5[2a - 90]$
∴ $4500 = 10a - 450$
∴ $10a = 4500 + 450$
∴ $a = \frac{4950}{10} = 495$
∴ first installment = a = ₹495
The last installment is the 10th installment.
∴ n = 10
We know that, $a_n = a + (n-1)d$
Here n = 10, a = 495, d = −10
∴ $a_{10} = 495 + (10-1)(-10) = 495 - 90$
$a_{10} = 405$

Last installment= a_{10} = ₹405.
∴ First installment is ₹495 and the last installment is ₹405.

(iii) The sum of the areas of two squares is 400 sq.m. if the difference between their perimeters is 16 m, find the sides of two square.

Solution: Let the side of first square be x meter and the side of second square be y meter
As per the first given condition,
∴ $x^2 + Y^2 = 400$ …. (i)
As per the second given condition,
$4x - 4y = 16$
∴ $x - y = 4$
∴ $x = y + 4$ …(ii)
Put the value of $x = y + 4$ in equation (i), we get
∴ $(y + 4)^2 + y^2 = 400$
∴ $y^2 + 8y + 16 + y^2 = 400$
∴ $2y^2 + 8y + 16 - 400 = 0$
∴ $2y^2 + 8y - 384 = 0$
Dividing both sides by 2 we get
$y^2 + 4y - 192 = 0$
∴ $y^2 + 16y - 12y - 12 = 0$
∴ $y(y + 16) - 12(y + 16) = 0$
∴ $(y + 16)(y - 12) = 0$
∴ $(y + 16) = 0$ or $(y - 12) = 0$
∴ $y = -16$ or $y = 12$
But side of square is never negative.
∴ $y \neq -16$
∴ $y = 12$
Putting the value of y=12 in equation (ii), we get
$x = 12 + 4 = 16$
∴Side of first square, $x = 16$ m and side of second square, $y = 12$ m.

5. Attempt any one sub question from the following: **[3]**

(i) Convert the following equations into simultaneous equations and solve:

$$\sqrt{\frac{x}{y}} = 4, \qquad \frac{1}{x} + \frac{1}{y} = \frac{1}{xy}$$

Solution: Answer is not given due to the change in reduced syllabus.

(ii) A dealer sells a toy for ₹24 and gains as much percent as the cost price of the toy. Find the cost price of the toy.

Solution: Selling price of the toy = ₹24
Let the cost price of the toy be ₹X
Gain% = x%(Given)
Gain% = $\left(\frac{\text{Selling price} - \text{Cost price}}{\text{Cost Price}}\right) \times 100$
∴ x = $\left(\frac{24 - x}{x}\right) \times 100$

$\therefore x^2 = 2400 - 100x$

$\therefore x^2 + 100x - 2400 = 0$

$\therefore x^2 + 120x - 20x - 2400 = 0$

$\therefore x(x + 120) - 20(x + 120) = 0$

$\therefore (x + 120)(x - 20) = 0$

$\therefore (x + 120) = 0 \qquad$ or $\qquad (x - 20) = 0$

$\therefore x = -120 \quad$ or $\qquad x = 20$

$x \neq -120$, because cost cannot be negative

$\therefore \ x = 20$

$\therefore$ Cost price $= ₹20$

$\therefore$ The cost price of the toy is ₹20