MATHEMATICS – 2019

ALGEBRA – PART – 1 (E)

N-610

Maximum Marks : 40 **Time : 2 hours**

1.

(A) Solve the following questions (Any four) : 4.

(i) Find the median of 66, 98, 54, 92, 87, 63, 72.

(ii) Multiply and write the answer in the simplest form : $5\sqrt{7} \times 2\sqrt{7}$

(iii) If 3x + 5y = 9 and 5x + 3y = 7, then find the value of x + y.

(iv) Write the ratio of second quantity to first quantity in the reduced form :
5 dozen pens, 120 pens.

(v) Write the following polynomial in coefficient form:

(vi) For computation of income tax which is the assessment year of financial year 01-04-2016 to 31-03-2017?

Sol. **(i)** 54, 63,66, $\boxed{72}$, 87,92,98 medium = $\frac{7+1}{2} = 4^{th}$

median

(ii) $5\sqrt{7} \times 2\sqrt{7} = 10 \times 7 = \boxed{70}$

(iii) 3x + 5y = 9 ... (a)
5x + 3y = 7 ... (b)
equation (a) + (b)
8x + 8y = 16

$\Rightarrow \quad x + y = \frac{16}{8} = \boxed{2}$

(iv) Ratio $\Rightarrow \frac{120}{5 \text{ dozen}} = \frac{120}{5 \times 12} = \frac{2}{1} = \boxed{2:1}$

$2x^3 + x^2 - 3x + 4.$

(v) [2,1, – 3, 4]

(vi) 31-03-2017 will be the assesment year.

(B) Solve the following question (Any two) : **4**

(i) Find the value of the polynomial $2x^3 + 2x$, when x = – 1.

(ii) If A = {11, 21, 31, 41}, B = {12, 22, 31, 32}, then find :
(1) $A \cup B$
(2) $A \cap B$

(iii) Sangeeta's monthly income is Rs. 25,000. She spent 90% of her income and donated 3% for socially useful causes. How much money did she save?

Sol. **(i)** $f(x) = 2x^3 + 2x, \quad x = -1$
$f(-1) = 2(-1)^3 + 2(-1)$
$= -2 - 2 = \boxed{-4}$

(ii) **(1)** $A \cup B = \{11, 12, 21, 22, 31, 32, 41\}$

(2) $A \cap B = \{31\}$

(iii) Spent = 90%
and donate = 3%
Total expenditure = 93%, Saving = 100 – 93 = 7%

Saved money = $25000 \times \frac{7}{100} = 1750$

2.

(A) Choose the correct alternative ? **4**

(i) In the A.P. 2, – 2, – 6, – 10,..... common difference (d) is :
(A) – 4 (B) 2 (C) – 2 (D) 4

(ii) For the quadratic equation $x^2 + 10x – 7 = 0$, then values of a, b, c are
(A) a = – 1, b = 10, c = 7 (B) a = 1, b = – 10, c = – 7
(C) a = 1, b = 10, c = – 7 (D) a = 1, b = 10, c = 7

(iii) The tax levied by Central Government for trading within a state is
(A) IGST (B) CGST (C) SGST (D) UTGST

(iv) If a die is rolled, what is the probability that number appearing on upper face is less than 2 ?
(A) $\frac{1}{3}$ (B) $\frac{1}{2}$ (C) 1 (D) $\frac{1}{6}$

Sol. **(i)** A.P $\Rightarrow$ 2, – 2, –6, – 10 , ...
$d = a_2 – a_1 = – 2 – 2 = – 4$ (A)

(ii) Equation $\Rightarrow$ $x^2 + 10x – 7 = 0$
General form $\Rightarrow$ $ax^2 + bx + c = 0$
On comparing
a = 1, b = 10 , c = – 7 (C)

(iii) CGST (B)

(iv) T(E) = {1, 2, 3, 4, 5, 6} = 6
F(E) = {1} = 1
$P(E) = \frac{1}{6}$ (D)

(B) Solve the following questions (Any two) : **4**

(i) First term and common difference of an A.P. are 12 and 4 respectively. If $t_n = 96$, find n.

(ii) If $\begin{vmatrix} 4 & 5 \\ m & 3 \end{vmatrix} = 22$, then find the value of m.

(iii) Solve the following quadratic equation :
$x^2 + 8x + 15 = 0$

Sol. **(i)** First term a = 12
difference = d = 4
$T_n = a_n = 96$
$a + (n – 1) d = 96$
$12 + (n – 1)4 = 96$
$(n – 1) 4 = 96 – 12 = 84$
$n – 1 = 21$
$n = \boxed{22}$

(ii) $\begin{vmatrix} 4 & 5 \\ m & 3 \end{vmatrix} = 22$

$\Rightarrow 12 – 5m = 22 \quad \Rightarrow – 5m = 10$
$m = – 2$

(iii) $x^2 + 8x + 15 = 0$
$\Rightarrow x^2 + 5x + 3x + 15 = 0$
$\Rightarrow x(x + 5) + 3(x + 5) = 0$
$\Rightarrow (x + 5)(x + 3) = 0$
$x = – 5, – 3$

3.

(A) Complete the following activities (Any two) :

(i) Smita has invested Rs. 12,000 to purchase shares of FV Rs. 10 at a premium of Rs. 2. Find the number of shares she purchased. Complete the given activity to get the answer.

Activity : FV = Rs. 10, Premium = Rs. 2

$\therefore$ MV = FV + $\square$ = $\square$ + 2 = 12.

$\therefore$ Number of shares = $\frac{\text{Total investment}}{\text{MV}}$

$= \frac{\square}{12} = \square$ shares.

Sol. (i) Activity : FV = Rs.10 , premium = Rs.2

$\therefore$ MV = FV + $\boxed{\text{Premium}}$ = $\boxed{10}$ + 2 = 12.

$\therefore$ No. of shares = $\frac{\text{Total investment}}{\text{MV}} = \frac{\boxed{12000}}{12} = \boxed{1000}$ shares.

(ii) The following table shows the daily supply of electricity to different places in a town. To show the information by a pie diagram, measures of central angles of sectors are to be decided.

Complete the following activity to find the measures :

Places	Supply of electricity (Thousand units)	Measure of central angle
Roads	4	$\frac{4}{30} \times 360 = 48°$
Factories	12	$\frac{\square}{\square} \times 360 = 144°$
Shops	6	$\frac{6}{30} \times 360 = \square$
Houses	8	$\frac{\square}{\square} \times 360 = \square$
Total $\Rightarrow$	30	

Sol. (ii)

Places	Supply of electricity (Thousand units)	Measure of central angle
Roads	4	$\frac{4}{30} \times 360 = 48°$
Factories	12	$\frac{\boxed{12}}{\boxed{30}} \times 360 = 144°$
Shops	6	$\frac{6}{30} \times 360 = \boxed{72}$
Houses	8	$\frac{\boxed{8}}{\boxed{30}} \times 360 = \boxed{96}$
Total $\Rightarrow$	30	

(iii) Two coins are tossed simultaneously. Complete the following activity of writing the sample space (S) and expected outcomes of the events :

(i) Event A : To get at least one head.

(ii) Event B : To get no head.

Activity : If two coins are tossed simultaneously.

$\therefore$ S = { ☐, HT, TH, ☐ }

(i) Event A : at least getting one head.

$\therefore$ A = { HH, ☐, TH }

(ii) Event B : to get no head

$\therefore$ B = { ☐ }

Sol. (iii) **Activity : If two coins are tossed simultaneously.**

$\therefore$ S = { HH, HT, TH, T T }

(i) Event A : at least getting one head.

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

(ii) Event B : to get no head

$\therefore$ B = { TT }

(B) **Solve the following questions (Any two) :**

(i) Find the 19th term of the A.P. 7, 13, 19, 25,.....

(ii) Obtain a quadratic equation whose roots are – 3 and – 7

(iii) Two numbers differ by 3. The sum of the greater number and twice the smaller number is 15. Find the smaller number.

Sol. (i) A.P. 7,13,19,25,.....

$a = 7 \quad d = 13 - 7 = 6$

$a_{19} = a + (19 - 1)d$

$= 7 + 18 \times 6$

$a_{19} = 115$

(ii) Root $\alpha = -3, \beta = -7$

quad. equation $\Rightarrow x^2 - (\alpha + \beta) + \alpha\beta = 0$

$\Rightarrow x^2 - \langle -3 + (-7) \rangle x + (-3)(-7) = 0$

$\Rightarrow x^2 + 10x + 21 = 0$

(iii) Assume nos. are x & x + 3

According to question

$\Rightarrow$ x + 3 + 2x = 15

$\Rightarrow$ 3x = 12

$\Rightarrow$ x = 4

So. smaller no. $\Rightarrow$ x = 4

4. Solve the following question (Any three) : 9

(i) Amit saves certain amount every month in a specific way. In the first month he saves Rs. 200, in the second month Rs. 250, in the third month Rs. 300 and so on. How much will be his total savings in 17 months ?

(ii) A two digit number is to be formed using the digits 0, 1, 2, 3. Repetition of the digits is allowed. Find the probability that a number so formed is a prime number.

(iii) Smt. Malhotra purchased solar panels for the taxable value of Rs. 85,000. She sold them for Rs.90,000. The rate of GST is 5%. Find the ITC of Smt. Malhotra. What is the amount of GST payable by her ?

(iv) Solve the following simultaneous equations graphically :
$x + y = 0$; $2x - y = 9$

Sol. (i) First month saving = 200
Second month saving = 250
Third month saving = 300
So, A.P. $\Rightarrow$ 200, 250, 300.....
$a = 200$ $d = 250 - 200 = 50$
Sum of saving of 17 months

$$S_{17} = \frac{17}{2}\left[2\times 200 + (17-1)50\right] = \frac{17}{2}\times 1200 = 10,200/-$$

(ii) Total two digit no. are = 3 × 4
(repetition is allowed) = 12 = $\langle 10,11,12,13,20,21,22,23,30,31,32,33\rangle$
So, T(E) = 12
Now prime no.s formed by , 0,1,2,3 are
= $\langle 11,13,23\rangle$
So, F(E) = 3

$$P(E) = \frac{3}{12} = \frac{1}{4}$$

(iii) C.P. = 85,000 Rs.
S.P. = 90,000 Rs.

$$(ITC) = 85000\times\frac{5}{100} = 4250 \text{ Rs.}$$

Output tax = 5% of 90,000

$$90,000\times\frac{5}{100} = 4500 \text{ Rs.}$$

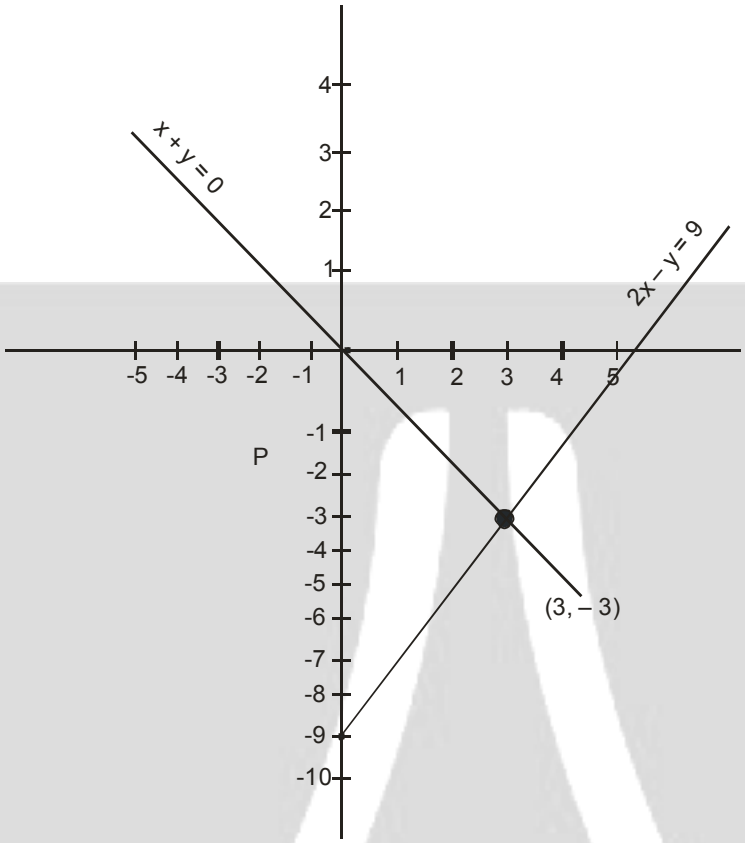
Amount of G.S.T. $\Rightarrow$ 4500 – 4250 = 250 Rs.
Thus amount of ITC = 4250/-
amount of GST = 250/-

(iv) $x + y = 0$
$2x - y = 0$
$3x = 9$
$x = 3$
$3 + y = 0$
$y = -3$
$x + y = 0$

x	0	1	−1
y	0	−1	1

$2x - y = 9$

x	0	5	4
y	−9	1	−1



5. Solve the following questions (Any one): **4**

(i) The following frequency distribution table shows marks obtained by 180 students in Mathematics examination.

Marks	Number of Students
0 – 10	25
10 – 20	x
20 – 30	30
30 – 40	2x
40 – 50	65

Find the value of x.

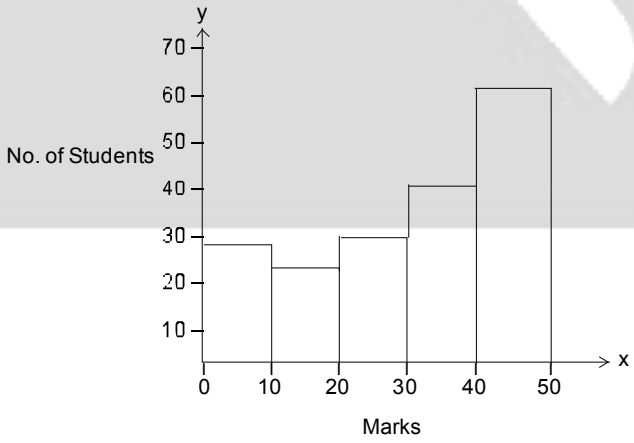
Also draw a histogram representing the above information.

Sol. (i) 25 + x + 30 + 2x + 65 = 180 (given)

3x = 60

x = 20

Marks	Number of Students
0 – 10	25
10 – 20	20
20 – 30	30
30 – 40	40
40 – 50	65
	180



(ii) Two taps together can fill a tank completely in $3\frac{1}{13}$ minutes. The smaller tap taken 3 minutes more than the bigger tap to fill the tank. How much time does each tap take to fill the tank completely?

Sol. (ii) Let large tap fill a tank in x minute. then smaller tap will fill in x + 3 min.

So, $\frac{1}{x}+\frac{1}{x+3}=\frac{13}{40}$

$40(2x+3)=13(x^2+3x)$

$80x+120=13x^2+39x$

$13x^2+39x-80x-120=0$

$13x^2-41x-120=0$

$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \Rightarrow \frac{41\pm\sqrt{7921}}{2\times13} \Rightarrow \frac{41\pm89}{26} = \frac{130}{26}=5 \text{ min}$

6. Solve the following questions (Any one): **3**

(i) The coordinates of the point of intersection of lines ax + by = 9 and bx + ay = 5 is (3, – 1). Find the values of a and b.

Sol. (i) Point of intersection will satisfy both the equations.

$3a-b=9$ ... (1) × 3

$3b-a=5$ ... (2)

$-3b+9a=27$

$3b-a=5$

$8a=32$

$a=4$

On putting value of a in equation (2)

$3b-4=5$

$3b=9$

$b=3$

(ii) The following frequency distribution table shows the distances travelled by some rickshaws in a day. Observe the table and answer the following questions:

Class (Daily distance travelled in km)	Continuous Classes	Frequency (Number of rickshaws)	Cumulative Frequency less than type
60 – 64	59.5 – 64.5	10	10
65 – 69	64.5 – 69.5	34	10 + 34 = 44
70 – 74	69.5 – 74.5	58	44 + 58 = 102
75 – 79	74.5 – 79.5	82	102 + 82 = 184
80 – 84	79.5 – 84.5	10	184 + 10 = 194
85 – 89	84.5 – 89.5	6	194 + 6 = 200

(i) Which is the modal class ? Why ?

(ii) Which is the median class and why ?

(iii) Write the cumulative frequency (C.F.) of the class preceding the median class.

(iv) What is the class interval (h) to calculate median?

Sol. (i) 74.5 – 79.5

Because maximum no. rickshaw are traveled in this internal

(ii) 69.5 – 74.5

Because $\frac{N}{2}=100$ & just greater than c.f. from $\frac{N}{2}$ is 102

(iii) 44

(iv) 5