

# Maharashtra Question Paper: March 2019

## Maths (Part - I)

**Q1. (A) Solve the following questions (Any four):**

**[4]**

**i. Find the median of: 66, 98, 54, 92, 87, 63, 72.**

**Solution:** Arrange the series in ascending order:

$$54 < 63 < 66 < 72 < 87 < 92 < 98$$

Now, using the median formula,

Median =  $(n+1)/2$  term, where n is the number of values in a set of data

$$= (7+1)/2$$

$$= 8/2$$

$$= 4^{\text{th}} \text{ term}$$

As we can see in the series  $54 < 63 < 66 < 72 < 87 < 92 < 98$ , the fourth term is 72.

Therefore, the median of the given data is 72.

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

**Solution:**  $\sqrt{7} (5 \times 2) = 10\sqrt{7}$

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

**Solution:** Solving the equations by using elimination method.

$$3x + 5y = 9 \dots\dots\dots(i)$$

$$3x = 9 - 5y$$

$$x = (9 - 5y)/3$$

Putting the value of x in equation  $5x + 3y = 7 \dots\dots\dots(ii)$

$$5(9 - 5y)/3 + 3y = 7$$

$$(45 - 25y)/3 + 3y = 7$$

$$(45/3) + (-25y)/3 + 3y = 7$$

$$15 + (-25y + 9y)/3 = 7$$

$$15 + (-16y)/3 = 7$$

$$15 - 7 = (16y)/3$$

$$8 = (16y)/3$$

$$y = 24/16$$

$$y = 3/2$$

Putting the value of y in equation (i)

$$3x + 5y = 9$$

$$3x = 9 - (5 \times 3)/2$$

$$3x = 9 - 15/2$$

$$3x = 3/2$$

$$x = 1/2$$

Now, finding the value of

$$x + y$$

$$1/2 + 3/2 = 4/2 = 2$$

Therefore, the answer is 2.

#### ***Simplest method of solving the problem***

Add both equations,  $3x + 5y = 9$  and  $5x + 3y = 7$

$$3x + 5y + 5x + 3y = 9 + 7$$

$$8x + 8y = 16$$

$$8(x + y) = 16$$

$$x + y = 2$$

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

**Solution:** 1 dozen = 12 quantity

$$\text{So, 5 dozen pen} = 5 \times 12 = 60$$

The ratio of second quantity to first quantity is given as;

$$120:60$$

$$2:1$$

**v. Write the following polynomial in coefficient form:  $2x^3 + x^2 - 3x + 4$ .**

**Solution:** Coefficient form of the polynomial is (2, 1, -3, 4)

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

**Solution:** For computation of income tax of financial year 01-04-2016 to 31-3-2017, the assessment year is 2017-18.

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

**[4]**

**i. Find the value of the polynomial  $2x^3 + 2x$ , when  $x = -1$ .**

**Solution:** Putting  $x = -1$  in the polynomial

$$\begin{aligned} &2x^3 + 2x \\ &= 2(-1)^3 + 2(-1) \\ &= (-2) + (-2) \\ &= -4 \end{aligned}$$

Thus, the answer is -4.

**ii. If  $A = \{11, 21, 31, 41\}$ ,  $B = \{12, 22, 31, 32\}$ , then find:**

**a.  $A \cup B$**

**b.  $A \cap B$**

**Solution:**  $A \cup B = \{11, 12, 21, 22, 31, 32, 41\}$

$A \cap B = \{31\}$

**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?**

**Solution:** 90% of Sangeeta's income =  $(90 \times 25,000)/100 = \text{Rs. } 22,500$

Money denoted for social cause = 3% of 25,000 =  $(3 \times 25,000)/100 = \text{Rs. } 750$

Money saved by Sangeeta = Income – Money spend by her – Money spend for social cause

Money saved by Sangeeta =  $25,000 - 22,500 - 750$

Money saved by Sangeeta =  $25,000 - 23,250 = \text{Rs. } 1750$

**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

**Solution:** Common difference (d) =  $a_2 - a_1$

$$d = (-2) - (2)$$

$$d = -4$$

Hence, option (A) i.e -4 is the answer.

**ii. For the quadratic equation  $x^2 + 10x - 7 = 0$ , the 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)  $a = 1, b = 10, c = 7$

**Solution:** Coefficient form of the polynomial is (1, 10, -7).

Therefore, option (C) i.e  $a = 1, b = 10, c = -7$  is the correct answer.

**iii. The tax levied by Central Government for trading within a state is:**

- (A) IGST
- (B) CGST
- (C) SGST
- (D) UTGST

**Solution:** The correct answer is option (B).

**iv. If a die is rolled, what is the probability that number appearing on upper face is less than 2?**

- (A)  $1/3$
- (B)  $1/2$
- (C) 1
- (D)  $1/6$

**Solution:** Probability = Number of favourable outcomes/Total Number of outcomes

Total Number of outcomes = 1, 2, 3, 4, 5, 6

Number of favourable outcomes = 1

$$P(E) = 1/6$$

Therefore, the answer is option (D) i.e 1/6.

**(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.**

**Solution:**  $t_1 = 12, d = 4, t_n = 96$

$$t_n = t_1 + (n - 1) d$$

$$96 = 12 + (n - 1) 4$$

$$96 - 12 = (n - 1) 4$$

$$84 = (n - 1) 4$$

$$21 = (n - 1)$$

$$21 + 1 = n$$

$$n = 22$$

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

**ii.**

**Solution:** By solving the above matrix.

$$5m - 12 = 22$$

$$5m = 22 + 12$$

$$5m = 34$$

$$m = 34/5$$

**iii. Solve the following quadratic equation:**

$$x^2 + 8x + 15 = 0$$

**Solution:**  $x^2 + 8x + 15 = 0$

$$x^2 + 5x + 3x + 15 = 0$$

$$x(x + 5) + 3(x + 5) = 0$$

$$(x + 3)(x + 5) = 0$$

$$x = -3, x = -5$$

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

[4]

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

$$\therefore MV = FV + \boxed{\phantom{00}} = \boxed{\phantom{00}} + 2 = 12$$

$$\begin{aligned}\therefore \text{Number of shares} &= \frac{\text{Total investment}}{MV} \\ &= \frac{\boxed{\phantom{0000}}}{12} = \boxed{\phantom{000}} \text{ shares}\end{aligned}$$

Solution:

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

$$\begin{aligned}\therefore \text{Number of shares} &= \frac{\text{Total investment}}{MV} \\ &= \frac{\boxed{12000}}{12} = \boxed{1000} \text{ shares}\end{aligned}$$

Therefore, the answer is 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	$\frac{4}{30} \times 360 = 48^\circ$
Factories	12	$\frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}} \times 360 = 144^\circ$
Shops	6	$\frac{6}{30} \times 360 = \boxed{\phantom{00}}$
Houses	8	$\frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}} \times 360 = \boxed{\phantom{00}}$
Total	30	

**Solution:**

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

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

- Event A: to get at least one head.
- Event B: to get no head.

**Activity:** If two coins are tossed simultaneously

$$\therefore S = \{ \boxed{\quad}, HT, TH, \boxed{\quad} \}$$

a. Event A : at least getting one head.

$$\therefore A = \{ HH, \boxed{\quad}, TH \}.$$

b. Event B : to get no head.

$$B = \{ \boxed{\quad} \}.$$

**Solution:**

**Activity:** If two coins are tossed simultaneously

$$\therefore S = \{ \boxed{HH}, HT, TH, \boxed{TT} \}$$

a. Event A : at least getting one head.

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

b. Event B : to get no head.

$$B = \{ \boxed{TT} \}.$$

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

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

**Solution:**  $t_n = a + (n - 1) d$

In the given A.P,  $a = 7, n = 19$

$$d = t_2 - t_1$$

$$d = 13 - 7 = 6$$

$$t_{19} = 7 + (19 - 1) 6$$

$$t_{19} = 7 + 108$$

$$t_{19} = 115$$

**ii. Obtain a quadratic equation whose roots are -3 and -7.**

**Solution:** Let  $\alpha = -3, \beta = -7$

$$\alpha + \beta = (-3) + (-7) = -10$$

$$\alpha \times \beta = (-3) \times (-7) = 21$$

Quadratic Equation is given by;

$$x^2 - (\alpha + \beta) x + \alpha\beta = 0$$

$$x^2 - (-10) x + 21 = 0$$

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

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



**Solution:** Let the greater number be “a” and the smaller number be “b”.

It is given that;

$$a - b = 3 \dots\dots\dots(i)$$

$$a = 3+b$$

$$a + 2b = 15 \dots\dots\dots(ii)$$

Putting the value of “a” in equation (ii)

$$3+b + 2b = 15$$

$$3+3b = 15$$

$$3(1+b)=15$$

$$1+b = 5$$

$$b = 4$$

Now, finding the value of a

$$a = 3+b$$

$$a = 3+4 = 7$$

Therefore, the smaller number is  $b = 4$ .

**4. Solve the following questions (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?**

**Solution:** It forms an A.P

200, 250, 300,.....

$$a = 200$$

$$d = 250 - 200 = 50$$

$$n = 17$$

$$t_n = ?$$

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

$$t_n = [(2 \times 200) + (17 - 1) 50]$$

$$t_n = [400 + (16 \times 50)]$$

$$t_n = [400 + 800]$$

$$t_n = 1200$$

Therefore, Amit's total saving in 17 months will be Rs. 1200.

**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.**

**Solution:** Total two digit number that can be formed using the digit 0, 1, 2, 3 are 10, 20, 30, 12, 21, 13, 31, 23, 32, 11, 22, 33

Total prime number formed are 13, 31, 23, 11

Required Probability = Number of favourable outcome / Total number of outcomes

$$P = 4/12$$

$$P = 1/3$$

**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?**

**Solution:** Taxable purchase value of solar panel = Rs. 85000

Rate of GST = 5%

Input Tax Credit (ITC) = 5% of 85000 = Rs. 4250

Selling price of the solar panel = Rs. 90000

Output Tax = 5% of 90000 = Rs. 4500

GST payable by Malhotra = Output Tax – Input Tax Credit (ITC)

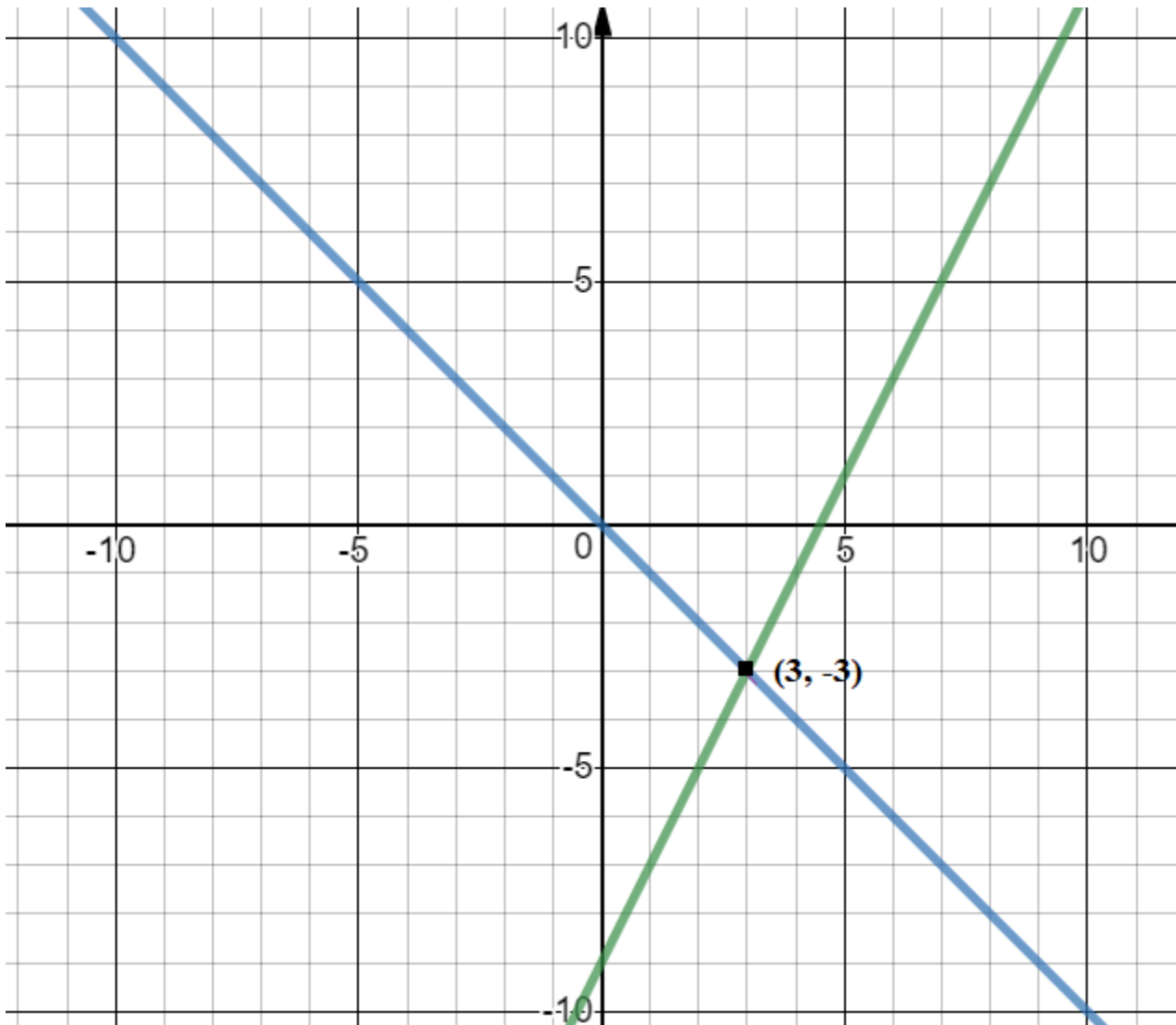
GST payable by Malhotra = 4500 – 4250 = Rs. 250

So, the tax paid by Malhotra is Rs. 250.

**iv. Solve the following simultaneous equations graphically:**

$$x + y = 0; 2x - y = 9$$

**Solution:**



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.**

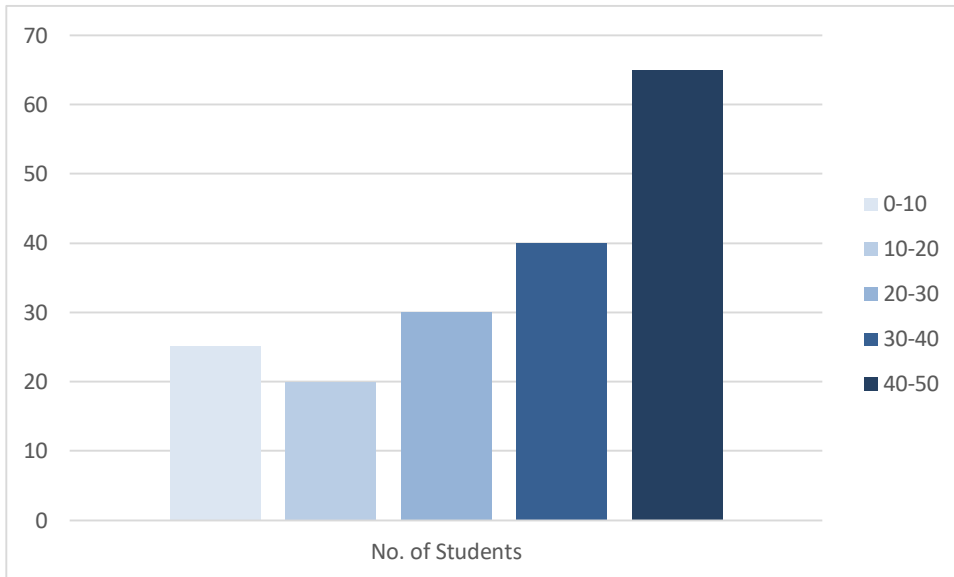
**Solution:** The marks obtained by all students is given = 180

$$25 + x + 30 + 2x + 65 = 180$$

$$3x + 120 = 180$$

$$3x = 60$$

$$x = 20$$



**ii.**

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

**Solutions:** Two tap can fill the tank completely in  $40/13$  minutes.

Let us consider that 1 tap can fill the tank in = x min

So, the smaller tap fill the tank in (x + 3) min

Work done by both tap in 1 min;

$$(1/x) + 1/(x+3) = 13/40$$

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

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

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

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

$$13x^2 - 65x + 24x - 120 = 0$$

$$13x(x-5) + 24(x-5) = 0$$

$$(13x+24)(x-5) = 0$$

$$x = -24/13, x = 5$$

Ignoring the negative value.

Therefore, one tap will take 5 minutes and other tap will be 8 min to fill the tank.

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

**i. The co-ordinates of the point of intersection of lines  $ax + by = 9$  and  $bx + ay = 5$  is  $(3, -1)$ . Find the values of  $a$  and  $b$ .**

**Solution:** Given equations are:

$$ax + by = 9 \dots\dots\dots(i)$$

$$bx + ay = 5 \dots\dots\dots(ii)$$

$(3, -1)$  is given as the point of intersection. So, it will satisfy equation (i) and (ii).

$$3a - b = 9 \dots\dots\dots(iii)$$

$$3b - a = 5 \dots\dots\dots(iv)$$

Now solving equation (iii) and (iv) we get  $b = 3$  and  $a = 4$ .

**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)	Continous 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	$194 + 6 = 200$

**a. Which is the modal class? Why?**

**Solution:** The class where the frequency is maximum is known as the modal class.

In the given table, the highest frequency is 82. So, the modal class is  $74.5 - 79.5$ .

**b. Which is the median class and why?**

**Solution:** Median frequency =  $(10 + 34 + 58 + 82 + 10 + 6)/2$

Median frequency =  $200/2 = 100$

Median class is defined as the class where the median frequency falls in the cumulative frequency.

As we can see in the table, 100 falls under  $69.5 - 74.5$

Therefore, the median class is  $69.5 - 74.5$

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

**Solution:** Median class preceding the median is  $64.5 - 69.5$  and the cumulative frequency of it is 44.

**d. What is the class interval ( $h$ ) to calculate median?**

**Solution:** Class interval = range of the class element set

$h = 64.5 - 59.5$

$h = 5$