

# MSBSHSE Class 10 Mathematics Question Paper 2015

## Algebra Paper with Solutions

### PART - A

**Q. 1. Attempt any five of the following sub-questions:** [5]

(i) State whether the following sequence is an A.P. or not?

1, 4, 7, 10,....

**Solution:**

Given,

1, 4, 7, 10,....

First term = 1

Second term - First term =  $4 - 1 = 3$

Third term - Second term =  $7 - 4 = 3$

The common difference is the same throughout the sequence.

Hence, the given sequence is an Arithmetic progression.

(ii) A card is drawn from the pack of 25 cards labeled with numbers 1 to 25. Write the sample space for this random experiment.

**Solution:**

Given,

25 cards labeled with numbers from 1 to 25.

Sample space =  $S = \{1, 2, 3, 4, 5, \dots, 25\}$

$n(S) = 25$

(iii) Find the value of  $x + y$ , if

$12x + 13y = 29$  and

$13x + 12y = 21$

**Solution:**

Given,

$12x + 13y = 29$ ....(i)

$13x + 12y = 21$ ....(ii)

Adding (i) and (ii),

$12x + 13y + 13x + 12y = 29 + 21$

$25x + 25y = 50$

$25(x + y) = 50$

$x + y = 50/25$

$x + y = 2$

(iv) For a sequence, if  $S_n = n/(n + 1)$  then find the value of  $S_{10}$ .

**Solution:**

Given,

$$S_n = n/(n + 1)$$
$$S_{10} = 10/(10 + 1)$$
$$= 10/11$$

(v) Verify whether 1 is the root of the quadratic equation:  
 $x^2 + 3x - 4 = 0$ .

**Solution:**

If  $\alpha$  is the root of the quadratic equation  $f(x) = 0$ , then  $f(\alpha) = 0$ .

Given,

$$x^2 + 3x - 4 = 0$$

Substituting  $x = 1$ ,

$$\text{LHS} = (1)^2 + 3(1) - 4$$

$$= 1 + 3 - 4$$

$$= 0$$

$$= \text{RHS}$$

Hence, 1 is the root of the given quadratic equation.

(vi) If  $x + y = 5$  and  $x = 3$ , then find the value of  $y$ .

**Solution:**

Given,

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

$$x = 3$$

Substituting  $x = 3$  in (i),

$$3 + y = 5$$

$$y = 5 - 3$$

$$y = 2$$

**Q.2. Attempt any four of the following sub-questions:**

[8]

(i) Solve the following quadratic equation by factorization method

$$x^2 - 7x + 12 = 0.$$

**Solution:**

Given,

$$x^2 - 7x + 12 = 0$$

Using the factorization method: splitting the middle term

$$x^2 - 3x - 4x + 12 = 0$$

$$x(x - 3) - 4(x - 3) = 0$$

$$(x - 4)(x - 3) = 0$$

$$x - 4 = 0, x - 3 = 0$$

$$x = 4, x = 3$$

(ii) Find the term  $t_{10}$  of an A.P.:

$$4, 9, 14, \dots$$

**Solution:**

Given AP:

$$4, 9, 14, \dots$$

$$\text{First term} = a = 4$$

Common difference =  $d = 9 - 4 = 5$

$n$ th term of an AP,

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

$$t_{10} = 4 + (10 - 1)5$$

$$= 4 + 9(5)$$

$$= 4 + 45$$

$$= 49$$

Therefore,  $t_{10} = 49$ .

(iii) If point A(2, 3) lies on the graph of the equation  $5x + ay = 19$ , then find a.

**Solution:**

Given,

A(2, 3) lies on the graph of the equation  $5x + ay = 19$ .

That means, the point satisfies the given equation.

Substituting  $x = 2$  and  $y = 3$  in the given linear equation,

$$5(2) + a(3) = 19$$

$$10 + 3a = 19$$

$$3a = 19 - 10$$

$$3a = 9$$

$$a = 9/3$$

$$a = 3$$

(iv) A die is thrown. If A is an event of getting an odd number, then write the sample space and event A in set notation.

**Solution:**

Given,

A die is thrown.

Sample space =  $S = \{1, 2, 3, 4, 5, 6\}$

$$n(S) = 6$$

A = The event of getting an odd number

$$A = \{1, 3, 5\}$$

$$n(A) = 3$$

(v) For a certain frequency distribution, the value of Mean is 101 and Median is 100. Find the value of Mode.

**Solution:**

Given,

$$\text{Mean} = 101$$

$$\text{Median} = 100$$

We know that,

$$\text{Mean} - \text{Mode} = 3(\text{Mean} - \text{Median})$$

$$101 - \text{Mode} = 3(101 - 100)$$

$$101 - \text{Mode} = 3(1)$$

$$101 - 3 = \text{Mode}$$

$$\Rightarrow \text{Mode} = 98$$

(vi) If one root of the quadratic equation  $kx^2 - 7x + 5 = 0$  is 1, then find the value of k.

**Solution:**

Given,

$$kx^2 - 7x + 5 = 0$$

One root of the given quadratic equation = 1

Substituting  $x = 1$  in the given equation,

$$k(1)^2 - 7(1) + 5 = 0$$

$$k - 7 + 5 = 0$$

$$k - 2 = 0$$

$$k = 2$$

**Q.3. Attempt any three of the following sub-questions:**

[9]

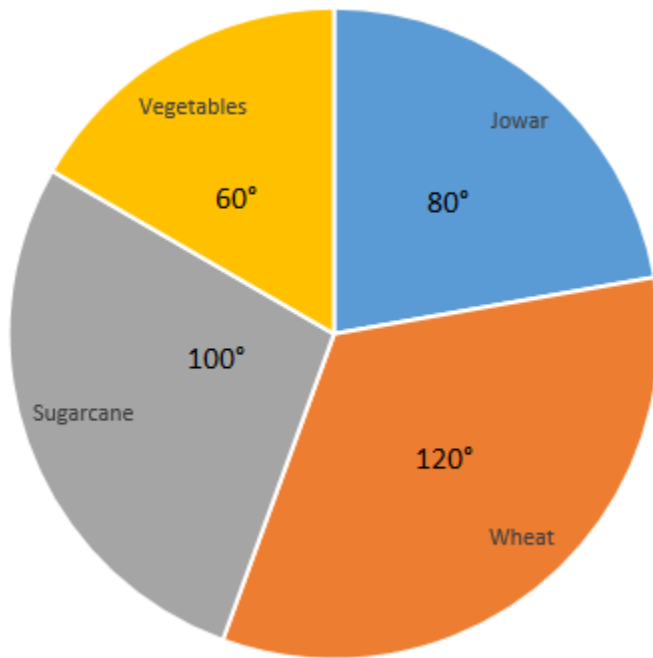
(i) The area under different crops in a certain village is given below. Represent it with a pie diagram:

Crop	Area in Hectares
Jowar	40
Wheat	60
Sugarcane	50
Vegetables	30

**Solution:**

Crop	Area in Hectares	Measure of central angle
Jowar	40	$(40/180) \times 360^\circ = 80^\circ$
Wheat	60	$(60/180) \times 360^\circ = 120^\circ$
Sugarcane	50	$(50/180) \times 360^\circ = 100^\circ$
Vegetables	30	$(30/180) \times 360^\circ = 60^\circ$
Total	180	$360^\circ$

Pie chart:



(ii) If two coins are tossed, then find the probability of the event that at the most one tail turns up.

**Solution:**

Given,

Two coins are tossed.

Sample space =  $S = \{HH, HT, TH, TT\}$

$n(S) = 4$

Let A be the event of getting at the most one tail.

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

$n(A) = 3$

$P(A) = n(A)/n(S)$

$= 3/4$

Hence, the required probability is  $3/4$ .

(iii) Solve the following simultaneous equations using the graphical method:

$$x + y = 7;$$

$$x - y = 5.$$

**Solution:**

Given,

$$x + y = 7$$

$$x - y = 5$$

Consider the first equation:

$$x + y = 7$$

$$y = 7 - x$$

x	0	6	7
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y	7	1	0
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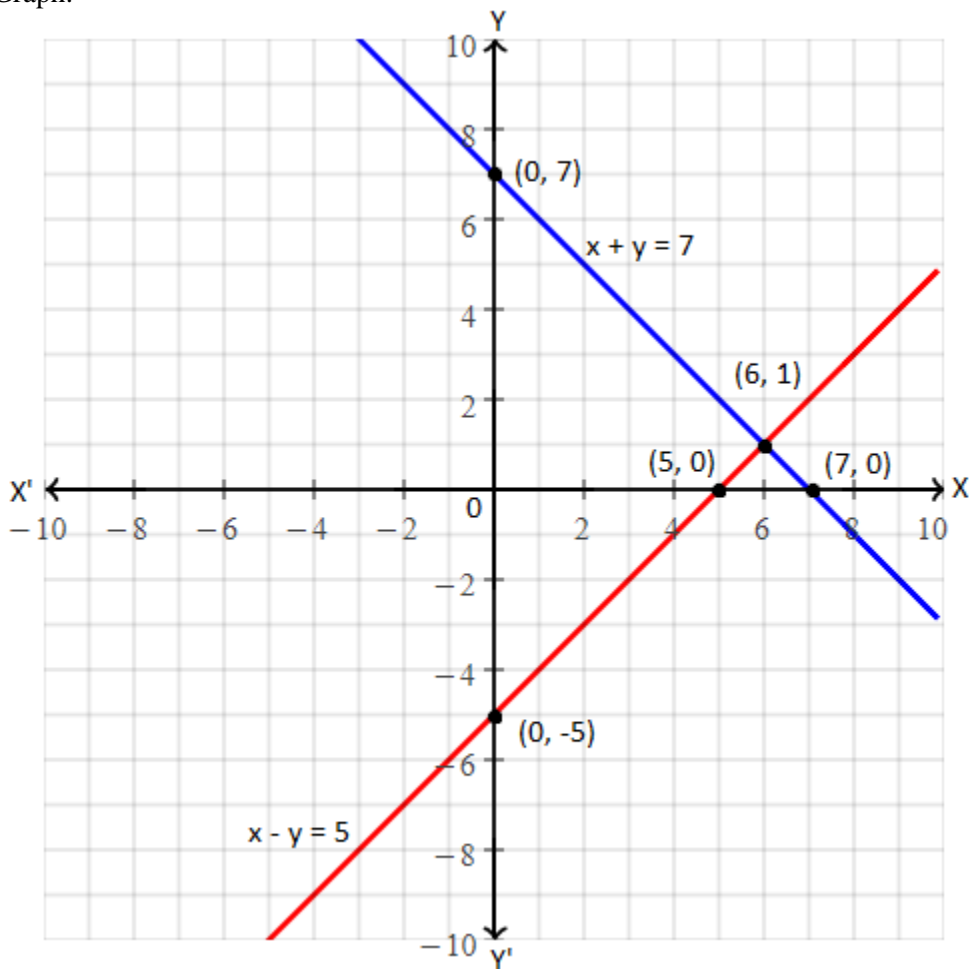
Now, consider another equation:

$$x - y = 5$$

$$y = x - 5$$

x	0	5	6
y	-5	0	1

Graph:



The lines intersecting with each other at (6, 1).

Hence, the solution of the given pair of linear equations is  $x = 6$  and  $y = 1$ .

(iv) There is an auditorium with 35 rows of seats. There are 20 seats in the first row, 22 seats in the second row, 24 seats in the third row, and so on. Find the number of seats in the twenty-second row.

**Solution:**

Given,

An auditorium has 35 rows of seats.  
Number of seats in the first row = 20  
Number of seats in the second row = 22  
Number of seats in the third row = 24  
i.e. 20, 22, 24,.....

This is an AP with  $a = 20$  and  $d = 2$   
 $n = 35$

nth term of an AP:

$$\begin{aligned}t_n &= a + (n - 1)d \\t_{22} &= 20 + (22 - 1)2 \\&= 20 + 21(2) \\&= 20 + 42 \\&= 62\end{aligned}$$

Hence, there are 62 seats in the twenty-second row.

(v) Solve the following quadratic equation by completing the square method:

$$x^2 + 11x + 24 = 0$$

**Solution:**

Given,

$$x^2 + 11x + 24 = 0$$

$$x^2 + 11x = -24 \dots (i)$$

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

$$a = 1, b = 11, c = 24$$

$$b^2/4a = (11)^2/4(1)$$

$$= 121/4$$

Adding  $121/4$  on both sides of (i),

$$x^2 + 11x + (121/4) = -24 + (121/4)$$

$$x^2 + 11x + (11/2)^2 = (-96 + 121)/4$$

$$(x + 11/2)^2 = 25/4$$

$$x + 11/2 = \pm 5/2$$

$$x = -(11/2) \pm (5/2)$$

$$x = (-11 \pm 5)/2$$

$$x = (-11 + 5)/2, x = (-11 - 5)/2$$

$$x = -6/2, x = -16/2$$

$$x = -3, x = -8$$

**Q.4. Attempt any two of the following sub-questions: [8]**

(i) Two-digit numbers are formed using the digits 0, 1, 2, 3, 4, 5 where digits are not repeated.

P is the event that the number so formed is even.

Q is the event that the number so formed is greater than 50.

R is the event that the number so formed is divisible by 3

Then write the sample space S and events P, Q, R using set notation.

**Solution:**

Two-digit numbers are formed using the digits 0, 1, 2, 3, 4, 5 without repeating the digits are:

$$S = \{10, 12, 13, 14, 15, 20, 21, 23, 24, 25, 30, 31, 32, 34, 35, 40, 41, 42, 43, 45, 50, 51, 52, 53, 54\}$$

$$n(S) = 25$$

P = The event the number so formed is even

$$P = \{10, 12, 14, 20, 24, 30, 32, 34, 40, 42, 50, 52, 54\}$$

$$n(P) = 13$$

Q = The event that the number so formed is greater than 50

$$Q = \{51, 52, 53, 54\}$$

$$n(Q) = 4$$

R = The event that number so formed is divisible by 3

$$R = \{12, 15, 21, 24, 30, 42, 45, 51, 54\}$$

$$n(R) = 9$$

(ii) The following table shows ages of 300 patients getting medical treatment in a hospital on a particular day:

Age (in years)	No. of Patients
10 - 20	60
20 - 30	42
30 - 40	55
40 - 50	70
50 - 60	53
60 - 70	20

Find the median age of the patient.

**Solution:**

Age (in years)	No. of Patients (Frequency)	Cumulative frequency
10 - 20	60	60
20 - 30	42	102
30 - 40	55	157
40 - 50	70	227
50 - 60	53	280
60 - 70	20	300

Sum of frequencies =  $N = 300$

$$N/2 = 300/2 = 150$$

Cumulative frequency greater than and nearest to 150 is 157 which lies in the interval 30 - 40.

Median class = 30 - 40

The lower limit of the median class =  $l = 30$

Frequency of the median class =  $f = 55$

Cumulative frequency of the class preceding the median class =  $cf = 102$

Class height =  $h = 10$

$$\text{Median} = l + \left\{ \frac{(N/2) - cf}{f} \right\} \times h$$



$$\begin{aligned} &= 30 + [(150 - 102)/ 55] \times 10 \\ &= 30 + (480/55) \\ &= 30 + 8.73 \\ &= 38.73 \end{aligned}$$

(iii) If  $\alpha + \beta = 5$  and  $\alpha^3 + \beta^3 = 35$ , find the quadratic equation whose roots are  $\alpha$  and  $\beta$

**Solution:**

Given,

$$\alpha + \beta = 5$$

$$\alpha^3 + \beta^3 = 35$$

$$\alpha^3 + \beta^3 = (\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta)$$

$$35 = (5)^3 - 3\alpha\beta(5)$$

$$35 = 125 - 15\alpha\beta$$

$$15\alpha\beta = 125 - 35$$

$$15\alpha\beta = 90$$

$$\alpha\beta = 90/15$$

$$\alpha\beta = 6$$

Hence, the required quadratic equation is  $x^2 - (\alpha + \beta)x + \alpha\beta = 0$

$$x^2 - 5x + 6 = 0$$

**Q.5. Attempt any two of the following sub-questions:**

**[10]**

(i) Babubhai borrows Rs. 4,000 and agrees to repay with a total interest of Rs. 500 in 10 installments, each installment being less than the preceding installment by Rs. 10. What should be the first and the last installment?

**Solution:**

Given,

Babubhai borrows Rs. 4,000 and agrees to repay with a total interest of Rs. 500 in 10 installments.

Total amount = Rs. 400 + Rs. 500

Rs. 4500

Also, given that each installment reduces by Rs. 10 than previous installments.

That mean, this is an AP with  $d = -10$

$$n = 10$$

Let  $a$  be the first installment.

$$S_{10} = 4500 \text{ (given)}$$

$$n/2 [2a + (n - 1)d] = 4500$$

$$(10/2) [2a + 9(-10)] = 4500$$

$$2a - 90 = 4500/5$$

$$2a = 900 + 90$$

$$2a = 990$$

$$a = 990/2$$

$$a = 495$$

$$t_{10} = a + (n - 1)d$$

$$= 495 + 9(-10)$$

$$= 495 - 90$$

$$= 405$$

Hence, the first installment is Rs. 495 and the last installment is Rs. 405.

(ii) On the first day of the sale of tickets for a drama, all 35 tickets were sold. If the rates of the tickets were Rs. 20 and Rs. 40 per ticket and the total collection was Rs. 900. Find the number of tickets sold at each rate.

**Solution:**

Let  $x$  be the number of tickets sold at Rs. 20 each and  $y$  be the number of tickets sold at Rs. 40 each.

According to the given,

$$x + y = 35 \dots (i)$$

$$20x + 40y = 900$$

$$20(x + 2y) = 900$$

$$x + 2y = 45 \dots (ii)$$

Subtracting (i) from (ii),

$$x + 2y - (x + y) = 45 - 35$$

$$y = 10$$

Substituting  $y = 10$  in (i),

$$x + 10 = 35$$

$$x = 35 - 10 = 25$$

Therefore, 25 tickets were sold at Rs. 20 each and 10 tickets were sold at Rs. 40 each.

(iii) Given below is the frequency distribution of driving speeds (in km/hour) of the vehicles of 400 college students:

Speed (in km/hr)	No. of Students
20 - 30	6
30 - 40	80
40 - 50	156
50 - 60	98
60 - 70	60

Draw Histogram and hence the frequency polygon for the above data.

**Solution:**

Speed (in km/hr)	No. of Students	Class mark
20 - 30	6	25
30 - 40	80	35
40 - 50	156	45
50 - 60	98	55
60 - 70	60	65

Scale:

X-axis: 1 cm = 10 km/hr

Y-axis: 1 cm = 20 students

