MSBSHSE Class 10 Mathematics Question Paper 2018 Algebra Paper with Solutions

PART - A

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

(i) Find the next two terms of an A.P. 4, 9, 14,.......

Solution:

Given AP:
4, 9, 14,.....
First term = a = 4
Common difference = d = 9 - 4 = 5
Fourth term = a + 3d = 4 + 3(5) = 4 + 15 = 19
Fifth term = a + 4d = 4 + 4(5) = 4 + 20 = 24
Hence, the next two terms of the given AP are 19 and 24.

(ii) State whether the given equation is quadratic or not. Give reason.
$(5/4)m^2 - 7 = 0$

Solution:

Given,
$(5/4)m^2 - 7 = 0$
Here, m = variable
Highest degree of the variable = 2
By comparing with the standard form $ax^2 + bx + c = 0$,
a = 5/4, b = 0, c = -7
Thus, a, b, c are real numbers and a ≠ 0.
Hence, the given equation is a quadratic equation in variable m.

(iii) If $D_x = 25$, $D = 5$ are the values of the determinants for certain simultaneous equations in x and y, find x.

Solution:

Given,
$D_x = 25$, $D = 5$
By Cramer's rule,
$x = D_x/D$
= 25/5
= 5
Therefore, x = 5

(iv) If S = {2, 4, 6, 8, 10, 12} and A = {4, 8, 12}, find A'.

Solution:

Given,

S = {2, 4, 6, 8, 10, 12}
A = {4, 8, 12}
A' = S - A
= {2, 4, 6, 8, 10, 12} - {4, 8, 12}
= {2, 6, 10}
Therefore, A' = {2, 6, 10}

(v) Write any one solution of equation x + 2y = 7.

Solution:
Given,
x + 2y = 7
Substituting x = 3 and y = 2
LHS = x + 2y
= 3 + 2(2)
= 3 + 4
= 7
= RHS
Therefore, x = 3 and y = 2 is one of the solutions of the equation x + 2y = 7.

(vi) If $S_5 = 15$ and $S_6 = 21$, find t_6.

Solution:
Given,
$S_5 = 15$, $S_6 = 21$
We know that,
$t_n = S_n - S_{n-1}$
$t_6 = S_6 - S_5$
= 21 - 15
= 6
Therefore, $t_6 = 6$

2. Attempt any four of the following sub questions: **[8]**
(i) Find 'n' if the nth term of the following A.P. is 66: 3, 6, 9, 12, ...

Solution:
Given,
3, 6, 9, 12, ...
First term = a = 3
Common difference = d = 6 - 3 = 3
$t_n = 66$
nth term of an AP
$t_n = a + (n - 1)d$
66 = 3 + (n - 1)3
(n - 1)3 = 66 - 3
(n - 1)3 = 63
n - 1 = 63/3
n - 1 = 21
n = 21 + 1
n = 22

(ii) If one of the roots of the quadratic equation $x^2 - 7x + k = 0$ is 4, then find the value of k.

Solution:

Given,

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

4 is one of the roots of the given quadratic equation.

$\Rightarrow (4)^2 - 7(4) + k = 0$

$\Rightarrow 16 - 28 + k = 0$

$\Rightarrow - 12 + k = 0$

$\Rightarrow k = 12$

Therefore, the value of k is 12.

(iii) A box contains 20 cards marked with numbers 1 to 20. One card is drawn at random. Write the event A using the number on the card is multiple of 4. Write S, n(S), A and n(A).

Solution:

Given that a box contains 20 cards marked with numbers 1 to 20.

Sample space: S = {1, 2, 3, 4,...., 20}

n(S) = 20

A is the event of having the number on the card is a multiple of 4.

A = {4, 8, 12, 16, 20}

n(A) = 5

(iv) Find the value of x - y if 3x + 2y = 15, 2x + 3y = 10.

Solution:

Given,

$3x + 2y = 15$….(i)

$2x + 3y = 10$….(ii)

(i) × 2 - (ii) × 3,

$6x + 4y - (6x + 9y) = 30 - 30$

$-5y = 0$

$y = 0$

Substituting y = 0 in (i),

$3x + 2(0) = 15$

$3x = 15$

$x = 15/3$

$x = 5$

$x - y = 5 - 0 = 5$

(v) Form the quadratic equation if its roots are 3 and -4.

Solution:

Let α and β be the zeroes of the quadratic equation.

Given,

$\alpha = 3, \beta = -4$

$\alpha + \beta = 3 - 4 = -1$

$\alpha\beta = 3(-4) = -12$

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

$x^2 - (-1)x - 12 = 0$
$x^2 + x - 12 = 0$

(vi) For a certain frequency distribution, the values of mean and median are 72 and 78 respectively. Find the value of mode.

Solution:
Given,
Mean = 72
Median = 78
Mean - Mode = 3(Mean - Median)
72 - Mode = 3(72 - 78)
Mode = 72 + 18
= 90

3. Attempt any three of the following sub questions: **[9]**
(i) For an A.P., find S_{10} if a = 6 and d = 3.

Solution:
Given,
a = 6
d = 3
$S_n = n/2\ [2a + (n - 1)d]$
$S_{10} = (10/2)\ [2(6) + (10 - 1)3]$
= 5 [12 + 9(3)]
= 5 [12 + 27]
= 5 × 39
= 195

(ii) Solve the following quadratic equation by using the formula method: $3q^2 - 2q = 8$.

Solution:
Given,
$3q^2 - 2q = 8$
$3q^2 - 2q - 8 = 0$
Comparing with the standard form $ax^2 + bx + c = 0$,
a = 3, b = -2, c = -8
$x = [-b \pm \sqrt{(b^2 - 4ac)}]/2a$
$= [-(-2) \pm \sqrt{\{(-2)^2 - 4(3)(-8)\}}]/ 2(3)$
$= [2 \pm \sqrt{(4 + 96)}]/6$
$= (2 \pm \sqrt{100})/6$
= (2 ± 10)/6
x = (2 + 10)/6, x = (2 - 10)/6
x = 12/6, x = -8/6
x = 2, -4/3

(iii) Solve the following simultaneous equations using Cramer’s rule:
4x + 3y = 18; 3x - 2y = 5.

Solution:

Given,
4x + 3y = 18
3x - 2y = 5

$$D = \begin{vmatrix} 4 & 3 \\ 3 & -2 \end{vmatrix} = 4(-2) - 3(3) = -8 - 9 = -17$$

$$D_x = \begin{vmatrix} 18 & 3 \\ 5 & -2 \end{vmatrix} = 18(-2) - 3(5) = -36 - 15 = -51$$

$$D_y = \begin{vmatrix} 4 & 18 \\ 3 & 5 \end{vmatrix} = 4(5) - 18(3) = 20 - 54 = -34$$

x = D_x/D = -51/-17 = 3
y = D_y/D = -34/-17 = 2
Therefore, x = 3 and y = 2.

(iv) A die is thrown, find the probability of the event of getting an odd number.

Solution:
Sample space when a die is thrown
S = {1, 2, 3, 4, 5, 6}
n(S) = 6
Let A be the event of getting an odd number.
A = {1, 3, 5}
n(A) = 3
P(A) = n(A)/n(S)
= 3/6
= 1/2
Hence, the probability of getting an odd number is ½.

(v) The marks obtained by a student in an examination are given below. The total marks out of 100 obtained in various subjects are as follows:

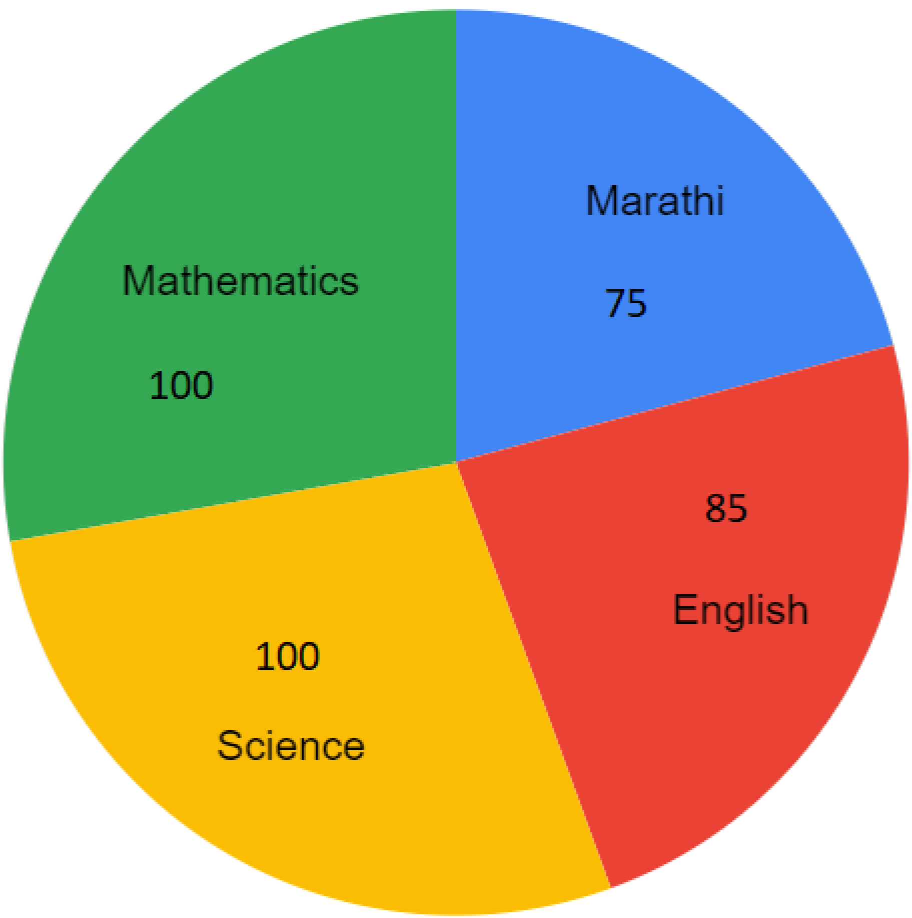
Subject	Marks
Marathi	75
English	85
Science	100
Mathematics	100
Total	360

Represent the above data using a pie diagram.

Solution:

Subject	Marks	Measure of central angle
Marathi	75	$(75/360) \times 360° = 75°$
English	85	$(85/360) \times 360° = 85°$
Science	100	$(100/360) \times 360° = 100°$
Mathematics	100	$(100/360) \times 360° = 100°$
Total	360	360°

Pie chart:



4. Attempt any two of the following sub questions: **[8]**
(i) If $\alpha + \beta = 5$ and $\alpha^3 + \beta^3 = 35$, find the quadratic equation whose roots are α and β.

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

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

(ii) Two dice are thrown. Find the probability of getting:

(a) The sum of the numbers on their upper faces is at least 9.

(b) The sum of the numbers on their upper faces is 15.

(c) The number of the upper face of the second die is greater than the number on the upper face of the first die.

Solution:

Sample space S = {(1, 1) (1, 2) (1, 3) (1, 4) (1, 5) (1, 6)
(2, 1) (2, 2) (2, 3) (2, 4)(2, 5)(2, 6)
(3, 1)(3, 2) (3, 3) (3, 4)(3, 5) (3, 6)
(4, 1) (4, 2) (4,3) (4, 4)(4, 5)(4, 6)
(5, 1)(5, 2)(5, 3)(5, 4)(5, 5) (5, 6)
(6, 1) (6, 2)(6, 3) (6, 4) (6,5) (6,6)}

n(S) = 36

Let A be the event if getting the sum of the numbers on their upper faces is at least 9.

A = {(3, 6) (4, 5)(4, 6)(5, 4) (5, 5) (5,6) (6,3) (6, 4) (6, 5)(6, 6)}

n(A) = 10

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

= 10/36

= 5/18

Let B be the event of getting the sum of the numbers on their upper faces is 15.

The maximum sum is 12.

n(B) = 0

P(B) = n(B)/n(S)

= 0/36

= 0

Let C be the event of getting the number of the upper face of the second die is greater than the number on the upper face of the first die.

C = {(1, 2) (1, 3) (1, 4) (1, 5) (1, 6) (2, 3) (2, 4) (2, 5) (2, 6) (3, 4) (3, 5) (3, 6) (4, 5) (4, 6) (5, 6)}

n(C) = 15

P(C) = n(C)/n(S)

= 15/36

= 5/12

(iii) Frequency distribution of daily commission received by 100 salesmen is given below:

Daily commission (in Rs.)	No. of salesmen

100 - 120	20
120 - 140	45
140 - 160	22
160 - 180	09
180 - 200	04

Find mean daily commission received by salesmen, by the assumed mean method.

Solution:

Daily commission (in Rs.)	No. of salesmen (f_i)	Class mark (x_i)	$d_i = x_i - A$ $d_i = x_i - 150$	$f_i d_i$
100 - 120	20	110	-40	-800
120 - 140	45	130	-20	-900
140 - 160	22	150 = A	0	0
160 - 180	09	170	20	180
180 - 200	04	190	40	160
	$\sum f_i = 100$			$\sum f_i d_i = -1360$

Mean = A + ($\sum f_i d_i / \sum f_i$)
= 150 + (-1360/100)
= 150 - 13.6
= 136.4
Hence, the mean daily commission is Rs. 136.4.

5. Attempt any two of the following sub questions: **[10]**
(i) A boat takes 10 hours to travel 30 km upstream and 44 km downstream, but it takes 13 hours to travel 40 km upstream and 55 km downstream. Find the speed of the boat in still water and the speed of the stream.

Solution:
Let x km/hr be the speed of the boat in still water and y km/hr be the speed of the stream.
Speed of the boat downstream = (x + y) km/hr
Speed of the boat upstream = (x - y) km/hr
Time = Distance/Speed
Time taken by the boat to cover 30 km upstream = 30/(x - y) hours
Time taken by the boat to cover 44 km downstream = 44/(x + y) hours
According to the given,
[30/(x - y)] + [44/(x + y)] = 10....(i)
Similarly,
[40/(x - y)] + [55/(x + y)] = 13....(ii)

Substituting $1/(x - y) = a$ and $1/(x + y) = b$ in the above equations,
$30a + 44b = 10$....(iii)
$40a + 55b = 13$....(iv)
(iii) x 4 - (iv) x 3,
$120a + 176b - (120a + 165b) = 40 - 49$
$11b = 1$
$b = 1/11$
Substituting $b = 1/11$ in (iii),
$30a + 44(1/11) = 10$
$30a + 4 = 10$
$30a = 6$
$a = 6/30 = 1/5$
Now,
$1/(x - y) = a$
$1/(x - y) = 1/5$
$x - y = 5$....(v)
And
$1/(x + y) = b$
$1/(x + y) = 1/11$
$x + y = 11$....(vi)
Adding (i) and (ii),
$2x = 16$
$x = 8$
Substituting $x = 8$ in (v),
$8 - y = 5$
$y = 8 - 5$
$y = 3$
Hence, the speed of the boat in still water is 8 km/hr and the speed of the stream is 3 km/hr.

(ii) If the 9th term of an A.P. is zero, then prove that the 29th term is double of the 19th term.

Solution:
Let a be the first term and d be the common difference of an AP.
nth term of AP
$t_n = a + (n - 1)d$
Given,
9th term of an AP is 0.
$t_9 = 0$
$a + (9 - 1)d = 0$
$a + 8d = 0$….(i)
29th term:
$t_{29} = a + (29 - 1)d$
$= a + 28d$
$= a + 8d + 20d$
$= 0 + 20d$ [from (i)]
$t_{29} = 20d$….(ii)
19th term:
$t_{19} = a + (19 - 1)d$
$= a + 18d$
$= a + 8d + 10d$

= 0 + 10d [from (i)]
t_{19} = 10d….(iii)
From (ii) and (iii),
$t_{29} = 2 \times t_{19}$
Hence proved.

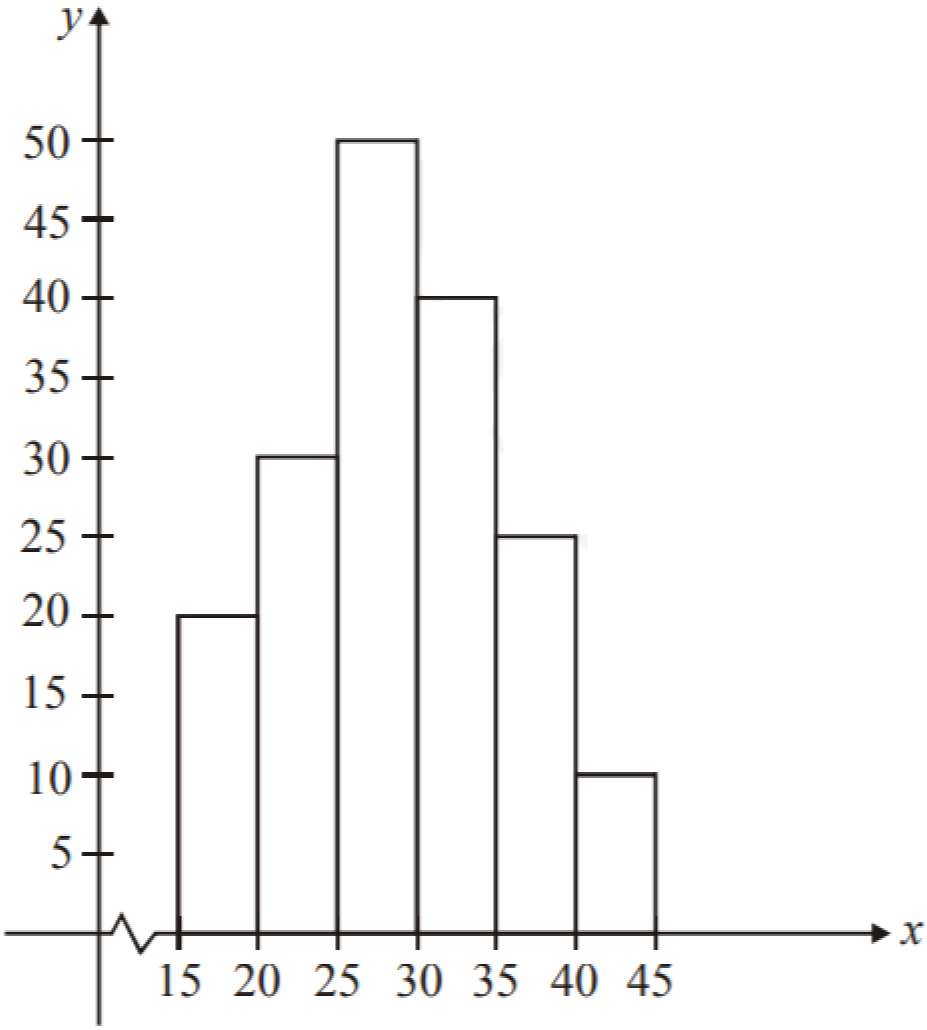
(iii) Draw histogram and frequency polygon on the same graph paper for the following frequency distribution:

Class	Frequency
15 - 20	20
20- 25	30
25 - 30	50
30 - 35	40
35 - 40	25
40 - 45	10

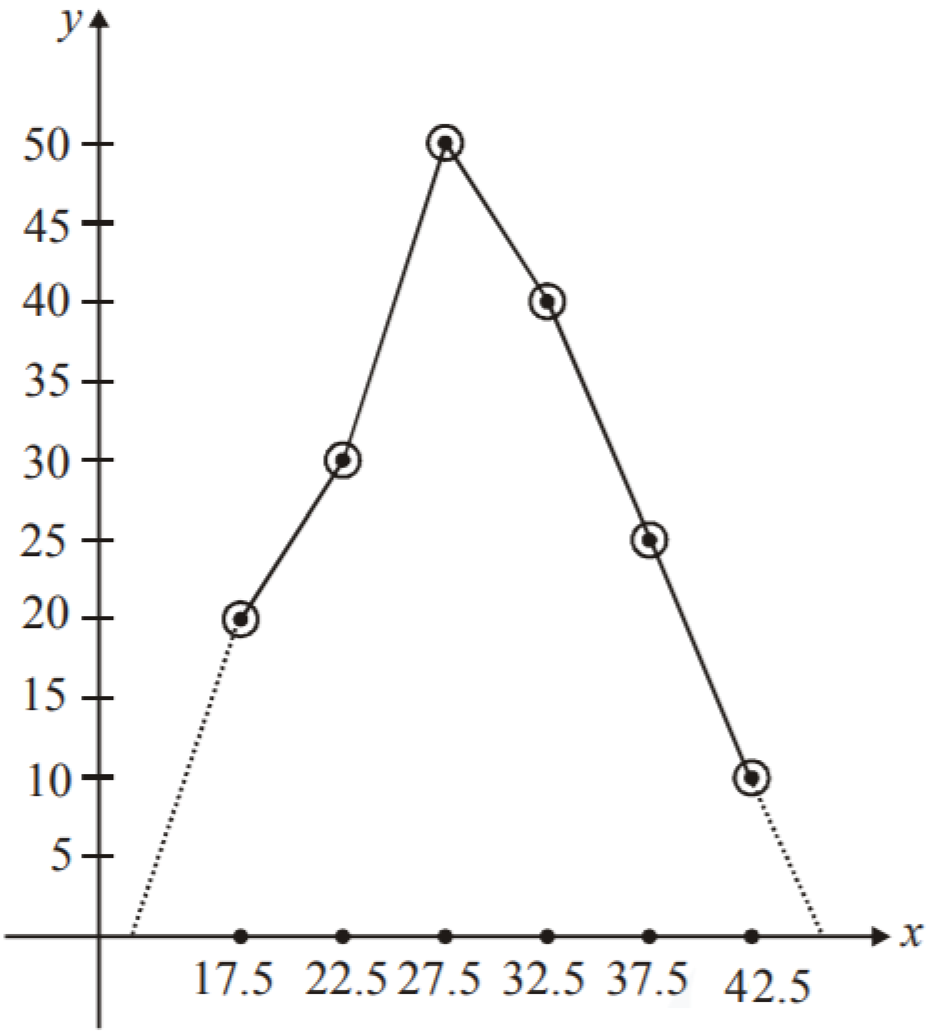
Solution:

Class	Frequency	Class mark
15 - 20	20	17.5
20- 25	30	22.5
25 - 30	50	27.5
30 - 35	40	32.5
35 - 40	25	37.5
40 - 45	10	42.5

Histogram:



Frequency polygon:


y
50
45
40
35
30
25
20
15
10
5
x
17.5
22.5
27.5
32.5
37.5
42.5