Mizoram Board
Class IX
Mathematics
Sample Paper – 2 Solution

Time: 3 hrs **Total Marks: 80**

Section A

1. Correct answer: iii

$\left(6+\sqrt{27}\right)-\left(3+\sqrt{3}\right)+\left(1-2\sqrt{3}\right)$

$=6+3\sqrt{3}-3-\sqrt{3}+1-2\sqrt{3}$

$=4$

It is positive and rational.

2. Correct answer: ii

The value of the polynomial $x^2 - x - 1$ at $x = -1$ equals $(-1)^2 - (-1) - 1 = 1 + 1 - 1 = 1$

3. Correct answer: ii

The number of line segments determined by 3 non-collinear points is three.

4. Correct answer: i

If we divide or multiply both sides of a linear equation with a non-zero number, then the solution of the linear equation remains the same as the graph of the equation remains same in both the cases.

5. Correct answer: i

m∠PSR = m∠RQP = 125° (since PQRS is a parallelogram, opposite angles will be equal)

⇒m∠PQT = 180° (PQT is a straight line)

⇒m∠PQR + m∠RQT = 180°

⇒125° + m∠RQT = 180°

⇒m∠RQT = 55°

6. Correct answer: i

Class size is the difference between two successive class marks, i.e. 10 – 6 = 4

7. Correct answer: ii

$\frac{56}{1000}=0.056$

8. Correct answer: iii
The abscissa or x-coordinate of any point on Y-axis is zero

9. Correct answer: ii

10. Correct answer: i
Since AOB is a straight line,
$\angle$ AOB = 180°
$\Rightarrow$ x + 10° + x + x + 20° = 180°
$\Rightarrow$ 3x = 150°
$\Rightarrow$ x = 50°

11. Correct answer: i
Probability of winning + Probability of losing = 1
Thus, probability of losing = 1 - 0.9 = 0.1

12. Correct answer: ii
If a data has an odd number of observations n, then the median = $\left(\frac{n+1}{2}\right)^{th}$ observation, i.e. 50^{th} observation

13. Correct answer: i
Given: height (h) = 12 cm and radius (r) = 7 cm
Volume of a Cone = $\frac{1}{3}\pi r^2 h$

$$= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 12 \text{ cm}^3$$
$$= 616 \text{ cm}^3$$

14. Correct answer: ii
Given: Let a, b and c denotes the sides of the triangle.
a= 37.5 cm, b= 37.5 cm, c=45 cm
S = 60 cm

Area of the triangle

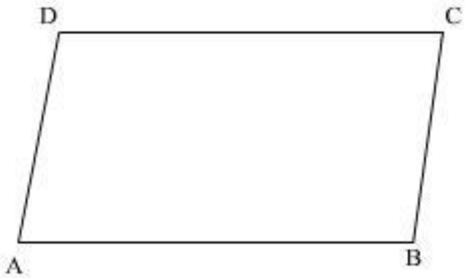
$$= \sqrt{s(s-a)(s-b)(s-c)}$$
$$= \sqrt{60 \times 22.5 \times 22.5 \times 15}$$
$$= 675 \text{ cm}^2$$

15. Correct answer: iv
The point of intersection of the perpendicular bisectors of the sides of a triangle is called circumcentre.

16. Correct answer:i
If a line segment joining two points subtends equal angles at the two points lying on the same side of the line segment, then the four points are con-cyclic.

17. Correct answer: iv
Area of a rectangle = length × Breadth= xy square units

18. Correct answer: i



AD || BC, AB is a transversal
∴ $\angle A + \angle B = 180^o$ (interior angles are supplementary)
∴ Similarly, $\angle B + \angle C = 180^o$, $\angle D + \angle A = 180^o$, $\angle C + \angle D = 180^o$

19. Correct answer: iii
Two sides and the angle (other than the angle between the two equal sides) is not enough to prove the congruency of triangles. So, SSA is not a congruence criterion.

20. Correct answer: ii
Here, $4x + 5x = 180^o$
Or, $9x = 180^o$
Or, $x = 20^o$
$4x = 4 \times 20^o = 80^o$
$5x = 5 \times 20^o = 100^o$
Thus, angles are: 80^o, 100^o

21. Correct answer: ii
Three non-collinear points determines three line segments.

22. Correct answer: i
The graph of a linear equation is always a straight line.

23. Correct answer: ii
All the points (-1,2), (-4,7),(-3,1) and (-2,4) have x coordinate with negative sign (x < 0) and y coordinate with positive sign (y > 0). And the coordinates of II quadrant are of the form x < 0 and y > 0.

24. Correct answer:iii

Let a = 30, b = 20 and c = -50. Then, a + b + c = 0

$a^3 + b^3 + c^3 = 3abc = 3 \times 30 \times 20 \times (-50) = -90000$

Section B

25. Factorising $ky^2 - 6ky + 8k$, we have

$= k(y^2 - 6y + 8)$

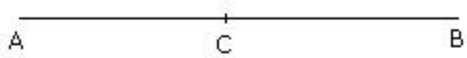
$= k(y^2 - 4y - 2y + 8)$

$= k(y - 4)(y - 2)$

Thus, the dimensions of cuboid are given by the expressions k, (y-4) and (y 2).

26.

Given: AC = BC



AC +AC = BC + AC

(If equals are added to equal the wholes are equal)

$\Rightarrow$ 2AC = AB

Hence, AC = $\frac{1}{2}$AB

27. Here $\angle ADC = y = \angle ACD$

Ext. $\angle ACD = \angle ABC + \angle BAC$

$\therefore 2\angle BAC = \angle ACD = y$

$\Rightarrow \angle BAC = \frac{y}{2}$

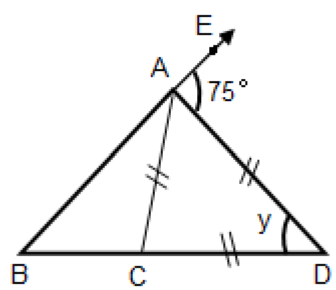
$\therefore \frac{y}{2} + (180° - 2y) = 180° - 75°$

$\Rightarrow \frac{y}{2} + 180° - 2y = 180° - 75$

$\Rightarrow \frac{y}{2} - 2y = -75°$

$\Rightarrow -\frac{3y}{2} = -75°$

$\Rightarrow y = 50°$



28. Let 'l' be the length of the cube.

Now, T.S.A. of the cube = 294 cm^2 ...(given)

$\therefore 6l^2 = 294$

$\therefore l^2 = \frac{294}{6} = 49$

$\therefore$ Side (l) = 7 cm.

Volume of cube = l × l × l = 7 × 7 × 7 = 343 cm^3

29. Number of students born in August = 6

Total number of students = 40

Required probability= $\frac{\text{Number of students born in August}}{\text{Total number of students}} = \frac{6}{40} = \frac{3}{20}$

30. Given: a = 3 + b

a – b = 3

Applying the cubic identity on both the sides

$(a - b)^3 = 3^3$

$\Rightarrow a^3 - b^3 - 3(a)(b)(a - b) = 27$

$\Rightarrow a^3 - b^3 - 3ab(3) = 27$ $(\because a - b = 3)$

$\Rightarrow a^3 - b^3 - 9ab = 27$

31.

Since AB || DC

$\angle x = 30^0$ [Alternate angles]

In ΔABD

$80^0 + 30^0 + \angle y = 180^0$

$\angle y = 180^0 - 110^0 = 70^0$

In ΔBDC

$30^0 + (70^0 - 30^0) + \angle z = 180^0$

$\angle z = 110^0$

Or

Let the angles of a quadrilateral be 2x, 5x, 8x and 9x respectively.

By the angle sum property of a quadrilateral, we have

2x + 5x + 8x + 9x = 360°

$\therefore$ 24x = 360°

$\therefore$ x = 15°

Now,

First angle = 2x = 2 × 15 = 30°,

Second angle = 5x = 5 × 15 = 75°,

Third angle = 8x = 8 × 15 = 120° and

Fourth angle = 9x = 9 × 15 = 135°.

Thus, the angles of a quadrilateral are 30°, 75°, 120° and 135°.

32. $27p^3 + 8q^3 + 54p^2q + 36pq^2$

$=(3p)^3 + (2q)^3 + 18pq(3p+2q)$

$=(3p)^3 + (2q)^3 + 3 \times 3p \times 2q\ (3p + 2q)$

$=(3p + 2q)^3$ $[(a + b)^3 = a^3 + b^3 + 3ab\ (a + b)$ where $a = 3p$ and $b = 2q$]

$= (3p + 2q)\ (3p + 2q)\ (3p + 2q)$

33. $b^2 + c^2 + 2(ab + bc + ca)$

$= a^2 + b^2 + c^2 + 2ab + 2bc + 2ca – a^2$ [Adding and suntracting a^2]

$=[a^2 + b^2 + c^2 + 2ab + 2bc + 2ca] – a^2$

$=(a + b + c)^2 – (a)^2$ [Using $x^2 + y^2 + 2xy + 2yz + 2zx = (x + y + z)^2$]

$=(a + b + c + a)(a + b + c – a)$ [Because $a^2 – b^2 = (a+ b)\ (a - b)$]

$=(2a + b +c)(b + c)$

Or

Let $p(z) = az^3 + 4z^2 + 3z - 4$ and $q(z) = z^3 - 4z + a$

When p(z) is divided by z-3, the remainder is given by:

$p(3) = a \times 3^3 + 4 \times 3^2 + 3 \times 3 - 4$

$= 27a + 36 + 9 - 4$

$= 27a + 41$ ………………..(i)

When q(z) is divided by z-3 the remainder is given by:

$q(3)= 3^3 – 4 \times 3 + a$

$= 27 – 12 + a$

$= 15 + a$ ……………..(ii)

Given that p(3) = q(3). So, from (i) and (ii), we have:

$27a + 41 = 15 + a$

$27a - a = -41 + 15$

$26a = -26$

$a = -1$

34. 2x = z (Alternate angles, as $l_1 \parallel l_2$)

y = z (Alternate angles, as $a_1 \parallel a_2$)

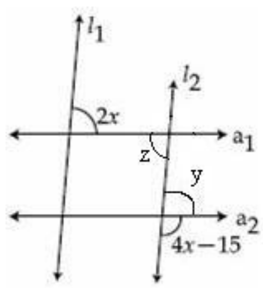
So, 2x = y

Now, y + 4x – 15 = 180°(linear pair)

2x + 4x – 15 = 180°

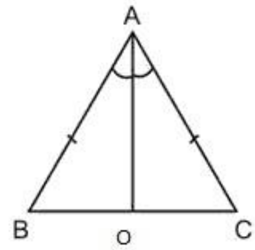
6x = 195°

x = 32.5



Or

Let ABC be an isosceles triangle with AB = AC.



Construction: Draw the bisector AO of $\angle$A.
In ΔABO and ΔACO, we have:
AB=AC (Given)
AO=OA (Common)
$\angle$BAO=$\angle$CAO (By Construction)
$\triangle$ABO $\cong$ $\triangle$ACO (By SAS congruence criteria)

Section C

35. Number of white balls = x
Total number of balls = 12

$\therefore P(\text{white ball}) = \frac{x}{12}$

If 6 white balls are added, we have
Total number of balls = 18
Number of white balls = x + 6

Now, $P(\text{getting a white ball}) = \frac{x+6}{18}$

According to the given information,

$\frac{x+6}{18} = 2\left(\frac{x}{12}\right)$

$\therefore \frac{x+6}{18} = \frac{x}{6}$

$\therefore 6x + 36 = 18x$

$\therefore 12x = 36$

$\therefore x = 3$

36. Length (l_1) of the storehouse = 40 m

Breadth (b_1) of the storehouse = 25 m

Height (h_1) of the storehouse = 10 m

Volume of storehouse = $l_1 \times b_1 \times h_1 = (40 \times 25 \times 10)\ m^3 = 10000\ m^3$

Length (l_2) of a wooden crate = 1.5 m

Breadth (b_2) of a wooden crate = 1.25 m

Height (h_2) of a wooden crate = 0.5 m

Volume of a wooden crate = $l_2 \times b_2 \times h_2 = (1.5 \times 1.25 \times 0.5)\ m^3 = 0.9375\ m^3$

Let the number of wooden crates stored in the storehouse be ‘n’.

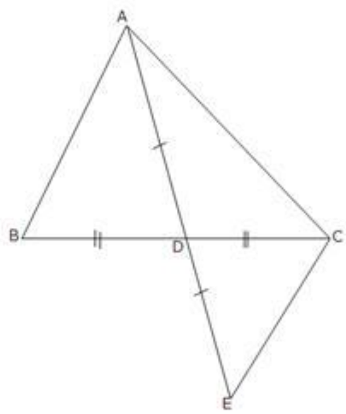
Hence, volume of ‘n’ wooden crates = Volume of storehouse

0.9375 × n = 10000

$\therefore n = \frac{10000}{0.9375} = 10666.66$

Thus, 10666 wooden crates can be stored in the storehouse.

37. Given: AD is median of triangle ABC
To Prove: AB+AC>2AD
Proof: Produce AD so that AD = DE



Now, in triangles ADB and EDC,
AD = DE
BD = DC
∠ADB = ∠EDC
Thus, triangles ADB and EDC are congruent (By SAS congruence criterion)
Hence, AB = EC (CPCT)
Now, in triangle AEC,
AC + CE > AE
AC + CE > 2AD
AC + AB > 2AD (since, AB = EC, proved above)

38.

$$\frac{16\times 2^{n+1}-4\times 2^{n}}{16\times 2^{n+2}-2\times 2^{n+2}}$$

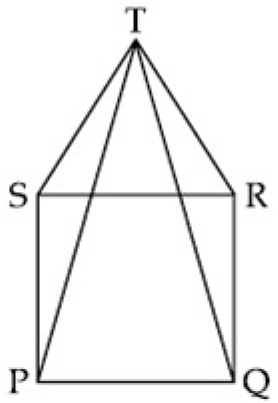
$$=\frac{2^{4}\times 2^{n+1}-2^{2}\times 2^{n}}{2^{4}\times 2^{n+2}-2\times 2^{n+2}}$$

$$=\frac{2^{n+5}-2^{n+2}}{2^{n+6}-2^{n+3}}$$

$$=\frac{2^{n+5}-2^{n+2}}{2.2^{n+5}-2.2^{n+2}}$$

$$=\frac{\left(2^{n+5}-2^{n+2}\right)}{2\left(2^{n+5}-2^{n+2}\right)}=\frac{1}{2}$$

39.



□PQRS is a square

$\therefore$ PQ = QR = RS = SP ... (i)

Also $\angle$RSP = $\angle$SRQ = $\angle$RQP = $\angle$SPQ = 90° ... (ii)

Also ΔTSR is equilateral

TS = TR = SR ... (iii)

Also $\angle$STR = $\angle$TSR = $\angle$TRS = 60°

From (i) and (iii)

TR = QR

Also $\angle$TSP = $\angle$RSP + $\angle$TSR = 90° + 60° = 150°

Similarly $\angle$TRQ = 150°

In ΔTSP and ΔTRQ,

PS = QR [by (i)]

$\angle$TSP = $\angle$TRQ [both 150°]

TS = TR [by (iii)]

$\therefore$ ΔTSP $\cong$ ΔTRQ [by SAS criterion]

40.

a)

$$\left\{5\left(2^{3\times\frac{1}{3}}+3^{3\times\frac{1}{3}}\right)^{3}\right\}^{\frac{1}{4}}$$

$$=\left[5(2+3)^{3}\right]^{\frac{1}{4}}$$

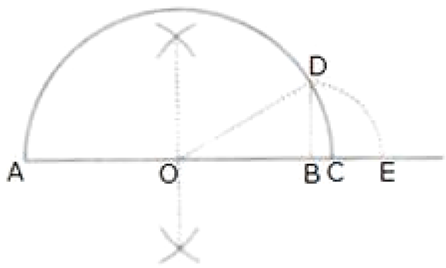
$$=\left(5\times5^{3}\right)^{\frac{1}{4}}$$

$$=5^{4\times\frac{1}{4}}$$

$$=5$$

b) In order to represent $\sqrt{7}$ on number line, we follow the steps given below:

Step 1: Draw a line and mark a point A on it.
Step 2: Mark a point B on the line drawn in step 1 such that AB = 7 cm.
Step 3: Mark a point C on AB produced such that BC = 1 unit.
Step 4: Find mid-point of AC. Let the mid-point be O.
Step 5: Taking O as the centre and OC = OA as radius draw a semicircle. Then, draw a line passing through B perpendicular to OB. Let the perpendicular cut the semicircle at D.
Step6: Taking B as the centre and radius BD draw an arc cutting OC produced at E. Point E so obtained represents $\sqrt{7}$.



41. Arranging the given data in ascending order, we have

41, 43, 57, 58, 61, 71, 92, 99, 127

Here, n = 9 (odd)

$$\therefore \text{Median} = \left(\frac{n+1}{2}\right)^{th} \text{ value}$$
$$= \left(\frac{9+1}{2}\right)^{th} \text{ value}$$
$$= 5^{th} \text{ value}$$
$$= 61$$

If 58 is replaced by 85, we get the following data:

41, 43, 57, 61, 71, 85, 92, 99, 127

$$\therefore \text{New median} = \left(\frac{n+1}{2}\right)^{th} \text{ value}$$
$$= \left(\frac{9+1}{2}\right)^{th} \text{ value}$$
$$= 5^{th} \text{ value}$$
$$= 71$$

Or

Diameter = 24 m ⇒ radius = 12 m

Radius of the conical part = Radius of the cylindrical part (r) = 12 m

Height of cylindrical part (h) = 11 m, height of the cone (h) = 5 m

For the conical part of the circus tent,

$l^2 = r^2 + h^2$

$$\therefore l = \sqrt{r^2 + h^2}$$
$$\therefore l = \sqrt{12^2 + 5^2} = \sqrt{144 + 25} = \sqrt{169} = 13 \text{ m}$$

Surface area of the tent = Curved surface area of the conical part + Curved surface area of the cylindrical part

$$\therefore \text{Surface area of the tent} = \pi rl + 2\pi rh$$
$$= \pi r(l + 2h)$$
$$= \frac{22}{7} \times 12(13 + 22)$$
$$= \frac{22}{7} \times 12 \times 35$$
$$= 1320 \text{ m}^2$$

Breadth of the canvas (B) = 5 m

Let the length of the canvas = L

Now, area of canvas required = surface area of the tent

∴ L × B = 1320

∴ L × 5 = 1320

∴ L = 264 m

Thus, 264 m long canvas is required to make the tent.

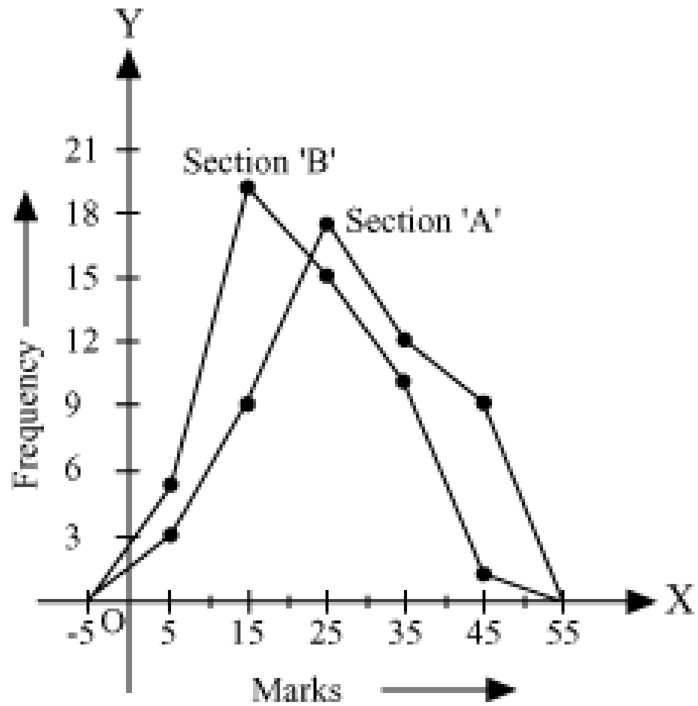
Section D

42. We can find class marks of the given class intervals by using the formula –

$$\text{Class mark} = \frac{\text{upper class limit} + \text{lower class limit}}{2}$$

Section A			Section B		
Marks	Class marks	Frequency	Marks	Class marks	Frequency
0 – 10	5	3	0 – 10	5	5
10 – 20	15	9	10 – 20	15	19
20 – 30	25	17	20 – 30	25	15
30 – 40	35	12	30 – 40	35	10
40 – 50	45	9	40 – 50	45	1

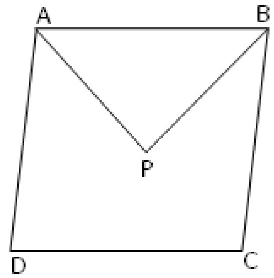
Now taking the class marks on the x-axis and frequency on the y-axis and choosing an appropriate scale (1 cm = 3 units on the y-axis) we can draw a frequency polygon as below:



From the graph we can see that the performance of students of section 'A' is better than the students of section 'B'.

43. Let us assume that Laxmi purchased x bananas and y oranges.
Since each banana costs Rs. 2, x bananas cost Rs. $2 \times x$ = Rs. 2x
Similarly, each orange costs Rs. 3.
Thus, y oranges cost Rs. $3 \times y$ = Rs. 3y
Thus, the total amount paid by Laxmi is Rs. (2x + 3y), which equals Rs. 30
Thus, we can express the given information in the form of a linear equation as $2x + 3y = 30$
Now, we know that Laxmi purchased 6 oranges, i.e., the value of y is 6.
Substitute this value of y in the equation $2x + 3y = 30$, thereby reducing it to a linear equation in one variable.
We can then solve the equation to obtain the value of x.
$2x + 3 \times 6 = 30$
$\Rightarrow 2x + 18 = 30$
This is a linear equation in one variable.
$\Rightarrow 2x = 30 - 18$
$\Rightarrow 2x = 12$
$\Rightarrow x = 6$
Thus, we see that the value of x is 6, i.e., Laxmi purchased 6 bananas.

44. Given: ABCD is a parallelogram such that angle bisector of adjacent angles A and B intersect at point P.



To prove that m∠APB = 90°.
AD ∥ BC
∴ m∠A + m∠B = 180° [Consecutive interior angles]

$$\therefore \frac{1}{2}m\angle A + \frac{1}{2}m\angle B = 90^\circ$$

But,

$$\frac{1}{2}m\angle A + \frac{1}{2}m\angle B + m\angle APB = 180^\circ \text{ ...(Angle sum property of a triangle)}$$

$$\therefore 90^\circ + m\angle APB = 180^\circ$$

$$\therefore m\angle APB = 90^\circ$$

Thus, the angle bisectors of two adjacent angles intersect at right angles.