Class: IX
SESSION : 2022-2023
SUBJECT: Mathematics
SAMPLE QUESTION PAPER - 5
with SOLUTION

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

1. This Question Paper has 5 Sections A-E.
2. Section A has 20 MCQs carrying 1 mark each.
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment (04 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E.
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

Section A

1. If the area of an equilateral triangle is $16\sqrt{3}$ cm^2 then the perimeter of the triangle is : **[1]**

a) 306 cm　　b) 12 cm

c) 24 cm　　d) 48 cm

2. Signs of the abscissa and ordinate of a point in the second quadrant are respectively. **[1]**

a) (-, +)　　b) (+, -)

c) (+, +)　　d) (-, -)

3. A histogram is a pictorial representation of the grouped data in which class intervals and frequency are respectively taken along **[1]**

a) horizontal axis only　　b) horizontal axis and vertical axis

c) vertical axis and horizontal axis　　d) vertical axis only

4. The simplest rationalising factor of $\sqrt[3]{500}$, is **[1]**

a) $\sqrt{3}$　　b) $\sqrt[3]{2}$

c) none of these　　d) $\sqrt[3]{5}$

5. An equilateral triangle ABC is inscribed in a circle with centre O. The measures of ∠BOC is **[1]**

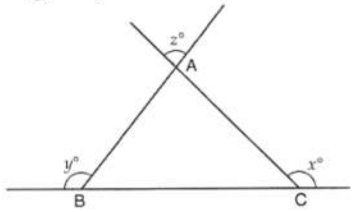
a) 90^{o}

b) 60^{o}

c) 30^{o}

d) 120^{o}

6. In figure, what is z in terms of x and y? **[1]**



a) x + y - 180°

b) x + y + 180°

c) x + y + 360°

d) 180° - (x + y)

7. The coefficient of x^2 in the expansion of $(x + 3)^4$ is **[1]**

a) 54

b) 27

c) 3

d) 1

8. How many lines pass through two points? **[1]**

a) many

b) three

c) two

d) only one

9. If one angle of a parallelogram is 24^{o} less than twice the smallest angle, then the measure of the largest angle of the parallelogram is **[1]**

a) 112^{o}

b) 68^{o}

c) 176^{o}

d) 102^{o}

10. Which one of the following statements is true? **[1]**

a) The sum of two irrational numbers may be a rational number or an irrational number

b) The sum of two irrational numbers is always an integer

c) The sum of two irrational numbers is always an irrational number

d) The sum of two irrational numbers is always a rational number

11. $\sqrt{8}+2\sqrt{32}-5\sqrt{2}$ is equal to **[1]**

a) none of these

b) $\sqrt{32}$

c) $\sqrt{8}$

d) $5\sqrt{2}$

[1]

12. If two angles are supplementary and the larger is 20° less then three times the smaller, then the angles are

a) $72\frac{1}{2}^{o}$, $17\frac{1}{2}^{o}$

b) 140°, 40°

c) 130°, 50°

d) $62\frac{1}{2}^{o}$, $27\frac{1}{2}^{o}$

13. If (-2, 5) is a solution of 2x + my = 11, then the value of 'm' is **[1]**

a) -2

b) 2

c) 3

d) -3

14. Two equal circles of radius r intersect such that each passes through the centre of the other. The length of the common chord of the circles, is **[1]**

a) $\frac{\sqrt{3}}{2}$r

b) $\sqrt{3}$r

c) $\sqrt{r}$

d) $\sqrt{2}$rAB

15. The distance of the point P (4, 3) from the origin is **[1]**

a) 3

b) 5

c) 7

d) 4

16. Which of the following is an irrational number **[1]**

a) $\sqrt{225}$

b) $7.\overline{478}$

c) $\sqrt{23}$

d) 0.3799

17. If a linear equation has solutions (-2, 2), (0, 0) and (2, -2), then it is of the form: **[1]**

a) x + y = 0

b) -2x + y = 0

c) x – y = 0

d) -x + 2y = 0

18. If $x + \frac{1}{x} = 5$, then $x^2 + \frac{1}{x^2} =$ **[1]**

a) 23

b) 27

c) 25

d) 10

19. **Assertion (A):** $\sqrt{3}$ is an irrational number. **[1]**
Reason (R): The sum of a rational number and an irrational number is an irrational number.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

20. Each question consists of two statements, namely, Assertion (A) and Reason (R). Choose the correct option. **[1]**

Assertion (A)	**Reason (R)**
ABCD is a quadrilateral in which P, Q, R and S are the midpoints of AB, BC, CD and DA respectively. Then, PQRS is a parallelogram.	The line segment joining the midpoints of any two sides of a triangle is parallel to the third side and equal to half of it.

a) Both Assertion (A) and Reason (R) are true and Reason (R) is a correct explanation of Assertion (A).

b) Both Assertion (A) and Reason (R) are true but Reason (R) is not a correct explanation of Assertion (A).

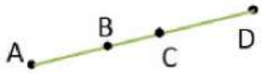
c) Assertion (A) is true and Reason (R) is false.

d) Assertion (A) is false and Reason (R) is true.

Section B

21. Consider the two 'postulates' given below: **[2]**
(i) Given any two distinct points A and B, there exists a third point C, which is between A and B.
(ii) There exists at least three points that are not on the same line.
Do these postulates contain any undefined terms? Are these postulates consistent? Do they follow from Euclid's postulates? Explain.

22. In fig., if AC = BD, then prove that AB = CD **[2]**



23. Name the quadrant in which the following points lie :(i) (2, 3)(ii) (–3, 4)(iii) (–3, –10) **[2]**

24. The radius of a spherical balloon increases from 7 cm to 14 cm as air is being pumped into it. Find the ratio of surface areas of the balloon in the two cases. **[2]**

OR

The slant height and base diameter of a conical tomb are 25 m and 14 m respectively. Find the cost of whitewashing its curved surface at the rate of ₹12 per m^2.

25. Show how $\sqrt{5}$ can be represented on the number line. **[2]**

OR

Simplify: : $125^{-\frac{1}{3}}\left[125^{\frac{1}{3}}-125^{\frac{2}{3}}\right]$.

Section C

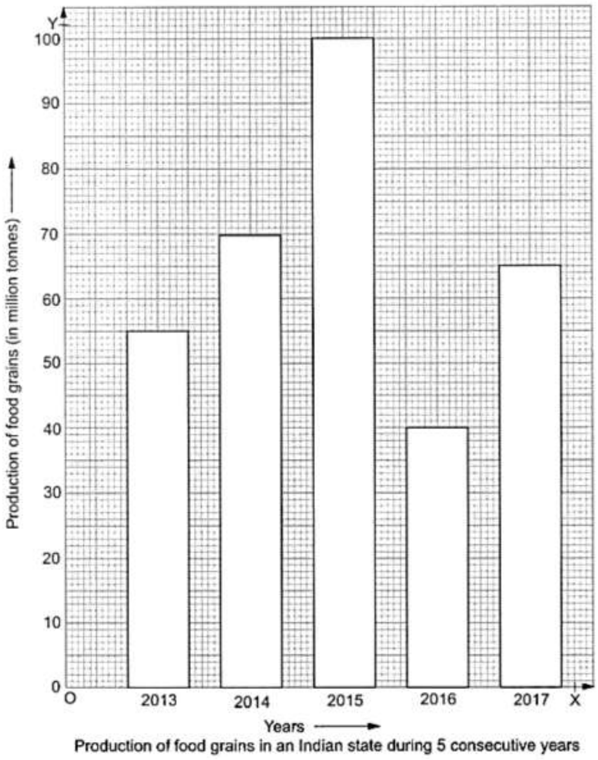
26. Read the given bar graph and answer the questions given below: **[3]**

i. What information is given by the bar graph?

ii. In which year was the production maximum?

iii. After which year was there a sudden fall in the production?

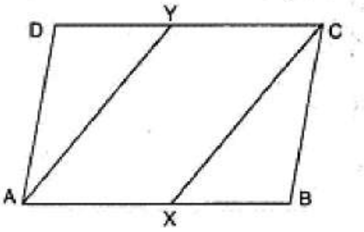
iv. Find the ratio between the maximum production and the minimum production during the given period.



Production of food grains in an Indian state during 5 consecutive years

27. If $a = xy^{p-1}$, $b = xy^{q-1}$ and $c = xy^{r-1}$, prove that $a^{q-r} b^{r-p} c^{p-q} = 1$ **[3]**

28. In the given figure, ABCD is a parallelogram and X, Y are the mid-points of the sides AB and DC respectively. Show that quadrilateral AXCY is a parallelogram. **[3]**



29. Find four solutions for the following equation : $12x + 5y = 0$ **[3]**

30. Factorize: $6x^2 + 5x - 6$ **[3]**

31. Below are the scores of two groups of Class IV students on a test of reading ability : **[3]**

Class interval	Group A	Group B
50-52	4	2
47-49	10	3
44-46	15	4
41-43	18	8

Class interval	Group A	Group B
38-40	20	12
35-37	12	17
32-34	13	22
Total	92	68

Construct a frequency polygon for each of these groups on the same axes.

OR

Various modes of transport used by 1850 students of a school are given below:

School bus	Private bus	Bicycle	Rickshaw	By foot
640	360	490	210	150

Draw a bar graph to represent the above data.

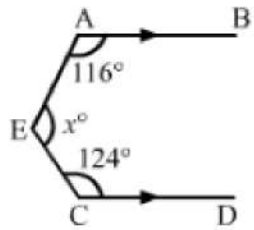
Section D

32. A cloth having an area of 165 m^2 is shaped into the form of a conical tent of radius 5 m. **[5]**

i. How many students can sit in the tent if a student on an average, occupies $\frac{5}{7}$ m^2 on the ground?

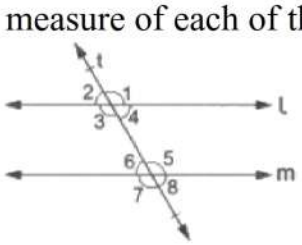
ii. Find the volume of the cone.

33. In each of the figures given below, AB || CD. Find the value of x° in each other case. **[5]**



OR

In the given figure, l || m and a transversal t cuts them. If $\angle 1 = 120^\circ$, find the measure of each of the remaining marked angles.



34. Show that (x + 4), (x - 3) and (x - 7) are the factors of $x^3 - 6x^2 - 19x + 84$ **[5]**

35. The perimeter of a triangular field is 420 m and its sides are in the ratio 6 : 7 : 8. Find the area of the triangular field. **[5]**

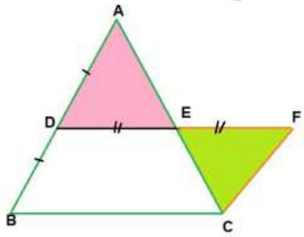
OR

Calculate the area of the triangle whose sides are 18 cm, 24 cm and 30 cm in length. Also, find the length of the altitude corresponding to the smallest side.

Section E

36. **Read the text carefully and answer the questions:** **[4]**

Haresh and Deep were trying to prove a theorem. For this they did the following



i. Draw a triangle ABC
ii. D and E are found as the mid points of AB and AC
iii. DE was joined and DE was extended to F so DE = EF
iv. FC was joined.

(i) $\triangle ADE$ and $\triangle EFC$ are congruent by which criteria?

(ii) Show that $CF \| AB$.

OR

Show that DF = BC and $DF \| BC$.

(iii) Show that CF = BD.

37. **Read the text carefully and answer the questions:** **[4]**

Rainwater harvesting system is a technology that collects and stores rainwater for human use.
Anup decided to do rainwater harvesting. He collected rainwater in the underground tank at the rate of 30 cm^3/sec.

(i) What will be the equation formed if the volume of water collected in x seconds is taken as y cm^3? and also find amount of water collected in 2 hours?

(ii) Write the equation in standard form.

(iii) How much water will be collected in 60 sec?

OR

How much time will it take to collect water in 900 cm^3?

38. **Read the text carefully and answer the questions:** **[4]**

There is a race competition between all students of a sports academy, so that the sports committee can choose better students for a marathon. The race track in the academy is in the form of a ring whose inner most circumference is 264 m and the outer most circumference is 308 m.

(i) Find the radius of the outer most circle.

(ii) Find the radius of the inner most circle.

OR

Find the area of the racetrack.

(iii) Find the width of the track.

SOLUTION

Section A

1. **(c)** 24 cm

Explanation: Area of equilateral triangle = $\frac{\sqrt{3}}{4}(\text{Side})^2$

$\Rightarrow \frac{\sqrt{3}}{4}(\text{Side})^2 = 16\sqrt{3}$

$\Rightarrow (\text{Slide})^2 = 64$

$\Rightarrow \text{Side} = 8 \text{ cm}$

Perimeter of equilateral triangle = 3 × side = 3 × 8 = 24 cm

2. **(a)** (-, +)

Explanation: Abscissa means just the horizontal axis i.e. x axis. Ordinate means just the vertical axis i.e. y axis.

x-corrdinate and y-corrdinate make a point.

The signs of abscissa and ordinate of a point in quadrant II are (-, +).

3. **(b)** horizontal axis and vertical axis

Explanation: In a histogram the class limits are marked on the horizontal axis and the frequency is marked on the vertical axis. Thus, a rectangle is constructed on each class interval.

4. **(b)** $\sqrt[3]{2}$

Explanation: $\sqrt[3]{500}$

$= \sqrt[3]{5 \times 2 \times 5 \times 2 \times 5}$

$= \sqrt[3]{5 \times 5 \times 5 \times 2 \times 2}$

$=5\sqrt[3]{2 \times 2}$

$=5\sqrt[3]{4}$

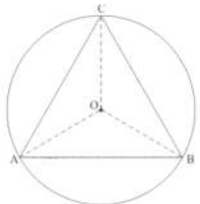
The simplest rationalising factor of $\sqrt[3]{500}$, is $\sqrt[3]{2}$

5. **(d)** 120°

Explanation:

We are given that an equilateral $\triangle ABC$ is inscribed in a circle with centre O. We need to find $\angle BOC$.

We have the following corresponding figure.



We are given AB = BC = AC

Since the sides, AB, BC, and AC are these equal chords of the circle.

Hence,

$\angle AOB + \angle BOC + \angle AOC = 360$

==> $\angle BOC + \angle BOC + \angle BOC = 360$

==> $3\angle BOC = 360$

==> $\angle BOC = \frac{360}{3}$

==> $\angle BOC = 120^{\circ}$

6. **(a)** x + y - 180°
Explanation: From figure
$\angle A = z°$
$\angle ACB = 180 - z°$
$\angle ABC = 180 - y°$
Now, in $\triangle ABC$
$\angle A + \angle B + \angle C = 180°$
$\Rightarrow z° + 180 - y° + 180° - x° = 180°$
$\Rightarrow z° = x° + y° - 180°$
7. **(a)** 54
Explanation: $(x + 3)^4$
$= (x+3)^2.(x+3)^2$
$= [x^2 + 6x + 9][x^2 + 6x + 9]$
$= x^4 + 36x^2 + 81$
$= 12x^3 + 108x + 18x^2$
$= x^4 + 12x^3 + 54x^2 + 108x + 81$
Therefore, the coefficient of x^2 is 54.
8. **(d)** only one
Explanation: only one because if a line is passing through two points then that two points are solution of a single linear equation
so only one line passes over two given points.
9. **(a)** 112^o
Explanation:
Let angles of parallelogram are $\angle A, \angle B, \angle C, \angle D$


Let smallest angle = $\angle A$
Let largest angle = $\angle B$
$= \angle B = 2\angle A - 24^o$ ...(i)
$\angle A + \angle B = 180^o$ [adjacent angle of parallelogram]
So, $\angle A + 2\angle A - 24^o = 180^o$
$= 3\angle A = 180^o + 24^o = 204^o$
$= \angle A = \frac{204^o}{3} = 68^o$
$= \angle B = 2 \times 68^o - 24^o = 112^o$
10. **(a)** The sum of two irrational numbers may be a rational number or an irrational number
Explanation: The sum of two irrational numbers may be a rational number or an irrational number
Eg. $a = \sqrt{2}$ (which is irrational)
$b = 2\sqrt{2}$ (which is irrational)
$a+b=\sqrt{2} + 2\sqrt{2} = 3\sqrt{2}$ (which is irrational)
and

Let a = 1+ $\sqrt{2}$ (which is irrational)
and b= 1-$\sqrt{2}$ (which is irrational)
Now, a + b = 1+$\sqrt{2}$+1-$\sqrt{2}$
= 2 (which is rational)

11. **(d)** $5\sqrt{2}$
Explanation: $\sqrt{8}+2\sqrt{32}-5\sqrt{2}$
$\Rightarrow 2\sqrt{2}+2\times 4\sqrt{2}-5\sqrt{2}$
$\Rightarrow 10\sqrt{2}-5\sqrt{2}$
$\Rightarrow 5\sqrt{2}$

12. **(c)** 130^{o}, 50^{o}

Explanation: Let the two supplementary angles be x^{o} and 180^{o} - x^{o}

Let 180^{o} - x be the larger angle

180^{0} - x = 3x - 20^{o}

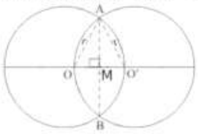
4x = 200^{o}

x = 50^{o}

So the angles are 50^{o} and 130^{o}.

13. **(c)** 3
Explanation: If (-2, 5) is a solution of 2x + my = 11
then it will satisfy the given equation
2 .(-2)+5 m=11
-4+5 m=11
5 m=11+4
5 m=15
$m=\frac{15}{5}=3$
m=3

14. **(b)** $\sqrt{3}$r
Explanation:
We need to find a common chord.
We have the corresponding figure as follows:



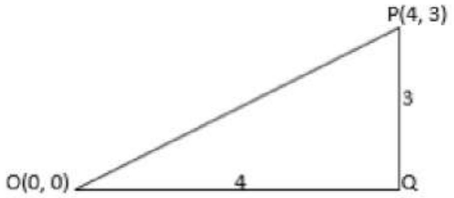
AO = AO' = r (radius)
And OO' = r
So, $\triangle$ OAO' is an equilateral triangle.
We know that the attitude of an equilateral triangle with side r is given by $\frac{\sqrt{3}}{2}$r
That is AM = $\frac{\sqrt{3}}{2}r$
We know that the line joining centre of the circles divides the common chord into two equal parts.
So we have

AB = 2AM= $2. \frac{\sqrt{3}}{2}r$

AB = $\sqrt{3}$r

15. **(b)** 5

Explanation:



Using Pythagorous theorem: $OP^2 = OQ^2 + QP^2$

$OP^2 = 4^2 + 3^2$

$OP^2 = \sqrt{16+9} = 5$

16. **(c)** $\sqrt{23}$

Explanation: It doesn't represent the form of $\frac{p}{q}$ and $q \neq 0$

17. **(a)** x + y = 0

Explanation: Linear equation has solutions (-2, 2), (0, 0) and (2, -2), then the equation will be

x + y = 0

As all the given three points satisfy the given equation

18. **(a)** 23

Explanation: Using ,$(a + b)^2 = a^2 + b^2 + 2ab$

$\left(x+\frac{1}{x}\right)^2 = x^2 + \left(\frac{1}{x^2}\right) + 2x\frac{1}{x}$

$\Rightarrow (5)^2 = x^2 + \left(\frac{1}{x^2}\right) + 2$

$\Rightarrow x^2 + \frac{1}{x^2} = 25 - 2$

$x^2 + \frac{1}{x^2} = 23$

19. **(b)** Both A and R are true but R is not the correct explanation of A.

Explanation: Both A and R are true but R is not the correct explanation of A.

20. **(a)** Both Assertion (A) and Reason (R) are true and Reason (R) is a correct explanation of Assertion (A).

Explanation: It is given that, ABCD is a quadrilateral in which P, Q, R and S are the mid-points of AB, BC, CD and DA respectively. Then, PQRS is a parallelogram.

Also, the line segment joining the mid-points of any two sides of a triangle is parallel to the third side and equal to half of it.

Hence, both assertion and reason are true and reason is correct explanation of the assertion

Section B

21. We are given with following two postulates

(i) Given any two distinct points A and B, there exists a third point C, which is between A and B.

(ii) There exists at least three points that are not on the same line.

The undefined terms in the given postulates are point and line.

The two given postulates are consistent, as they do not refer to similar situations and they refer to two different situations.

We can also conclude that, it is impossible to derive any conclusion or any statement that contradicts any well known axiom and postulate.

The two given postulates do not follow from the postulates given by Euclid.
The two given postulates can be observed following from the axiom, "Given two distinct points, there is an unique line that passes through them".

22. AC = BD . . . . [Given] . . . (1)
AC = AB + BC . . . . [Point B lies between A and C] . . . . (2)
BD = BC + CD . . . . [Point C lies between B and D] . . . . (3)
Substituting (2) and (3) in (1), we get
AB + BC = BC + CD
⇒ AB = CD . . . . [Subtracting equals from equals]

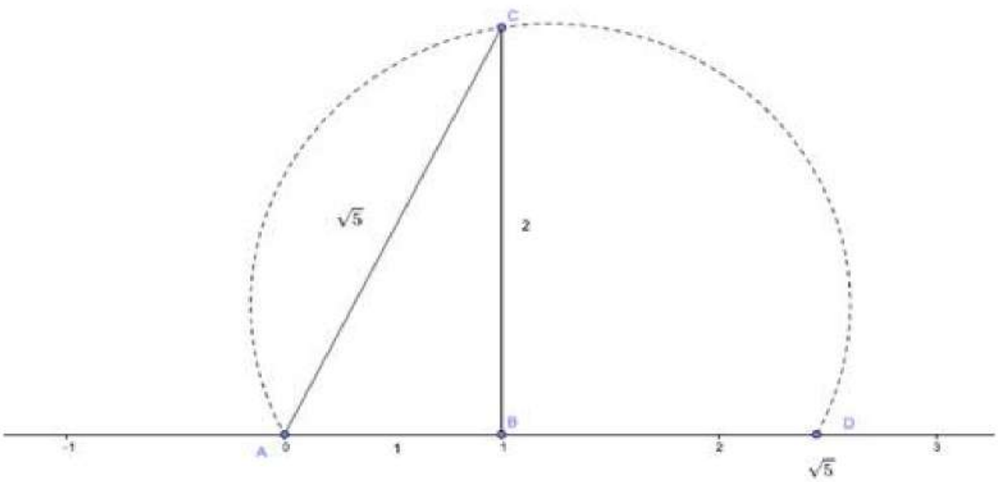
23. (i) I quadrant
(ii) II quadrant
(iii) III quadrant

24. Case I : r = 7 cm
Surface area = $4\pi r^2$
$= 4 \times \frac{22}{7} \times (7)^2 = 616\ cm^2$
Case II : r = 14 cm
Surface area = $4\pi r^2$
$= 4 \times \frac{22}{7} \times (14)^2 = 2464\ cm^2$
∴ Ratio of surface area of the balloon = 616 : 2464
=1 : 4

OR

Radius of a cone, r = 7 m
Slant height of a cone, l = 25 m
Curved surface area of a cone = πrl
$= \left(\frac{22}{7} \times 7 \times 25\right) m^2$
$= 550\ m^2$
Cost of whitewashing = Rs. 12 per m^2
⇒ Cost of whitewashing 550 m^2 area = Rs. (12 × 550) = Rs. 6600

25. According to the Pythagoras theorem, we can conclude that $\left(\sqrt{5}\right)^2 = (2)^2 + (1)^2$ We need to draw a line segment AB of 1 unit on the number line. Then draw a straight line segment BC of 2 units. Then join the points C and A, to form a line segment BC. Then draw the arc ACD, to get the number $\sqrt{5}$ on the number line.



OR

Given, $125^{-\frac{1}{3}}\left[(125)^{\frac{1}{3}}-(125)^{\frac{2}{3}}\right]$

$=\frac{1}{125^{\frac{1}{3}}}\left[\left(5^{3}\right)^{\frac{1}{3}}-\left(5^{3}\right)^{\frac{2}{3}}\right]$

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

$=\frac{1}{5}\left(5-5^{2}\right)=\frac{1}{5}(5-25)=\frac{1}{5}(-20)=-4$

Section C

26. i. The given bar graph shows the annual production (in million tonnes) of food grains in an Indian state during the period from 2013 to 2017.
    ii. It is clear that the bar of maximum height corresponds to the year 2015. So, the production was maximum in the year 2015.
    iii. From the bar graph, we find that there was a sudden fall in production after the year 2015.
    iv. The maximum production in a year during the given period = 100 million tonnes.
    The minimum production in a year during the given period = 40 million tonnes.
    ∴ maximum production: minimum production
    = 100 : 40 = 5 : 2.

The ratio between the maximum production and the minimum production during the given period = 5: 2.

27. $a = xy^{p-x}$, $b = xy^{q-1}$ and $c = xy^{r-1}$

$\therefore a^{q-r} \times b^{r-p} \times c^{p-q}$

$= (xy^{p-x})^{q-r} \times (xy^{q-1})^{r-p} \times (xy^{r-1})^{p-q}$

$= x^{q-r} \times y^{(p-1)(q-r)} \times x^{r-p} \times y^{(q-1)(r-p)} \times x^{p-q} \times y^{(r-1)(p-q)}$

$= x^{q-r} \times x^{r-p} \times x^{p-q} \times y^{pq-pr-q+r} \times y^{qr-pq-r+p} \times y^{pr-qr-p+q}$

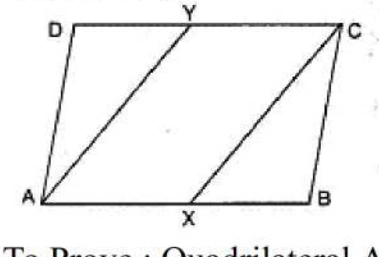
$= x^{q-r+r-p+p-q} \times y^{p q-p r-q+r+q r-p q-r+p+p r-q r-p+q}$

$= x^0 \times y^0$

$= 1 \times 1$

$= 1$

28. Given: ABCD is a parallelogram and X, Y are the mid-points of the sides AB and DC respectively.



To Prove : Quadrilateral AXCY is a parallelogram.

Proof : AB = DC [Opp. sides of a parallelogram are equal]

$\Rightarrow \frac{1}{2}$ AB = $\frac{1}{2}$ DC [Halves of equals are equal]

As X and Y are the mid-points of the sides AB and DC respectively

∴AX = YC . . . (1)

AB || DC . . . [Opp. sides of a || gm are parallel]

∴ AX = YC . . . (2)

In view of (1) and (2),
AXCY is a parallelogram,
A quadrilateral is a || gm if it's one pair of opposite sides are parallel and equal.

29. $12x + 5y = 0$

$\Rightarrow 5y = -12x$

$\Rightarrow y = \frac{-12}{5}x$

Put $x = 0$, then $y = \frac{-12}{5}(0) = 0$

Put $x = 5$, then $y = \frac{-12}{5}(5) = -12$

Put $x = 10$, then $y = \frac{-12}{5}(10) = -24$

Put $x = 15$, then $y = \frac{-12}{5}(15) = -36$

$\therefore$ (0, 0), (5, –12), (10, –24) and (15, –36) are the four solutions of the equation $12x + 5y = 0$

30. $6x^2 + 5x - 6$

$6x^2 + 5x - 6 = 6x^2 + 9x - 4x - 6$

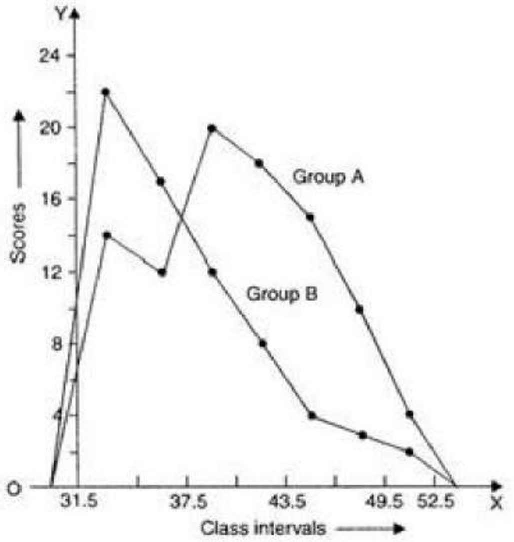
$= 3x(2x+3) - 2(2x+3)$

$= (3x-2)(2x+3).$

Therefore, we conclude that on factorizing the polynomial

$6x^2 + 5x - 6 we get (3x-2)(2x+3)$

31. Frequency polygon for group A and B representing the scores of two groups of Class IV students in a test of reading ability.



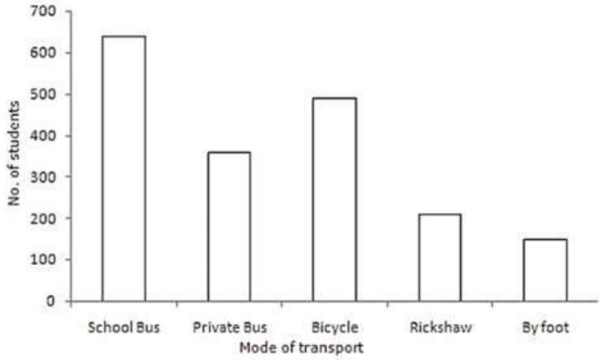
Let us convert the given distributions in such a manner that the intervals are continuous. It is shown below

Class interval	Group A	Group B
49.5-52.5	4	2
46.5-49.5	10	3
43.5-46.5	15	4
40.5-43.5	18	8
37.5-40.5	20	12
34.5-37.5	12	17
31.5-34.5	13	22

Class interval	Group A	Group B
Total	92	68

OR

Take themode of transport along the x-axis and the number of students along the y-axis.
Along the y-axis, take 1 big division = 100 units.
Now we shall draw the bar chart, as shown below:



Section D

32. Suppose l be the slant height of the conical tent.
Radius of the base of conical tent $(r) = 5m$

i. Area of the circular base of the cone = $\pi r^2 = \frac{22}{7} \times 5^2 m^2$

Number of student = $\frac{\textit{Area of the base}}{\textit{Area occupied by one student}}$

$= \frac{\frac{22}{7} \times 5 \times 5 m^2}{\frac{5}{7} m^2} = \frac{22}{7} \times 5 \times 5 \times \frac{7}{5} = 110$

ii. Also, curved surface area of cone = πrl

$\Rightarrow 165 = \frac{22}{7} \times 5 \times l$

$\Rightarrow l = \frac{165 \times 7}{22 \times 5}$

$\Rightarrow l = \frac{21}{2} m = 10.5m$

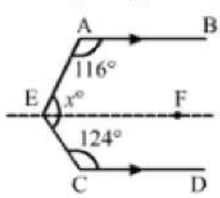
Also, $h^2 = l^2 - r^2$

$\Rightarrow h = \sqrt{(10.5)^2 - 5^2} = \sqrt{15.5 \times 5.5}$ ≈<p

Volume of conical tent = $\frac{1}{3} \pi r^2 h$

$= \frac{1}{3} \times \frac{22}{7} \times 5^2 \times 9.23 m^3 = 241.74 m^3$.

33.



Draw EF || AB || CD
Then, $\angle AEF + \angle CEF = x^\circ$
Now, EF || AB and AE is the transversal
$\therefore \angle AEF + \angle BAE = 180^\circ$ [Consecutive Interior Angles]
$\Rightarrow \angle AEF + 116 = 180$
$\Rightarrow \angle AEF = 64^\circ$
Again, EF || CD and CE is the transversal.
$\angle CEF + \angle ECD = 180^\circ$ [Consecutive Interior Angles]
$\Rightarrow \angle CEF + 124 = 180$
$\Rightarrow \angle CEF = 56^\circ$

Therefore,
$x^\circ = \angle AEF + \angle CEF$
$x^\circ = (64 + 56)^\circ$
$x^\circ = 120^\circ$

OR

We have, $\angle 1 = 120^\circ$. Then
$\angle 1 = \angle 5 = 120^\circ$ [Corresponding angles]
$\Rightarrow \angle 5 = 120^\circ$
$\angle 1 = \angle 3 = 120^\circ$ [Vertically-opposite angles]
$\Rightarrow \angle 3 = 120^\circ$
$\angle 5 = \angle 7 = 120^\circ$[Vertically-opposite angles]
$\Rightarrow \angle 7 = 120^\circ$
$\angle 1 + \angle 2 = 180^\circ$ [Since AFB is a straight line]
$\Rightarrow 120^\circ + \angle 2 = 180^\circ$
$\Rightarrow \angle 2 = 60^\circ$
$\angle 2 = \angle 4 = 60^\circ$ [Vertically-opposite angles]
$\Rightarrow \angle 4 = 60^\circ$
$\angle 2 = \angle 6 = 60^\circ$Corresponding angles]
$\Rightarrow \angle 6 = 60^\circ$
$\angle 6 = \angle 8 = 60^\circ$[Vertically-opposite angles]
$\Rightarrow \angle 8 = 60^\circ$
$\therefore \angle 1 = 120^\circ, \angle 2 = 60^\circ$, $\angle 3 = 120^\circ, \angle 4 = 60^\circ$, $\angle 5 = 120^\circ$,
$\angle 6 = 60^\circ, \angle 7 = 120^\circ$ and $\angle 8 = 60^\circ$

34. Here, $f(x) = x^3 - 6x^2 - 19x + 84$
To prove that (x + 4), (x - 3) and (x - 7) are factors of f(x),
We must have f(- 4) , f(3) and f(7) should be zero
Let, x + 4 = 0
$\Rightarrow$ x = - 4
Substitute the value of x in f(x)
$f(-4) = (-4)^3 - 6(-4)^2 - 19(-4) + 84$
$= -64 - (6 \times 16) - (19 \times (-4)) + 84$
$= -64 - 96 + 76 + 84$
$= 160 - 160$
$= 0$
Let, x - 3 = 0
$\Rightarrow$ x = 3
Substitute the value of x in f(x)
$f(3) = (3)^3 - 6(3)^2 - 19(3) + 84$
$= 27 - (6 \times 9) - (19 \times 3) + 84$
$= 27 - 54 - 57 + 84$
$= 111 - 111$
$= 0$
Let, x - 7 = 0
$\Rightarrow$ x = 7
Substitute the value of x in f(x)
$f(7) = (7)^3 - 6(7)^2 - 19(7) + 84$
$= 343 - (6 \times 49) - (19 \times 7) + 84$
$= 343 - 294 - 133 + 84$
$= 427 - 427$

$= 0$

Hence, (x+4),(x-3) and (x-7) are factors of f(x).

35. Suppose that the sides in metres are 6x, 7x and 8x.

Now, 6x + 7x + 8x = perimeter = 420

$\Rightarrow$ 21x = 420

$\Rightarrow\ x = \frac{420}{21}$

$\Rightarrow$ x = 20

$\therefore$ The sides of the triangular field are $6 \times 20m, 7 \times 20m, 8 \times 20m,$ i.e., 120 m, 140 m and 160 m.

Now, s = Half the perimeter of triangular field.

$= \frac{1}{2} \times 420m = 210m$

Using Heron's formula,

Area of triangular field $= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{210(210-120)(210-140)(210-160)}$

$= \sqrt{210 \times 90 \times 70 \times 50}$

$= \sqrt{66150000} = 8133.265m^2$

Hence, the area of the triangular field = 8133.265 m^2.

OR

Let a = 18 cm, b = 24 cm and c = 30 cm

$\Rightarrow$ half perimeter = s = $\frac{a+b+c}{2} = \frac{18+24+30}{2} = 36$cm

By Heron's formula, we have:

Area of triangle $= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{36(36-18)(36-24)(36-30)}$

$= \sqrt{36 \times 18 \times 12 \times 6}$

$= \sqrt{12 \times 3 \times 6 \times 3 \times 12 \times 6}$

$= 12 \times 3 \times 6$

= 216 cm^2

We know that the smallest side is 18 cm.

Thus, we can find out the altitude of the triangle corresponding to 18 cm.

We have:

Area of triangle = 216 cm^2

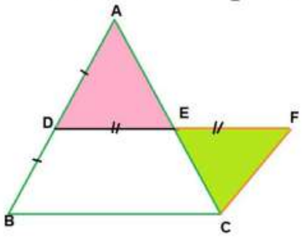
$\Rightarrow \frac{1}{2} \times$ Base $\times$ Height = 216 $\Rightarrow \frac{1}{2} \times (18)$(Height) = 216

$\Rightarrow$ Height $= \frac{216 \times 2}{18} = 24$cm

Section E

36. **Read the text carefully and answer the questions:**

Haresh and Deep were trying to prove a theorem. For this they did the following



i. Draw a triangle ABC
ii. D and E are found as the mid points of AB and AC
iii. DE was joined and DE was extended to F so DE = EF
iv. FC was joined.

(i) $\triangle ADE$ and $\triangle CFE$

DE = EF (By construction)

$\angle AED = \angle CEF$ (Vertically opposite angles)

AE = EC(By construction)

By SAS criteria $\triangle ADE \cong \triangle CFE$

(ii) $\triangle ADE \cong \triangle CFE$

Corresponding part of congruent triangle are equal

$\angle EFC = \angle EDA$

alternate interior angles are equal

$\Rightarrow AD \parallel FC$

$\Rightarrow CF \parallel AB$

OR

$DE = \frac{BC}{2}$ {line drawn from mid points of 2 sides of $\triangle$ is parallel and half of third side}

$DE \parallel BC$ and $DF \parallel BC$

DF = DE + EF

$\Rightarrow$ DF = 2DE(BE = EF)

$\Rightarrow$ DF = BC

(iii) $\triangle ADE \cong \triangle CFE$

Corresponding part of congruent triangle are equal.

CF = AD

We know that D is mid point AB

$\Rightarrow$ AD = BD

$\Rightarrow$ CF = BD

37. **Read the text carefully and answer the questions:**

Rainwater harvesting system is a technology that collects and stores rainwater for human use.

Anup decided to do rainwater harvesting. He collected rainwater in the underground tank at the rate of 30 cm^3/sec.

(i) Let 'x be time taken and y be amount of water collected as per given statement.

Equation is 30x = y

Now when x = 2 hours = 120 sec

$y = 30 \times 120 = 3600\ cm^3$

(ii) 30x - y + 0 = 0

Standard form of a linear equation in two variables is ax + by + c = 0

(iii) Since, $y = 30x$

If $x = 60$, then, $y = 30 \times 60$

$= 1800$

Required volume is 1800 cm^3.

OR

Since, $y = 30x$

If $y = 900$, then, $900 = 30x$

$x = \frac{900}{30} = 30$

Required time is 30 sec.

38. **Read the text carefully and answer the questions:**

There is a race competition between all students of a sports academy, so that the sports committee can choose better students for a marathon. The race track in the academy is in the form of a ring whose inner most circumference is 264 m and the outer most circumference is 308 m.

(i) Let the radius of outer most circle be R.

Outer most circumference = 308 m [Given]

$\Rightarrow 2\pi R = 308 \Rightarrow 2 \times \frac{22}{7} \times R = 308$

$\Rightarrow R = \frac{308 \times 7}{2 \times 22} = 49$ m

(ii) Let the radius of inner most circle be r Inner most circumference = 264 m [Given]

$\Rightarrow 2\pi r = 264$

$\Rightarrow 2 \times \frac{22}{7} \times r = 264 \Rightarrow r = \frac{264 \times 7}{2 \times 22} = 42$ m

Radius of inner most circle = r = 42 m

OR

Area of the racetrack = Area of outer circle - Area of inner circle

$= \pi(R^2 - r^2) = \pi[(49)^2 - (42)^2]$

$= \frac{22}{7}[2401 - 1764] = 2002 \text{ m}^2$

Hence area of racetrack is 2002 m^2.

(iii) Width of the track = Radius of outer most track - Radius of inner most track

$= 49 - 42 = 7$ m