

CBSE Board
Class IX Mathematics

Time: 3 hrs

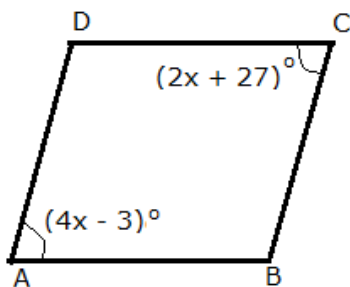
Total Marks: 80

General Instructions:

1. All questions are **compulsory**.
2. The question paper consists of **30** questions divided into **four sections** A, B, C, and D. **Section A** comprises of **6** questions of 1 mark each, **Section B** comprises of **6** questions of 2 marks each, **Section C** comprises of **10** questions of 3 marks each and **Section D** comprises of **8** questions of 4 marks each.
3. Question numbers **1 to 6** in **Section A** are multiple choice questions where you are to select **one** correct option out of the given four.
4. Use of calculator is **not** permitted.

Section A
(Questions 1 to 6 carry 1 mark each)

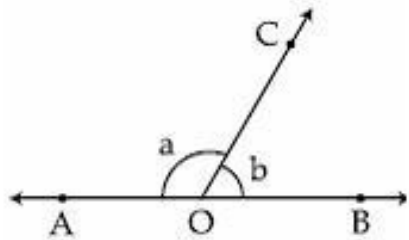
1. Simplify : $(6 + \sqrt{27}) - (3 + \sqrt{3}) + (1 - 2\sqrt{3})$
2. Find the value of the polynomial $x^2 - x - 1$ at $x = -1$.
3. In $2y - 3 = \sqrt{2}x$, what are the values of a, b and c?
4. In the following figure ABCD is a parallelogram, Find the value of x.



5. 25.7, 16.3, 2.8, 21.7, 24.3, 22.7, 24.9, what is the range of the given data?
6. What is the length of a chord which is at a distance 5 cm from the centre of a circle whose radius is 13 cm?

Section B
(Questions 7 to 12 carry 2 marks each)

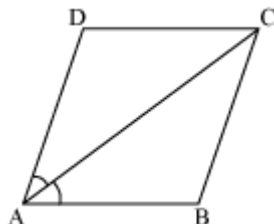
7. Simplify: $\left(\frac{12^{\frac{1}{5}}}{27^{\frac{1}{5}}}\right)^{\frac{5}{2}}$
8. The perpendicular distance of a point from the x-axis is 2 units and the perpendicular distance from the y-axis is 5 units. Write the coordinates of such a point if it lies in one of the following quadrants:
(i) I Quadrant (ii) II Quadrant (iii) III Quadrant (iv) IV Quadrant
9. 10 students of Class X took part in a mathematics quiz. If the number of girls is 4 more than the number of boys, then find the number of boys and the number of girls who took part in the quiz.
10. Find the area of an isosceles triangle with base 10 cm and perimeter 36 cm.
11. What is the area of the triangle having sides of lengths 7 cm, 8 cm and 9 cm?
12. In the figure, $\angle AOC$ and $\angle BOC$ form a linear pair. If $a - b = 80^\circ$, then find the values of a and b .



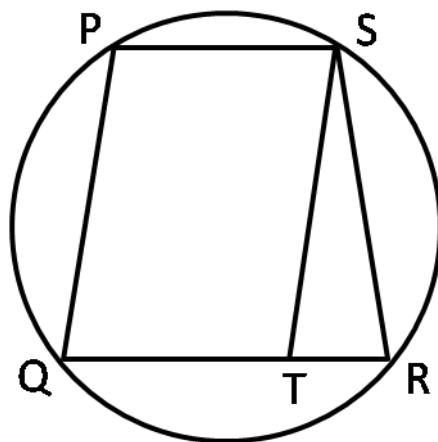
Section C
(Questions 13 to 22 carry 3 marks each)

13. If $\frac{3+\sqrt{8}}{3-\sqrt{8}} + \frac{3-\sqrt{8}}{3+\sqrt{8}} = a + b\sqrt{2}$, then find a and b .
14. The area of a rectangle gets reduced by 80 sq. units if its length is reduced by 5 units and breadth is increased by 2 units. If we increase the length by 10 units and decrease the breadth by 5 units, the area will increase by 50 sq. units. Find the length and breadth of the rectangle.

15. Diagonal AC of a parallelogram ABCD bisects $\angle A$ (see the given figure). Show that
- it bisects $\angle C$
 - ABCD is a rhombus.



16. The ratio of income of two persons is $9 : 7$ and the ratio of their expenditures is $4 : 3$. If each of them manages to save Rs. 2000 per month, find their monthly income.
17. PQST is a parallelogram. The circle through S, P and Q intersect QT produced at R. Prove that $ST = SR$



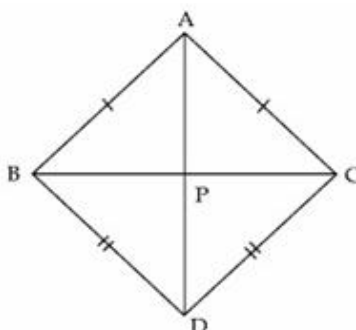
18. A game of chance involves spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 and these are equally likely outcomes. What is the probability that it will point at
- An odd number?
 - A number greater than 2?
 - A number less than 9?
19. Use a suitable identity to factorise $27p^3 + 8q^3 + 54p^2q + 36pq^2$.
20. The taxi fare in a city is as follows: For the first kilometre, the fare is Rs. 8 and for the remaining distance it is Rs.5 per kilometre. Taking the distance covered as x km and total fare as Rs. y , write a linear equation for this information, and draw its graph.
21. Show that the bisectors of the angles of a parallelogram form a rectangle.

22. A survey was conducted by a group of students as a part of their Environment Awareness Programme, in which they collected the following data regarding the number of plants in 20 houses in a locality. Find the mean number of plants per house.

No of plants	0-2	2-4	4-6	6-8	8-10	10-12	12-14
No of houses	1	2	1	5	6	2	3

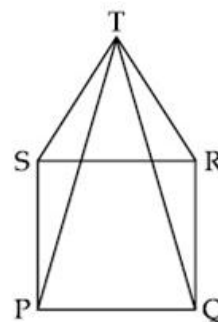
Section D
(Questions 23 to 30 carry 4 marks each)

23. Simplify: $\frac{16 \times 2^{n+1} - 4 \times 2^n}{16 \times 2^{n+2} - 2 \times 2^{n+2}}$
24. In the given figure, if the two isosceles triangles have a common base, then prove that the line segment joining their vertices bisects the common base at right angles.



25. Factorize $2x^3 - 3x^2 - 17x + 30$.
26. In the figure, PQRS is a square and SRT is an equilateral triangle. Prove that:

- a) $\angle PST = \angle QRT$
- b) $PT = QT$
- c) $\triangle TSP \cong \triangle TRQ$



27. Sonu and Monu had adjacent triangular fields with a common boundary of 25 m. The other two sides of Sonu's field were 52 m and 63 m, while Monu's were 114 m and 101 m. If the cost of fertilization is Rs 20 per sq m, then find the total cost of fertilization for both Sonu and Monu together.

28. If AD is the median of $\triangle ABC$, then prove that $AB + AC > 2AD$.
29. Ajay was asked to find the sum of the four angles of a quadrilateral. He found the sum of the four angles as 270° by giving the reasoning as follows:
Sum of the three angles of a triangle [made up of three sides]
 $= 2 \text{ right angles} = (3 - 1) \text{ right angles}$.
So, the sum of the four angles of quadrilateral [made up of four sides]
 $= (4 - 1) \text{ right angles} = 3 \text{ right angles} = 270^\circ$.
His classmate Anju pointed out that the sum obtained is incorrect and found the correct sum. Ajay accepted his mistake and thanked Anju for the same. Write the correct solution. What value is depicted from this action?
30. The polynomials $p(x) = ax^3 + 4x^2 + 3x - 4$ and $q(x) = x^3 - 4x + a$ leave the same remainder when divided by $x - 3$. Find the remainder when $p(x)$ is divided by $(x - 2)$.

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Solution

Time: 3 hrs

Total Marks: 80

Section A

1.

$$(6 + \sqrt{27}) - (3 + \sqrt{3}) + (1 - 2\sqrt{3}) = 6 + 3\sqrt{3} - 3 - \sqrt{3} + 1 - 2\sqrt{3} = 4$$

2. Substitute $x = -1$ in the polynomial $x^2 - x - 1$, we get

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

\therefore The value of the polynomial $x^2 - x - 1$ at $x = -1$ is 1.

3. We have, $2y - 3 = \sqrt{2}x$

$$\therefore \sqrt{2}x - 2y + 3 = 0$$

On comparing this equation with standard form of a linear equation,

i.e. $ax + by + c = 0$, we get

$$a = \sqrt{2}, b = -2 \text{ and } c = 3$$

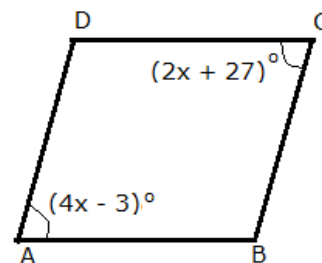
4. In a parallelogram, the opposite angles are equal.

$$\therefore m\angle A = m\angle C$$

$$\therefore (2x + 27)^\circ = (4x - 3)^\circ$$

$$\therefore (27 + 3)^\circ = 4x - 2x$$

$$\therefore 30^\circ = 2x \Rightarrow x = \frac{30^\circ}{2} = 15^\circ$$



5. Range = Maximum value - Minimum value = $25.7 - 2.8 = 22.9$

6. Here, $OC = 5$ cm and $OA = 13$ cm

$\angle C = 90^\circ$ (The line joining the centre of a circle and the mid-point of a chord is perpendicular to the chord)

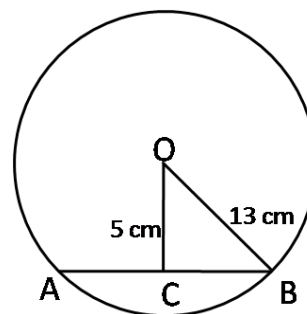
$\therefore \triangle BOC$ is a right angled triangle.

Then, By Pythagoras theorem, $OB^2 = OC^2 + BC^2$

$$\therefore BC = \sqrt{13^2 - 5^2} = \sqrt{144} = 12 \text{ cm}$$

Since, OC bisects the chord AB .

Hence, $AB = 12 \times 2 = 24$ cm



Section B

$$7. \quad \left(\frac{12^{\frac{1}{5}}}{27^{\frac{1}{5}}} \right)^{\frac{5}{2}} = \frac{12^{\frac{1}{2}}}{27^{\frac{1}{2}}} = \frac{3^{\frac{1}{2}} \times 4^{\frac{1}{2}}}{3^{\frac{1}{2}} \times 9^{\frac{1}{2}}} = \frac{2}{3}$$

8. (i) I quadrant: (5, 2)
(ii) II quadrant: (-5, 2)
(iii) III quadrant: (-5, -2)
(iv) IV quadrant: (5, -2)

9. Let the number of boys be 'x' and girls be 'y'.
Number of girls is 4 more than number of boys
According to given condition,
 $y = x + 4$ (1)

Total number of students = 10 (given)

Hence, $x + y = 10$ (2)

$x + x + 4 = 10$ [From (i)]

$$2x + 4 = 10$$

$$2x = 6$$

$$x = 3 \quad \text{----- (3)}$$

$y = 3 + 4$ Substituting (3) in (1)

$$y = 7$$

Hence, there are 3 boys and 7 girls in the class.

10. Perimeter = 36 cm = 10 cm + 2(Length of each equal side)

$$\Rightarrow \text{Length of each equal side} = 13 \text{ cm}$$

Here, $s = \frac{36}{2} = 18$, and the sides are 10, 13 and 13.

By Heron's formula,

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

$$= \sqrt{18 \times 8 \times 5 \times 5}$$

$$= 60 \text{ sq. cm}$$

11. Let $a = 7$ cm, $b = 8$ cm and $c = 9$ cm.

$$\therefore \text{Semi-perimeter} = s = \frac{a+b+c}{2} = \frac{7 \text{ cm} + 8 \text{ cm} + 9 \text{ cm}}{2} = 12 \text{ cm}$$

Using Heron's formula,

$$\begin{aligned} \text{Area of the triangle} &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{12 \times (12-7) \times (12-8) \times (12-9)} \text{ cm}^2 \\ &= \sqrt{12 \times 5 \times 4 \times 3} \text{ cm}^2 \\ &= 12\sqrt{5} \text{ cm}^2 \end{aligned}$$

12. $a + b = 180^\circ$ (Linear pair)....(i)

$$a - b = 80^\circ \quad (\text{given})....(\text{ii})$$

Adding (i) and (ii),

$$2a = 260^\circ$$

$$\Rightarrow a = 130^\circ$$

$$\Rightarrow b = 180^\circ - 130^\circ = 50^\circ$$

Section C

- 13.

$$\begin{aligned} \frac{(3 + \sqrt{8})}{(3 - \sqrt{8})} + \frac{(3 - \sqrt{8})}{(3 + \sqrt{8})} &= \frac{(3 + \sqrt{8})}{(3 - \sqrt{8})} \times \frac{(3 + \sqrt{8})}{(3 + \sqrt{8})} + \frac{(3 - \sqrt{8})}{(3 + \sqrt{8})} \times \frac{(3 - \sqrt{8})}{(3 - \sqrt{8})} \\ &= \frac{(3 + \sqrt{8})^2}{9 - 8} + \frac{(3 - \sqrt{8})^2}{9 - 8} \\ &= \frac{(3 + \sqrt{8})^2}{1} + \frac{(3 - \sqrt{8})^2}{1} \\ &= 9 + 8 + 6\sqrt{8} + 9 + 8 - 6\sqrt{8} \\ &= 34 = a + b\sqrt{2} \\ \Rightarrow a &= 34, \quad b = 0 \end{aligned}$$

14. Let the present area, length & breadth of the rectangle be 'z', 'x' & 'y' respectively.
Therefore, $z = xy$ (\because Area = Length \times Breadth)(1)

\because Area is $(z - 80)$ sq. units if length = $(x - 5)$ and breadth = $(y + 2)$

Therefore, $(z - 80) = (x - 5)(y + 2)$

$$z - 80 = xy + 2x - 5y - 10$$

$$z - 80 = z + 2x - 5y - 10$$

$$-70 = -5y + 2x \quad \dots(2)$$

\because Area is $(z + 80)$ sq. units if length = $(x + 10)$ and breadth = $(y - 5)$

$$(z + 80) = (x + 10)(y - 5)$$

$$z + 80 = xy - 5x + 10y - 50$$

$$z + 80 = z - 5x + 10y - 50$$

$$100 = 10y - 5x \quad \dots (3)$$

Multiply equation (2) by 2 and add it to equation (3) we get

$$100 = 10y - 5x$$

$$\underline{-140 = -10y + 4x}$$

$$-40 = -x$$

$$\Rightarrow x = 40$$

Substituting the value of x in equation (3) we get $100 = 10y - 5(40)$

$$\Rightarrow y = 30$$

So length of the rectangle is 40 cm and breadth of the rectangle is 30 cm.

15.

- i. ABCD is a parallelogram.

$$\therefore \angle DAC = \angle BCA \quad (\text{Alternate interior angles}) \quad \dots (1)$$

$$\text{And } \angle BAC = \angle DCA \quad (\text{Alternate interior angles}) \quad \dots (2)$$

$$\text{Also, } \angle DAC = \angle BAC \quad (\text{AC bisects } \angle A) \quad \dots (3)$$

From equations (1), (2) and (3), we have

$$\angle DAC = \angle BCA = \angle BAC = \angle DCA \quad \dots (4)$$

$$\Rightarrow \angle DCA = \angle BCA$$

Hence, AC bisects $\angle C$.

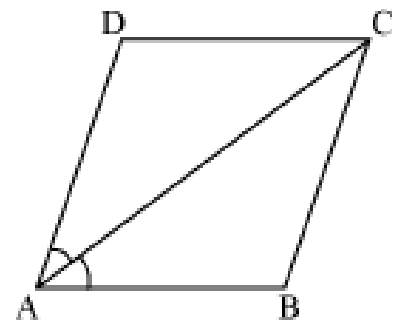
- ii. From equation (4), we have $\angle DAC = \angle DCA$

$$DA = DC \quad (\text{sides opposite to equal angles are equal})$$

But $DA = BC$ and $AB = CD$ (opposite sides of parallelogram)

$$\therefore AB = BC = CD = DA$$

Hence, ABCD is rhombus.



16. Let the common multiple for their monthly income and their expenditure be x and y respectively.

According to the given income ratio, income of first person is $9x$ and that of second person is $7x$.

According to the given expenditure ratio, expenditure of first person is $4y$ and second person is $3y$.

Both of them manage to save Rs. 2000 per month

Income – Expenditure = Savings

Hence,

$$9x - 4y = 2000 \quad \dots(i)$$

$$7x - 3y = 2000 \quad \dots(ii)$$

Multiplying (i) by 3 and (ii) by 4, we get

$$27x - 12y = 6000 \quad \dots(iii)$$

$$28x - 12y = 8000 \quad \dots(iv)$$

Subtracting (iii) from (iv), we get

$$\Rightarrow x = 2000$$

Now, income of first person = $9x = 9(2000) = \text{Rs. } 18000$

Income of second person = $7x = 7(2000) = \text{Rs. } 14000$

17. Now, PQST is a cyclic quadrilateral.

$$\angle SRQ + \angle SPQ = 180^\circ \dots (i)$$

(Since, opposite sides of a cyclic quadrilateral are supplementary)

$$\text{Also, } \angle STQ + \angle STR = 180^\circ \quad (\text{Linear pair of angles})$$

$$\angle STQ = \angle SPQ \quad (\text{opposite angles of a parallelogram are equal})$$

$$\text{Therefore, } \angle SPQ + \angle STR = 180^\circ \dots (ii)$$

From (i) and (ii),

$$\angle SRQ + \angle SPQ = \angle SPQ + \angle STR$$

$$\text{Therefore, } \angle SRQ = \angle STR$$

In ΔSTR ,

$$\angle SRQ = \angle STR$$

ΔSTR is an isosceles triangle. Hence, $ST = SR$

18.

i. Let E denote the event 'the arrow points at an odd number'.

The favourable outcomes of the event $E = 1, 3, 5, 7$

The number of outcomes = $n(E) = 4$

$$\text{So, } P(E) = \frac{4}{8} = \frac{1}{2}$$

ii. Let F denote the event 'the arrow points at a number greater than 2'.

The favourable outcomes of the event $F = 3, 4, 5, 6, 7, 8$

The number of outcomes $n(F) = 6$

$$\text{So, } P(F) = \frac{6}{8} = \frac{3}{4}$$

iii. Let N denote the event 'the arrow points at a number less than 9'.

The favourable outcomes of the event = $1, 2, 3, 4, 5, 6, 7, 8$

The number of outcomes $n(N) = 8$

$$\text{So, } P(N) = \frac{8}{8} = 1$$

19. $27p^3 + 8q^3 + 54p^2q + 36pq^2$

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

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

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

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

20. Total distance covered = x km.

Fare for the 1st kilometre = Rs. 8

Fare for the remaining distance per kilometre = Rs. (x - 1)5

Total fare = 8 + (x - 1)5

$$y = 8 + 5x - 5$$

$$y = 5x + 3$$

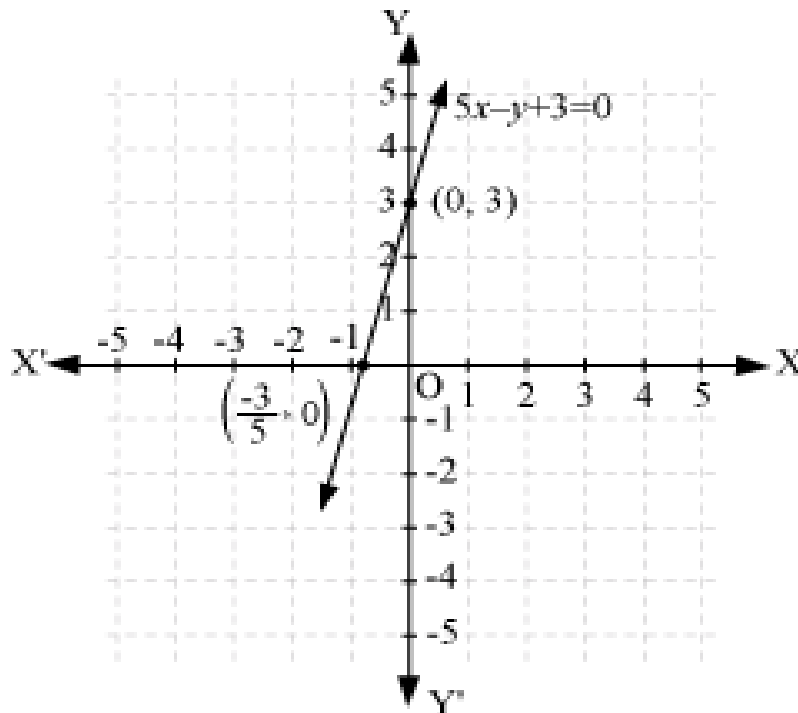
$$5x - y + 3 = 0$$

We observe that point (0, 3) and $\left(-\frac{3}{5}, 0\right)$ satisfy the above equation.

So these are solutions of this equation.

x	0	$-\frac{3}{5}$
y	3	0

Now join the points with a straight line as below:



Here we may find that the variables x and y are representing the distance covered and fare paid for that distance respectively and these quantities may not be negative.

Hence we will consider only those values of x and y which are lying in 1st quadrant.

21. Since DS bisect $\angle D$ and AS bisects $\angle A$, therefore,

$$\angle DAS + \angle ADS = \frac{1}{2}\angle A + \frac{1}{2}\angle D$$

$$\Rightarrow \angle DAS + \angle ADS = \frac{1}{2}(\angle A + \angle D) = \frac{1}{2} \times 180^\circ = 90^\circ$$

$\angle A$ and $\angle D$ are interior angles on the same sides of the transversal.

Also,

$$\angle DAS + \angle ADS + \angle DSA = 180^\circ \text{ (Angle sum property of triangle)}$$

$$\Rightarrow 90^\circ + \angle DSA = 180^\circ$$

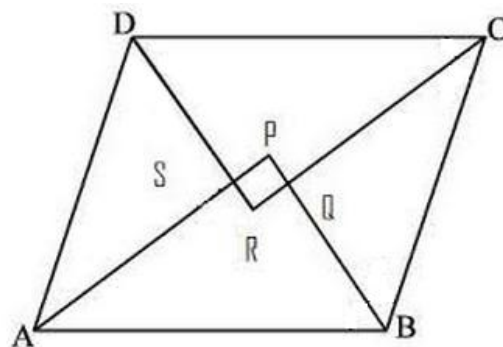
$$\Rightarrow \angle DSA = 90^\circ$$

$$\text{So, } \angle PSR = 90^\circ$$

Similarly, it can be shown that $\angle APB = 90^\circ$ or $\angle SPQ = 90^\circ$.

Similarly, $\angle PQR = 90^\circ$ and $\angle SRQ = 90^\circ$.

So, PQRS is a rectangle.



22. Let us find the class marks x_i of each class by taking the average of the upper class limit and lower class limit and put them in a table.

We can use the Direct Method because numerical values of x_i and f_i are small.

Class interval	No. of houses (f_i)	Class marks (x_i)	$f_i x_i$
0-2	1	1	1
2-4	2	3	6
4-6	1	5	5
6-8	5	7	35
8-10	6	9	54
10-12	2	11	22
12-14	3	13	39
Total	$\sum f_i = 20$		$\sum f_i x_i = 162$

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{162}{20} = 8.1$$

Thus, the mean number of plants per house is 8.1 plants

Section D

23.

$$\begin{aligned}
 & \frac{16 \times 2^{n+1} - 4 \times 2^n}{16 \times 2^{n+2} - 2 \times 2^{n+2}} \\
 &= \frac{2^4 \times 2^{n+1} - 2^2 \times 2^n}{2^4 \times 2^{n+2} - 2 \times 2^{n+2}} \\
 &= \frac{2^{n+5} - 2^{n+2}}{2^{n+6} - 2^{n+3}} \\
 &= \frac{2^{n+5} - 2^{n+2}}{2 \cdot 2^{n+5} - 2 \cdot 2^{n+2}} \\
 &= \frac{(2^{n+5} - 2^{n+2})}{2(2^{n+5} - 2^{n+2})} \\
 &= \frac{1}{2}
 \end{aligned}$$

24. Since $AB = AC$, $BD = DC$, $AD = AD$

$\therefore \triangle ABD \cong \triangle ACD$ (SSS congruence criterion)

$\Rightarrow \angle BAD = \angle CAD$ (CPCT)

In $\triangle ABP$ and $\triangle ACP$

$AB = AC$, $\angle BAD = \angle CAD$, $AP = AP$

$\therefore \triangle ABP \cong \triangle ACP$ (SAS congruence criterion)

$\Rightarrow BP = PC$ and $\angle APC = \angle APB$ (CPCT)

$\angle APB + \angle APC = 180^\circ$ (linear pair)

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

Hence AP bisects common base at right angle.

25. Let $f(x) = 2x^3 - 3x^2 - 17x + 30$.

$$f(-3) = 2(-3)^3 - 3(-3)^2 - 17(-3) + 30 = -54 - 27 + 51 + 30 = -81 + 81 = 0$$

Thus, $(x + 3)$ is a factor of $f(x)$.

$$\begin{array}{r}
 2x^2-9x+10 \\
 x+3\overline{)2x^3-3x^2-17x+30} \\
 \underline{2x^3+6x^2} \\
 -9x^2-17x \\
 \underline{-9x^2-27x} \\
 10x+30 \\
 \underline{10x+30} \\
 0
 \end{array}$$

$$\begin{aligned}
 2x^3 - 3x^2 - 17x + 30 &= (x + 3)(2x^2 - 9x + 10) \\
 &= (x + 3)(2x^2 - 4x - 5x + 10) \\
 &= (x + 3)[2x(x - 2) - 5(x - 2)] \\
 &= (x + 3)(2x - 5)(x - 2)
 \end{aligned}$$

26. □PQRS is a square.

$$\therefore PQ = QR = RS = SP \quad \dots(i)$$

$$\text{Also } \angle RSP = \angle SRQ = \angle RQP = \angle SPQ = 90^\circ \quad \dots(ii)$$

Also $\triangle TSR$ is equilateral.

$$TS = TR = SR \dots(iii)$$

$$\text{Also } \angle STR = \angle TSR = \angle TRS = 60^\circ$$

$$TR = QR \dots \text{from (i) and (ii)}$$

$$\text{Also } \angle TSP = \angle RSP + \angle TSR$$

$$\angle TSP = 90^\circ + 60^\circ = 150^\circ$$

$$\text{Similarly } \angle TRQ = 150^\circ$$

In $\triangle TSP$ and $\triangle TRQ$,

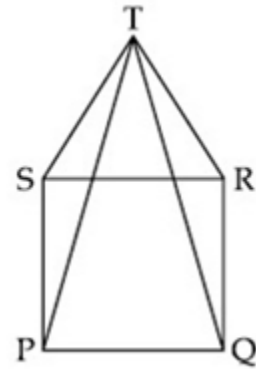
$$PS = QR \dots (\because \text{by (i)})$$

$$\angle TSP = \angle TRQ \dots (\because \text{Both } 150^\circ)$$

$$TS = TR \dots (\because \text{by (iii)})$$

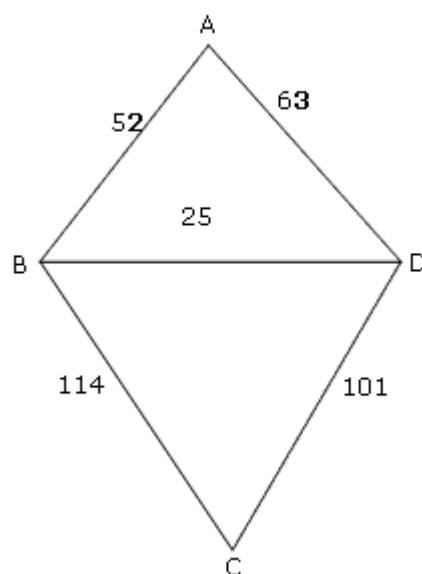
$$\therefore \triangle TSP \cong \triangle TRQ \quad \dots (\text{by SAS criterion})$$

$$\therefore PT = QT \quad \dots (\text{c.p.c.t})$$



27.

Sonu and Monu's field together form a quadrilateral ABCD.



Sonu's field is $\triangle ABD$,

$$s = \frac{a+b+c}{2} = \frac{52+25+63}{2} = 70$$

$$s - a = 70 - 52 = 18, \quad s - b = 70 - 25 = 45 \quad \text{and} \quad s - c = 70 - 63 = 7$$

Area of $\triangle ABD$ =

$$\sqrt{s(s-a)(s-b)(s-c)} = \sqrt{70 \cdot 18 \cdot 45 \cdot 7} = 630 \text{ sq m}$$

Monu's field is $\triangle BCD$,

$$s = \frac{a+b+c}{2} = \frac{114+25+101}{2} = 120$$

$$s - a = 120 - 114 = 6, \quad s - b = 120 - 25 = 95 \quad \text{and} \quad s - c = 120 - 101 = 19$$

Area of $\triangle BCD$ =

$$\sqrt{s(s-a)(s-b)(s-c)} = \sqrt{120 \cdot 6 \cdot 95 \cdot 19} = 1140 \text{ sq m}$$

$$\text{Total area is} = 630 + 1140 = 1770 \text{ sq m}$$

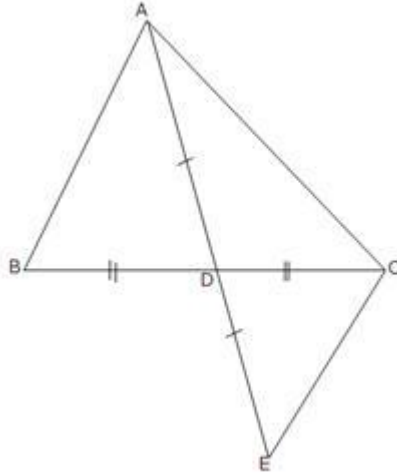
The cost of fertilization is Rs 20 per sq m.

$$\text{Therefore the total cost is} = 1770 \times 20 = \text{Rs } 35,400.$$

28. 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,

$$AD = DE$$

$$BD = DC$$

$$\angle ADB = \angle EDC$$

Thus, triangles ADB and EDC are congruent (By SAS congruence criterion)

Hence, $AB = EC$ (CPCT)

Now, in triangle AEC,

$$AC + CE > AE$$

$$AC + CE > 2AD$$

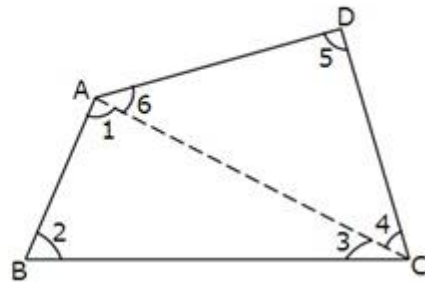
$$AC + AB > 2AD \text{ (since, } AB = EC, \text{ proved above)}$$

29.

Let ABCD be a quadrilateral.

We have to find $\angle A + \angle B + \angle C + \angle D$.

Join AC and mark the angles as shown in the figure.



From $\triangle ABC$, we have:

$$\angle 1 + \angle 2 + \angle 3 = 180^\circ \quad (\text{Angle sum property of a triangle}) \quad \dots (1)$$

Form $\triangle ADC$, we have:

$$\angle 6 + \angle 5 + \angle 4 = 180^\circ \quad (\text{Angle sum property of a triangle}) \quad \dots (2)$$

Adding (1) and (2),

$$\angle 1 + \angle 2 + \angle 3 + \angle 6 + \angle 5 + \angle 4 = 180^\circ + 180^\circ$$

$$\Rightarrow (\angle 1 + \angle 6) + \angle 2 + (\angle 3 + \angle 4) + \angle 5 = 360^\circ$$

$$\Rightarrow \angle A + \angle B + \angle C + \angle D = 360^\circ$$

Thus, the required sum is 360° and not 270° .

Value: Cooperative learning among students without any gender bias. Promoting secularism and self-confidence among students. Accepting own mistakes gracefully. It also provides guidance to the students not to generalize statements in haste, without any proper thinking.

30. Remainder when $p(x)$ is divided by $(x - 3)$ is given by

$$p(3) = 27a + 36 + 9 - 4 = 27a + 41$$

Remainder when $q(x)$ is divided by $(x - 3)$ is given by:

$$q(3) = 27 - 12 + a = 15 + a$$

$$\text{Given, } p(3) = q(3)$$

$$\Rightarrow 27a + 41 = 15 + a$$

$$\Rightarrow a = -1$$

$$\text{Therefore, } p(x) = -x^3 + 4x^2 + 3x - 4$$

Now, when $p(x)$ is divided by $(x - 2)$, the remainder is given by

$$p(2) = -8 + 16 + 6 - 4 = 10$$