CLASS 9 MATHS NOTES

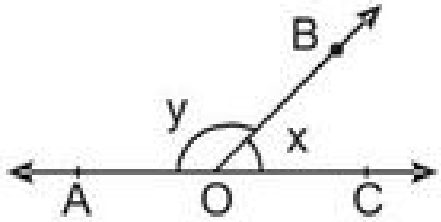
LINES & ANGLES

CHAPTER-6

LINES AND ANGLES

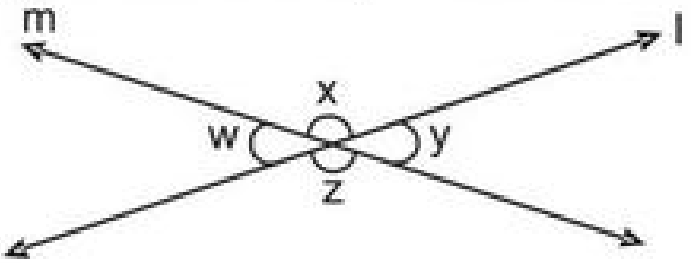
KEY POINTS

- Line is a collection of points which has only length neither breadth nor thickness.
- **Line Segment :** A part of portion of a line with two end points.
- **Ray :** A part of a line with one end point.
- **Collinear points :** Three or more points lying on the same line.
- **Angle :** An angle is formed when two rays originate from the same end point. The rays making an angle are called the arms and the end point is the vertex.
- **Acute angle :** An angle measure between 0° and 90°
- **Right angle :** Angle exactly equal to 90°
- **Obtuse angle :** An angle greater than 90° but less than 180°
- **Straight angle :** An angle exactly equal to 180°
- **Reflex Angle :** An angle greater than 180° but less than 360°
- **Complimentary Angles :** A pair of angles whose sum is 90°
- **Supplementary angle :** A pair of angles whose sum is 180°
- **Complete Angle :** An angle whose measure is 360°.
- **Adjacent angles :** Two angles are adjacent if
  (i) They have a common vertex.
  (ii) a common arm
  (iii) Their non common arms are on opposite sides of common arm.
- **Linear pair of angle :** A pair of adjacent angles whose sum is 180°



∠AOB & ∠COB are forming linear pair.

- **Vertically opposite angles :** Angles formed by two intersecting lines on opposite side of the point of intersection.



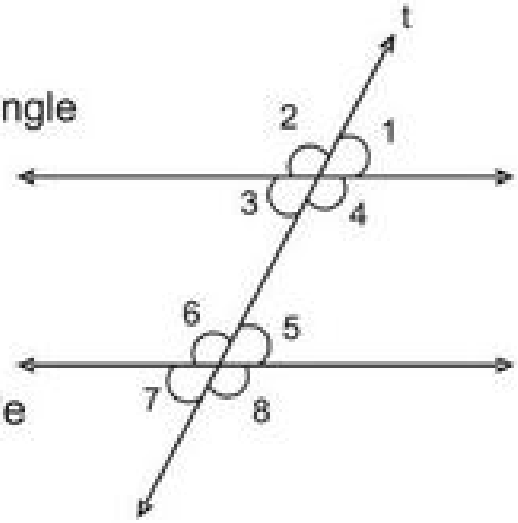
$\angle x = \angle z$
$\angle y = \angle w$

- **Intersecting line :** Two lines are said to be intersecting when the perpendicular distance between the two lines is not same every where. They meet at one point.

- **Non Intersecting lines :** Two lines are said to be non-intersecting lines when the perpendicular distance between them is same every where. They do not meet. If these lines are in the same plane these are known as **Parallel lines.**

- **Transversal line :** In the given figure l || m and t is transversal then

(a) $\left.\begin{array}{l}\angle 1 = \angle 3 \\ \angle 2 = \angle 4 \\ \angle 5 = \angle 7 \\ \angle 6 = \angle 8\end{array}\right]$ Vertically opposite angle



(b) $\left.\begin{array}{l}\angle 1 = \angle 5 \\ \angle 2 = \angle 6 \\ \angle 3 = \angle 7 \\ \angle 4 = \angle 8\end{array}\right]$ Corresponding angle

(c) $\left.\begin{array}{l}\angle 3 = \angle 5 \\ \angle 4 = \angle 6\end{array}\right]$ Alternate Interior angle

(d) $\left.\begin{array}{l}\angle 3 + \angle 6 = 180^\circ \\ \angle 4 + \angle 5 = 180^\circ\end{array}\right]$ Angles on the same sides of a transversal are supplementary.

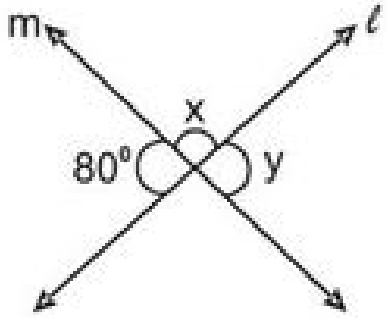
$\angle 3$, $\angle 6$ and $\angle 4$, $\angle 5$ are called co-interior angles or allied angles or consecutive interior angles.

- Sum of all interior angles of a triangle is 180°.
- Two lines which are parallel to the third line are also parallel to each other.

Important Questions with Solutions

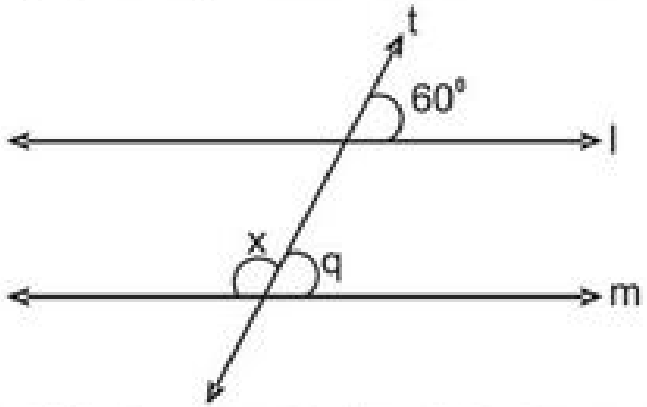
Part – A

1. From the figure find x and y

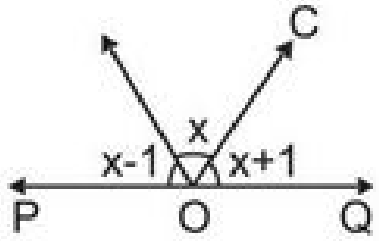


2. If an angle is equal to its complement find the angle.

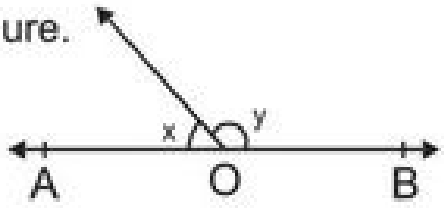
3. In the adjoining figure if l || m and *t* is transversal, find the value of x.



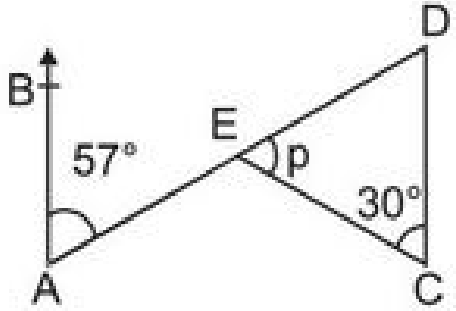
4. In the figure POQ is a straight line. The three adjacent angles are consecutive numbers. What are the measure of these angles?



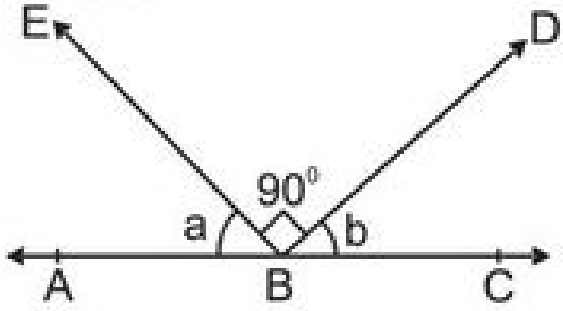
5. Twice of x is 30° less than y, find x & y from figure.



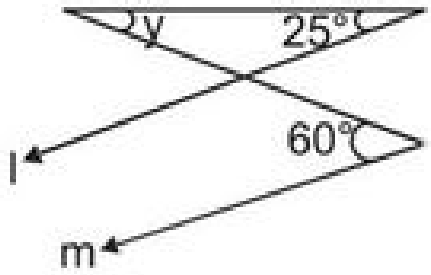
6. In the adjoining figure if AB||CD what is the value of p?



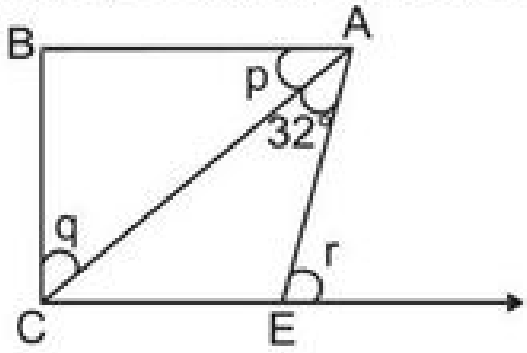
7. In the adjoining figure find tha value of a + b if $\angle DBE = 90°$



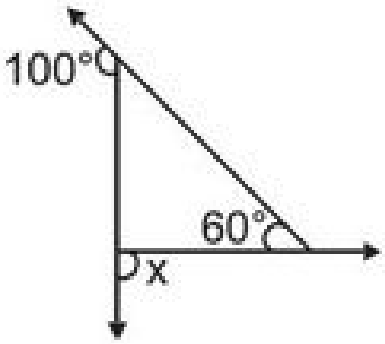
8. In the figure l || m find $\angle y$



9. If p : q = 11 : 19, AB || CE what are the values of p, q & r.



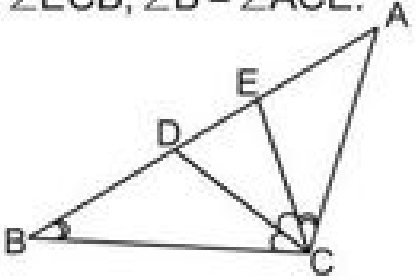
10. What is x in the figure?



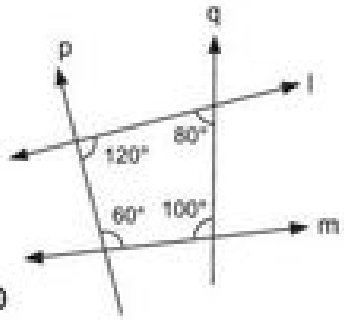
11. One of the angle of a pair of supplementary angles is 2^0 more than its supplement, find the angles.

12. In the figure CD is the angle bisector of $\angle ECB$, $\angle B = \angle ACE$.

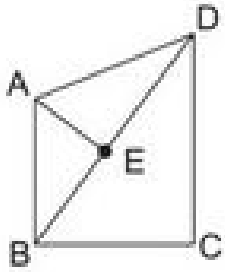
Prove that $\angle ADC = \angle ACD$



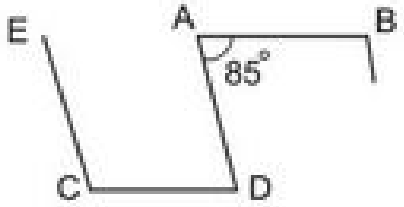
13. From the figure, tell which pair of lines are parallel and why? Explain the reason



14. In figure, if $\angle AED = \angle BDC + \angle BAE$. then show that : AB || CD.

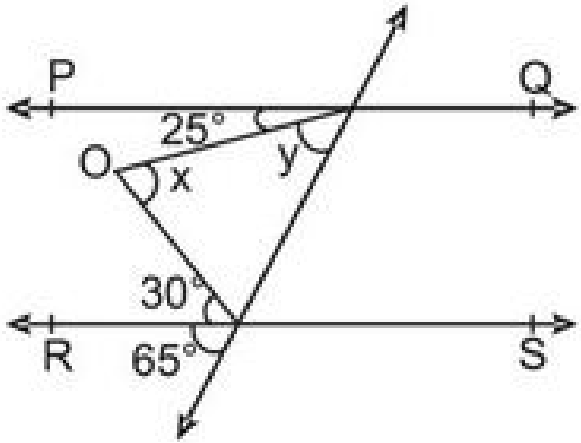


15. In figure, AB || CD and EC || AD, find x -



PART-B

16. In the adjoining figure PQ || RS find x and y.

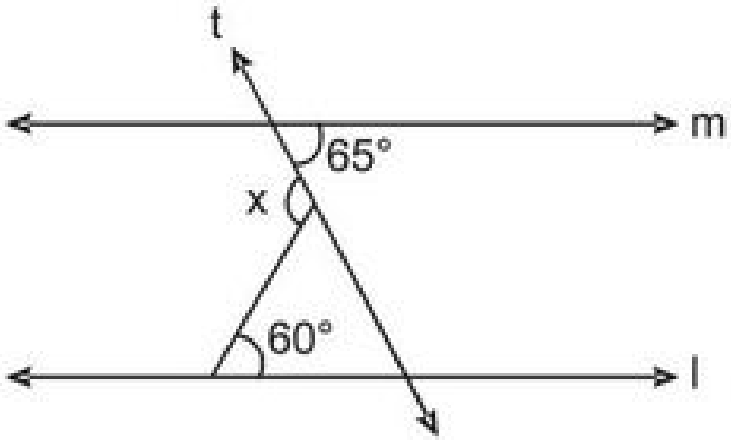


17. By contributing money, 5 friends bought pizza. They want to divide it equally among themselves. But one of them was given double piece, as he was very hungry. Find the angle of the piece of pizza each one received.

18. BO and CO are external bisector of $\angle B$ and $\angle C$ of a ΔABC Intersecting at O. If $\angle A = 60°$ $\angle ABC = 70°$, find $\angle BOC$.

19. In the above question 18, if internal bisector of $\angle B$ and $\angle C$ intersect at P, prove that $\angle PBO = 90°$ and $\angle BOC + \angle BPC = 180°$

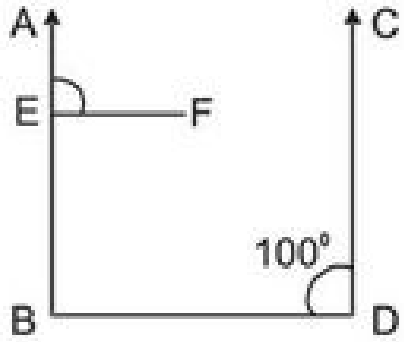
20. In the given figure if l || m and 't' is the transversal find x.



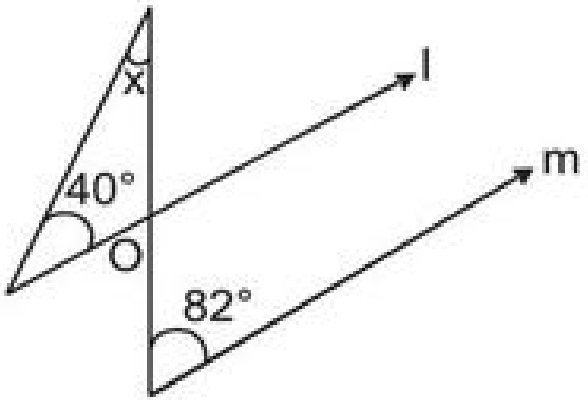
21. An exterior angle of a triangle is 103° and two of its interior opposite angles are equal, find the angles.

22. Prove that vertically opposite angles are equal.

23. In the figure AB || CD and EF || BD if ∠CDB = 100°, find ∠AEF



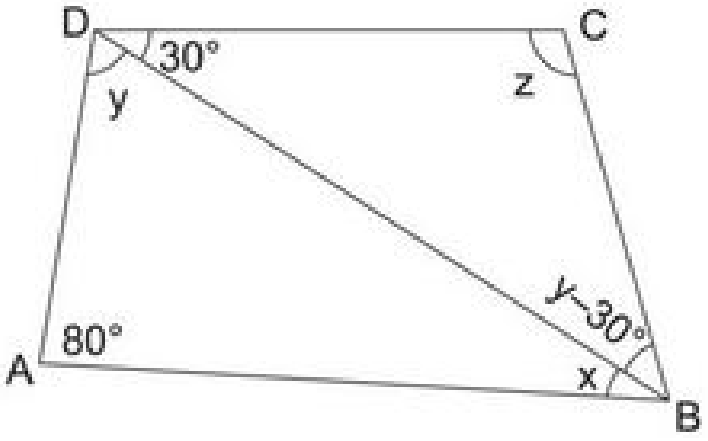
24. In the given figure l || m find the value of x.



25. The angles of a triangle are $(x-40°)$, $(x-20°)$, $(\frac{x}{2}-10°)$

Find the value of x and then find the angles of the triangle.

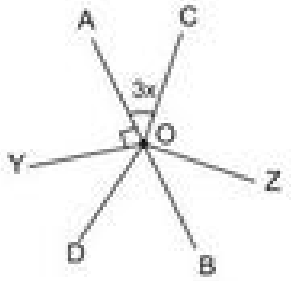
26. In the given figure if AB || DC and ∠BDC = 30° ∠BAD = 80° find ∠x, ∠y, ∠z.



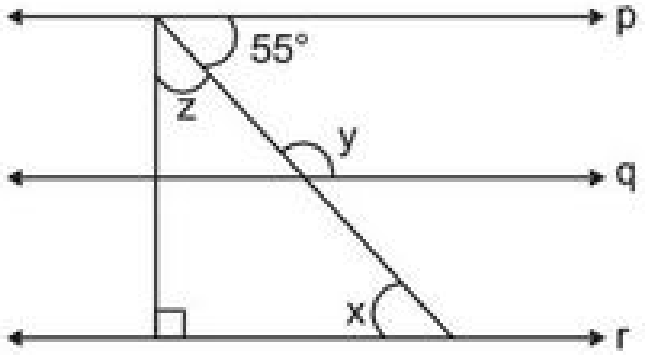
Part – C

27. If one of the angle of two intersecting lines is right angle then prove that other three angles will also be right angles.

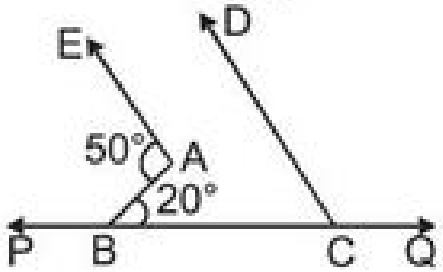
28. AB and CD are intersecting lines. OD is bisector of ∠BOY. Find x.



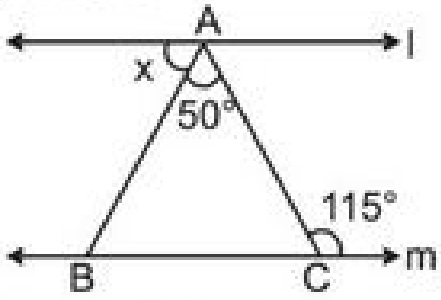
29. If p || q || r, find x, y, z from given figure.



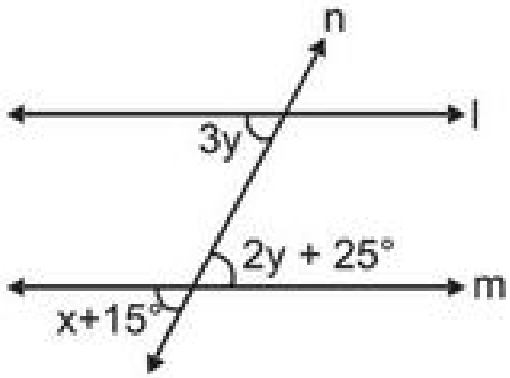
30. In the given figure find ∠DCB if AE || CD.



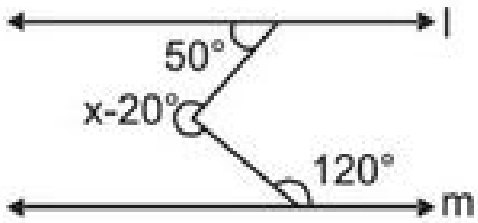
31. In the given figure l || m find x.



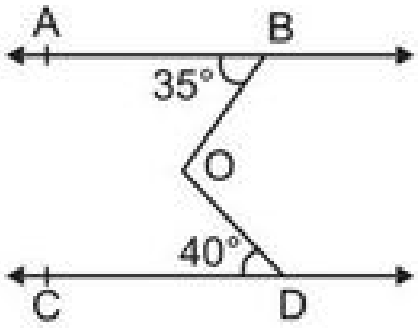
32. In the given figure l || m and n is the transversal, find x.



33. For what value of x, l || m.



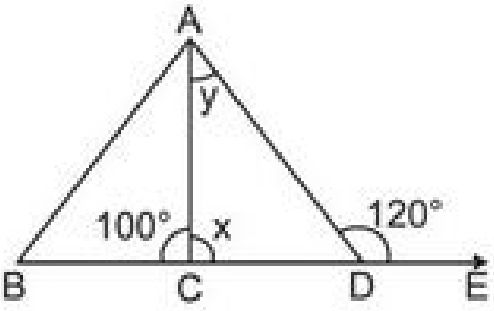
34. From the figure find reflex angle ∠BOD if AB || CD.



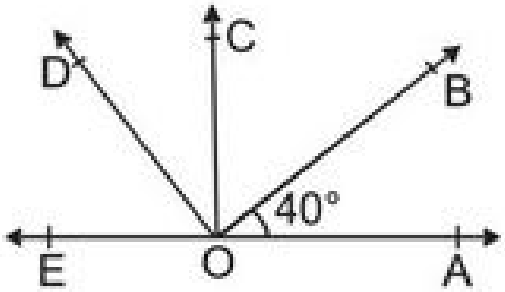
35. If the angles of a triangle are in the ratio 5 : 3 : 7 then show that the triangle is acute angled triangle.

36. Two lines are respectively perpendicular to two parallel lines show that they are parallel to each other.

37. As shown in the figure find x & y if $\angle ACB = 100°$, $\angle ADE = 120°$.



38. In the given figure $\angle DOB = 85°$, $\angle COA = 85°$, $\angle BOA = 40°$, find $\angle COB$ and $\angle DOC$.



39. Prove that the bisectors of the angles of a linear pair are at right angle.

40. If two complementary angles are such that two times the measure of one is equal to three times the measure of the other. Find the measure of larger angle.

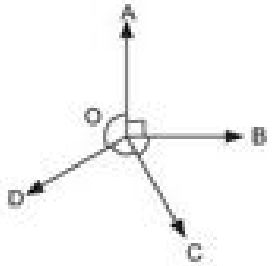
41. Prove that the sum of all exterior angles of a triangle is 360°.

42. If the bisectors of $\angle Q$ and $\angle R$ of a triangle ΔPQR meet at point S, then prove that

$$\angle QSR = 90° + \frac{1}{2}\angle P$$

43. In figure, O is the mother dairy booth which supplies milk to four centers A, B, C and D.

If ratio of the angles between B and C, C and D and D and A is 2 : 1 : 3 then find the angles.



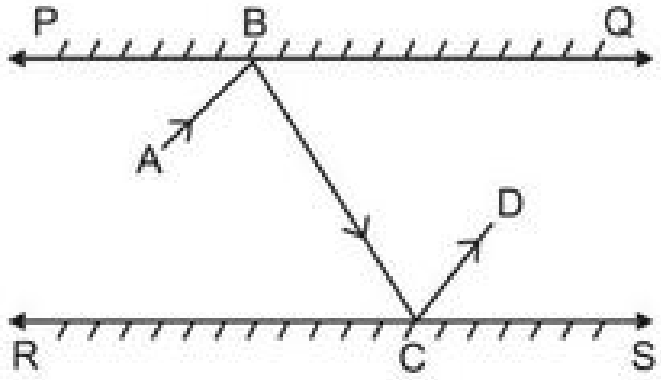
44. Show that if sum of the two angles of a triangle is equal to the third angle then the triangle is right angled triangle.

Part – D

45. If a transversal intersects two parallel lines prove that internal bisectors of the angle on the same side of a transversal meet at right angles.

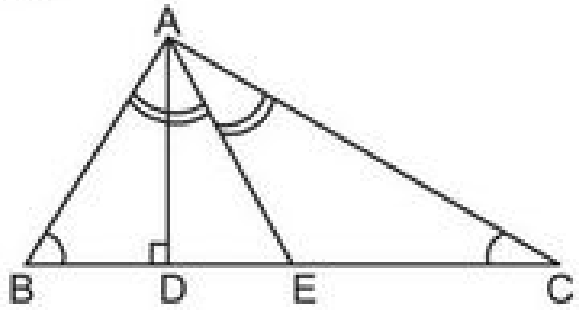
46. In the given figure PQ, RS are two mirrors placed parallel to each other. An incident ray AB strikes the mirror PQ at B; the reflected ray moves along the path BC again strikes the mirror RS at C and reflects back along CD.

Prove that AB || CD.



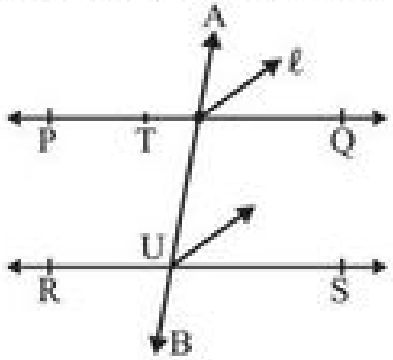
47. In the figure AE is the bisector of $\angle A$, $AD \perp BC$. Show that

$2(\angle ADE - \angle EAC) = \angle B + \angle C$



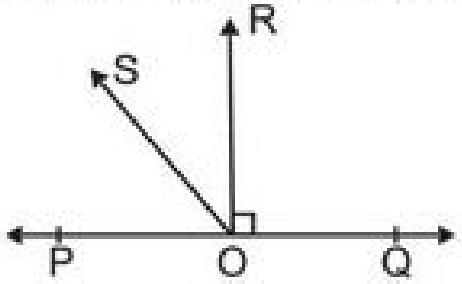
48. Prove that quadrilateral formed by the intersection of bisectors of interior angles made by a transversal on two parallel lines is a rectangle.

49. In the given figure $\ell \parallel m$ where ℓ and m are the bisectors of corresponding angles $\angle ATQ$ and $\angle TUS$. Respectively Prove that PQ || RS.



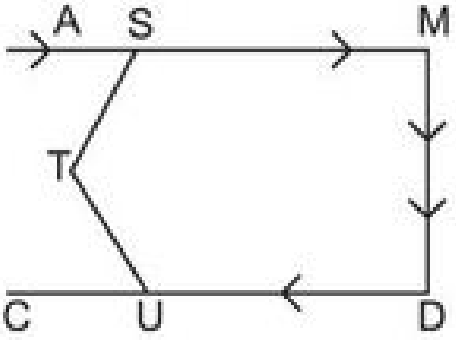
50. POQ is a straight line $RO \perp PQ$, SO is a ray from O then prove that

$$\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$$



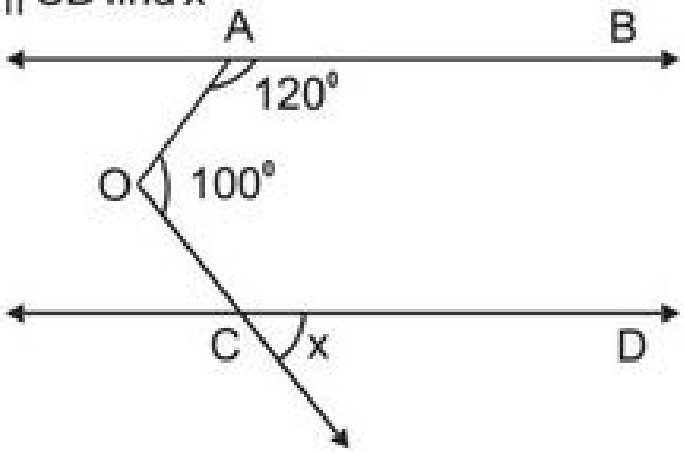
51. A route for going from place A to place C is shown in the adjoining figure. To avoid trafic on the highway AM, a road is cut through S via T

to reach C, by authorities. If $\angle MST = 125°$, $\angle CUT = 50°$, what will be the measure of angle $\angle STU$.

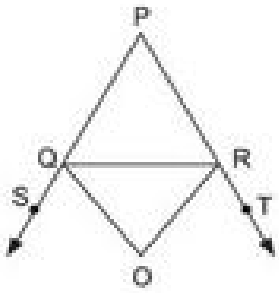


52. In a Co-Educational School a teacher conduct a mathematical quiz to solve a question on black board. She needs two students and prize will be given to the students who solve the question first. For this purpose she chooses a boy and a girl. The problem is given in the figure.

(i) If AB || CD find x



53. In ΔPQR, sides PQ and PR are extended to S and T respectively. OQ and OR are bisector of $\angle RQS$ and $\angle QRT$ meeting at O. Show that



$2\angle QOR = \angle PQR + \angle QRP$

CHAPTER-6

LINES & ANGLES

ANSWERS

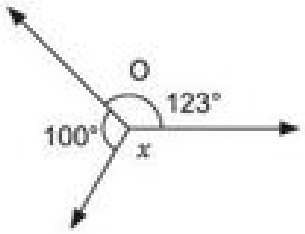
1. $x = 100^0, y = 80^0$
2. 45^0
3. 120^0
4. $59^0, 60^0, 61^0$
5. $50^0, 130^0$
6. 93^0
7. $a + b = 90^0$
8. 35^0
9. $33^0, 57^0, 65^0$
10. 140^0
11. $86^0, 94^0$
12. $l \parallel m$
15. 95^0
16. $x = 55^0, y = 40^0$
17. 4 friends = 60°, 1 friend = 60° x 2 = 120^0
18. 60^0
20. 125^0
21. $51\frac{1}{2}^\circ, 51\frac{1}{2}^\circ$
23. 80^0
24. 42^0
25. $x = 100^\circ, 60^\circ, 80^\circ, 40^\circ$
26. $x = 30^0, y = 70^0, z = 110^0$
28. $x = 15^0$
29. $x = 55^0, y = 125^0, z = 35^0$
30. 30^0
31. 65^0
32. 60^0
33. 270^0
34. 285^0
37. $80^0, 40^0$
38. $45^0, 40^0$
40. 54^0
43. $90^0, 45^0, 135^0$
47. 17.5^0
51. 105^0
52. 40^0

PRACTICE TEST
LINES AND ANGLES

Time : 50 Min. M.M. 20

1. If $\angle ABC = 142°$, find reflex $\angle ABC$. (1)

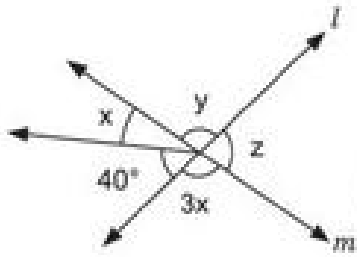
2. Two angles form a linear pair. If one of the angle is acute, what is the type of other angle? (1)

3. Find x in the given figure : 

(2)

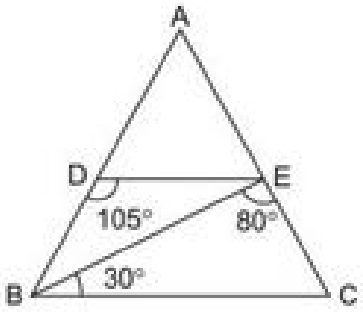
4. If two parallel lines intersected by a transversal, then name the pair of angles formed that are equal. (2)

5. In a ΔABC, $\angle A + \angle B = 125°$ and $\angle B + \angle C = 150°$. Find all the angle of ΔABC. (3)

6. l and m are the intersecting lines in the given figure. Find x, y and z. 

(3)

7. If two parallel lines are intersected by a transversal, then prove that the bisectors of the interior angles on both sides of transversal form a rectangle. (4)

8. ABC is a triangle in which DE || BC.
Find $\angle A$. 

(4)