CBSE Class 9 Mathemaics
Important Questions
Chapter 6
Lines and Angles

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1 Marks Questions

1. Measurement of reflex angle is

(i) 90°

(ii) between 0° and 90°

(iii) between 90° and 180°

(iv) between 180° and 360°

Ans. (iv) between 180° and 360°

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2. The sum of angle of a triangle is

(i) 0°

(ii) 90°

(iii) 180°

(iv) none of these

Ans. (iii) 180°

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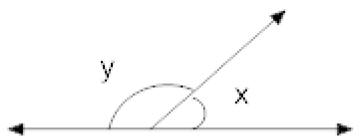
3. In fig if x=30° **then y=**



(i) 90°

(ii) 180°

(iii) 150°

(iv) 210°

Ans. (iii) 150°

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4. If two lines intersect each other then

(i) vertically opposite angles are equal

(ii) corresponding angle are equal

(iii) alternate interior angle are equal

(iv) none of these

Ans. (i) vertically opposite angles are equal

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5. The measure of Complementary angle of 63° **is**

(a) 30°

(b) 36°

(c) 27°

(d) none of there

Ans. (c) 27°

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6. If two angles of a triangle is 30° and 45° what is measure of third angle

(a) 95°

(b) 90°

(c) 60°

(d) 105°

Ans. (d) 105°

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7. The measurement of Complete angle is

(a) 0°

(b) 90°

(c) 180°

(d) 360°

Ans. (d) 360°

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8. The measurement of sum of linear pair is

(a) 180°

(b) 90°

(c) 270°

(d) 360°

Ans. (a) 180°

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9. The difference of two complementary angles is 40^{0} **. The angles are**

(a) $65^{0}, 35^{0}$

(b) $70^{0}, 30^{0}$

(c) $25^{0}, 65^{0}$

(d) $70^{0}, 110^{0}$

Ans. (c) $25^{0}, 65^{0}$

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10. Given two distinct points P and Q in the interior of $\angle ABC$**, then** $\overrightarrow{AB}$ **will be**

(a) in the interior of $\angle ABC$

(b) in the interior of $\angle ABC$

(c) on the $\angle ABC$

(d) on the both sides of $\overline{BA}$

Ans. (c) on the $\angle ABC$

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11. The complement of $(90-a)^0$ **is**

(a) -a^0

(b) $(90+2a)^0$

(c) $(90-a)^0$

(d) a^0

Ans. (d) a^0

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12. The number of angles formed by a transversal with a pair of lines is

(a) 6

(b) 3

(c) 8

(d) 4

Ans. (c) 8

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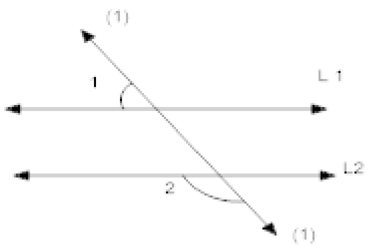
13. In fig $L_1 \parallel L_2$ **And** $\angle 1 = 52^0$ **the measure of** $\angle$ **2 is.**



(A) 38^0

(B) 128^0

(C) 52^0

(D) 48^0

Ans. (B) 128^0

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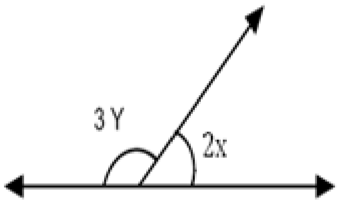
14. In fig x= 30^0 the value of Y is



(A) 10^0

(B) 40^0

(C) 36^0

(D) 45^0

Ans. (B) 40^0

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15. Which of the following pairs of angles are complementary angle?

(A) $25^0, 65^0$

(B) $70^0, 110^0$

(C) $30^0, 70^0$

(D) $32.1^0, 47.9^0$

Ans. (A) $25^0, 65^0$

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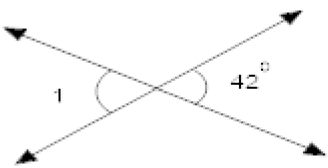
16. In fig the measure of $\angle$ 1 is.



(A) 158^0

(B) 138^0

(C) 42^0

(D) 48^0

Ans. (C) 42^0

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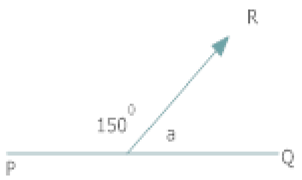
17. In figure the measure of $\angle a$ is



(a) 30^0

(b) 150^0

(c) 15^0

(d) 50^0

Ans. (a) 30^0

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18. The correct statement is-

(a) A line segment has one end point only.

(b) The ray AB is the same as the ray BA.

(c) Three points are collinear if all of them lie on a line.

(d) Two lines are coincident if they have only one point in common.

Ans. (c) Three points are collinear if all of them lie on a line.

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19. One angle is five times its supplement. The angles are-

(a) $15^0, 75^0$

(b) $30^0, 150^0$

(c) $36^0, 144^0$

(d) $160^0, 40^0$

Ans. (b) $30^0, 150^0$

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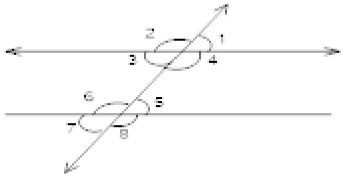
20. In figure if $m \parallel n$ **and** $\angle 1 : \angle 2 = 1 : 2$. *The measure of* $\angle 8$ *is*



(a) 120^0

(b) 60^0

(c) 30^0

(d) 45^0

Ans. (b) 60^0

2 Marks Questions

1. In Fig. 6.13, lines AB and CD intersect at O. If $\angle AOC + \angle BOE = 70^\circ$ **and** $\angle BOD = 40^\circ$**, find** $\angle BOE$ **and reflex** $\angle COE$ **.**

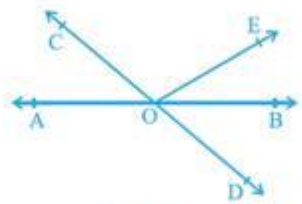


Fig. 6.13

Ans. We are given that $\angle AOC + \angle BOE = 70^\circ$ and $\angle BOD = 40^\circ$.

We need to find $\angle BOE$ and reflex $\angle COE$.

From the given figure, we can conclude that $\angle COB$ and $\angle COE$ form a linear pair.

We know that sum of the angles of a linear pair is 180° .

$\therefore \angle COB + \angle COE = 180^\circ$

$\because \angle COB = \angle AOC + \angle BOE$, or

$\therefore \angle AOC + \angle BOE + \angle COE = 180^\circ$

$\Rightarrow 70^\circ + \angle COE = 180^\circ$

$\Rightarrow \angle COE = 180^\circ - 70^\circ$

$= 110^\circ$.

Reflex $\angle COE = 360^\circ - \angle COE$

$= 360^\circ - 110^\circ$

$= 250^\circ$.

$\angle AOC = \angle BOD$ (Vertically opposite angles), or

$\angle BOD + \angle BOE = 70^\circ$.

But, we are given that $\angle BOD = 40^\circ$.

$40^\circ + \angle BOE = 70^\circ$

$\angle BOE = 70^\circ - 40^\circ$

$= 30^\circ$.

Therefore, we can conclude that Reflex $\angle COE = 250^\circ$ and $\angle BOE = 30^\circ$.

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2. In Fig. 6.14, lines XY and MN intersect at O. If $\angle POY = 90^\circ$ and *a*:*b*= 2 : 3, find *c*.

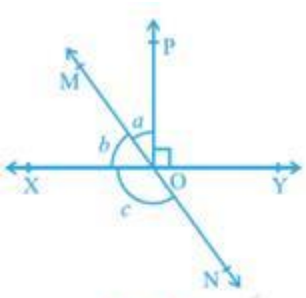

Fig. 6.14

Ans. We are given that $\angle POY = 90^\circ$ and $a : b = 2 : 3$.

We need find the value of *c* in the given figure.

Let *a* be equal to 2*x* and *b* be equal to *3x*.

$\because\ a+b=90^\circ \Rightarrow 2x+3x=90^\circ \Rightarrow 5x=90^\circ$

$\Rightarrow x=18^\circ$

Therefore $b=3\times18^\circ=54^\circ$

Now $b+c=180^\circ$ [Linear pair]

$\Rightarrow 54^\circ+c=180^\circ$

$\Rightarrow c=180^\circ-54^\circ=126^\circ$

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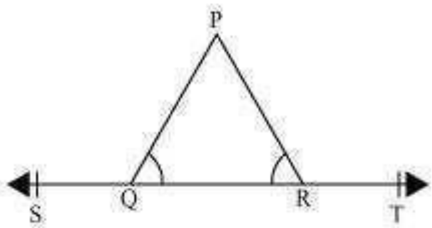
3. In the given figure, $\angle PQR=\angle PRQ$, then prove that $\angle PQS=\angle PRT$.



Ans. We need to prove that $\angle PQS=\angle PRT$.

We are given that $\angle PQR=\angle PRQ$.

From the given figure, we can conclude that $\angle PQS$ and $\angle PQR$, and $\angle PRS$ and $\angle PRT$ form a linear pair.

We know that sum of the angles of a linear pair is 180°.

$\therefore \angle PQS+\angle PQR=180^\circ$, and(i)

$\angle PRQ+\angle PRT=180^\circ$. (ii)

From equation (i) and (ii), we can conclude that

$\angle PQS+\angle PQR=\angle PRQ+\angle PRT$.

But, $\angle PQR=\angle PRQ$.

$\therefore \angle PQS=\angle PRT$.

Therefore, the desired result is proved.

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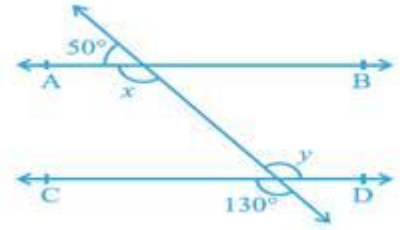
4. In the given figure, find the values of x and y and then show that AB || CD.



Ans. We need to find the value of *x* and *y* in the figure given below and then prove that $AB \parallel CD$.

From the figure, we can conclude that $y = 130^\circ$ (Vertically opposite angles), and

x and 50° form a pair of linear pair.

We know that the sum of linear pair of angles is 180°.

$x + 50^\circ = 180^\circ$

$x = 130^\circ$.

$x = y = 130^\circ$.

From the figure, we can conclude that x and y form a pair of alternate interior angles corresponding to the lines *AB* and *CD*.

Therefore, we can conclude that $x = 130^\circ, y = 130^\circ$ and $AB \parallel CD$.

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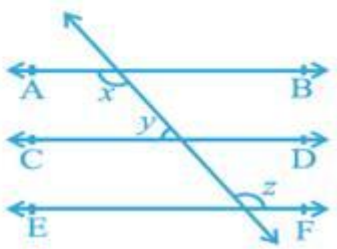
5. In the given figure, if AB || CD, CD || EF and y: z = 3: 7, find x.



Ans. We are given that $AB \parallel CD$, $CD \parallel EF$ and $y : z = 3 : 7$.

We need to find the value of *x* in the figure given below.

We know that lines parallel to the same line are also parallel to each other.

We can conclude that $AB \parallel CD \parallel EF$.

Let $y = 3a$ and $z = 7a$.

We know that angles on same side of a transversal are supplementary.

$\therefore x+y=180^\circ$.

$x=z$ (Alternate interior angles)

$z+y=180^\circ$, or $7a+3a=180^\circ$

$\Rightarrow 10a=180^\circ$

$a=18^\circ$.

$z=7a=126^\circ$

$y=3a=54^\circ$.

Now $x+54^\circ=180^\circ$

$x=126^\circ$.

Therefore, we can conclude that $x=126^\circ$.

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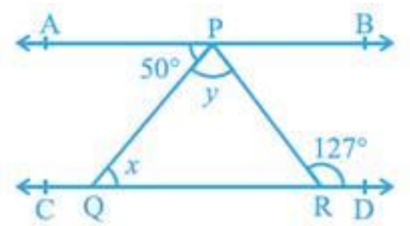
6. In the given figure, if AB || CD, $\angle APQ=50^\circ$ and $\angle PRD=127^\circ$, find x and y.



Ans. We are given that $AB \parallel CD$, $\angle APQ=50^\circ$ and $\angle PRD=127^\circ$.

We need to find the value of *x* and *y* in the figure.

$\angle APQ=x=50^\circ$. (Alternate interior angles)

$\angle PRD=\angle APR=127^\circ$. (Alternate interior angles)

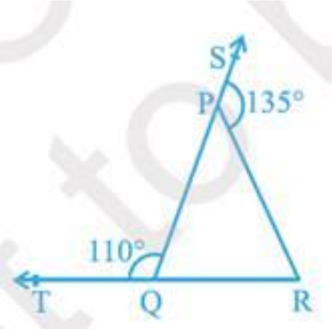
$\angle APR=\angle QPR+\angle APQ$.

$127^\circ=y+50^\circ$

$\Rightarrow y=77^\circ$.

Therefore, we can conclude that $x=50^\circ$ and $y=77^\circ$.

7. In the given figure, sides QP and RQ of ΔPQR are produced to points S and T respectively. If $\angle SPR = 135^\circ$ and $\angle PQT = 110^\circ$, find $\angle$ PRQ.



Ans. We are given that $\angle SPR = 135^\circ$ and $\angle PQT = 110^\circ$.

We need to find the value of $\angle PRQ$ in the figure given below.

From the figure, we can conclude that $\angle SPR$ and $\angle RPQ$, and $\angle SPR$ and $\angle RPQ$ form a linear pair.

We know that the sum of angles of a linear pair is 180°.

$\angle SPR + \angle RPQ = 180^\circ$, and

$\angle PQT + \angle PQR = 180^\circ$.

$135^\circ + \angle RPQ = 180^\circ$, and

$110^\circ + \angle PQR = 180^\circ$, or

$\angle RPQ = 45^\circ$, and

$\angle PQR = 70^\circ$.

From the figure, we can conclude that

$\angle PQR + \angle RPQ + \angle PRQ = 180^\circ$. (Angle sum property)

$\Rightarrow 70^\circ + 45^\circ + \angle PRQ = 180^\circ$

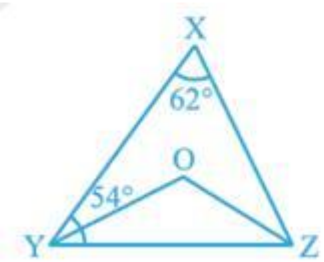
$\Rightarrow 115^\circ + \angle PRQ = 180^\circ$

$\Rightarrow \angle PRQ = 65^\circ$.

Therefore, we can conclude that $\angle PRQ = 65^\circ$.

8. In the given figure, $\angle X = 62^\circ$, $\angle XYZ = 54^\circ$. If YO and ZO are the bisectors of $\angle$ XYZ and XZY respectively of ΔXYZ, find OZY and YOZ.

Ans. We are given that $\angle X = 62^\circ, \angle XYZ = 54^\circ$ and *YO* and *ZO* are bisectors of $\angle XYZ$ and $\angle XZY$, respectively.



We need to find $\angle OZY$ and $\angle YOZ$ in the figure.

From the figure, we can conclude that in ΔXYZ

$\angle X + \angle XYZ + \angle XZY = 180^\circ$. (Angle sum property)

$\Rightarrow 62^\circ + 54^\circ + \angle XZY = 180^\circ$

$\Rightarrow 116^\circ + \angle XZY = 180^\circ$

$\Rightarrow \angle XZY = 64^\circ$.

We are given that *OY* and *OZ* are the bisectors of $\angle XYZ$ and $\angle XZY$, respectively.

$\angle OYZ = \angle XYO = \frac{54^\circ}{2} = 27^\circ$, and

$\angle OZY = \angle XZO = \frac{64^\circ}{2} = 32^\circ$.

From the figure, we can conclude that in ΔOYZ

$\angle OYZ + \angle OZY + \angle YOZ = 180^\circ$. (Angle sum property)

$27^\circ + 32^\circ + \angle YOZ = 180^\circ$

$\Rightarrow 59^\circ + \angle YOZ = 180^\circ$

$\Rightarrow \angle YOZ = 121^\circ$.

Therefore, we can conclude that $\angle YOZ = 121^\circ$ and $\angle OZY = 32^\circ$.

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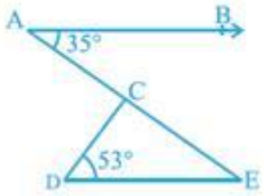
9. In the given figure, if AB || DE, $\angle BAC = 35^\circ$ and $\angle CDE = 53^\circ$, find $\angle$ DCE.



Ans. We are given that $AB \parallel DE$, $\angle BAC = 35^\circ$ and $\angle CDE = 53^\circ$.

We need to find the value of $\angle DCE$ in the figure given below.

From the figure, we can conclude that

$\angle BAC = \angle CED = 35^\circ$ (Alternate interior angles)

From the figure, we can conclude that in ΔDCE

$\angle DCE + \angle CED + \angle CDE = 180^\circ$. (Angle sum property)

$\angle DCE + 35^\circ + 53^\circ = 180^\circ$

$\Rightarrow \angle DCE + 88^\circ = 180^\circ$

$\Rightarrow \angle DCE = 92^\circ$.

Therefore, we can conclude that $\angle DCE = 92^\circ$.

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10. In the given figure, if lines PQ and RS intersect at point T, such that $\angle PRT = 40^\circ$, $\angle RPT = 95^\circ$ and $\angle TSQ = 75^\circ$, find $\angle$ SQT.

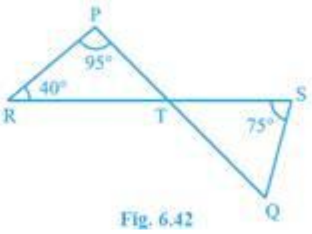

Fig. 6.42

Ans. We are given that $\angle PRT = 40^\circ$, $\angle RPT = 95^\circ$ and $\angle TSQ = 75^\circ$.

We need to find the value of $\angle SQT$ in the figure.

From the figure, we can conclude that in ΔRTP

$\angle PRT + \angle RTP + \angle RPT = 180^\circ$.(Angle sum property)

$40^\circ + \angle RTP + 95^\circ = 180^\circ$

$\Rightarrow \angle RTP + 135^\circ = 180^\circ$

$\Rightarrow \angle RTP = 45^\circ$.

From the figure, we can conclude that

$\angle RTP = \angle STQ = 45^\circ$. (Vertically opposite angles)

From the figure, we can conclude that in ΔSTQ

$\angle SQT + \angle STQ + \angle TSQ = 180^\circ$. (Angle sum property)

$\angle SQT + 45^\circ + 75^\circ = 180^\circ$

$\Rightarrow \angle SQT + 120^\circ = 180^\circ$

$\Rightarrow \angle SQT = 60^\circ$.

Therefore, we can conclude that $\angle SQT = 60^\circ$.

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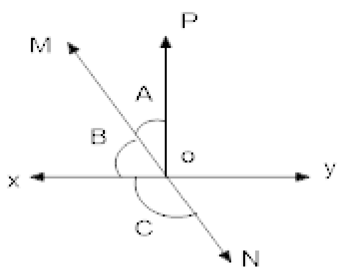
11. In fig lines x y and m n intersect at 0 If $\angle$ poy $=90^\circ$ and a:b $=2:3$ find c



Ans. Given in fig. $\angle$ POY=90°

a: b: 2: 3

Let a=2x and b =3x

a + b + $\angle$ POY=180° ($\because$ XOY is a line)

2x+3x+90°=180°

5x=180°-90°

5x=90°

x= $\frac{90^\circ}{5} = 18^\circ$

$\therefore$ a= 36°, b=54°

MoN is a line.

b+C=180°

$54^\circ + C = 180^\circ$

$C = 180^\circ - 54^\circ = 126^\circ$

$Ans \quad C = 126^\circ$

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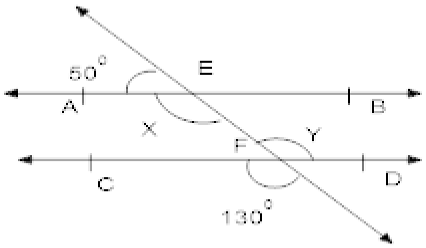
12. In fig find the volume of x and y then Show that AB || CD



Ans. $50^\circ + x = 180^\circ \qquad (by\ linear\ \text{pair})$

$x = 180^\circ - 50^\circ$

$x = 130^\circ$

$y = 130^\circ$ ($\because$ Vertically opposite angles are equal)

x=y as they are corresponding angles. $\therefore AB \parallel CD$

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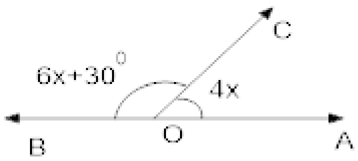
13. What value of x would make AOB a line if $\angle$ AOC=4x and $\angle$ BOC=6x+30°



Ans. $given$ $\angle$AOC=4x And $\angle$ BOC =6x+30°

$\angle$ AOC+$\angle$ BOC =180° $(By$ linear pair$)$

$4x + 6x + 30^\circ = 180^\circ$

$10x = 180^\circ - 30^\circ$

$10x = 150^\circ = x = 15^\circ$

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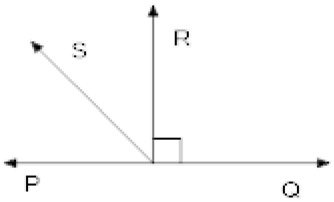
14. In fig POQ is a line. Ray OR is perpendicular to line PQ. OS is another ray lying between rays OP and OR. Prove that $\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$



Ans. $R.H.S \quad = \frac{1}{2}(\angle QOS - \angle POS)$

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

$= \frac{1}{2}(\angle ROS + 90^\circ - \angle POS)$ ....(i)

$\because \ \angle POS + \angle ROS = 90^\circ$

$\therefore$ By 1

$= \frac{1}{2}(ROS + \angle POS + \angle ROS - \angle POS)[by\ 1]$

$= \frac{1}{2} \times 2\ \angle ROS = \angle ROS$

= L.H.S

Hence proved.

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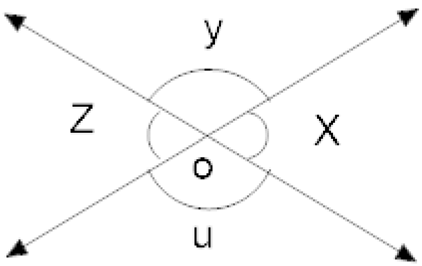
15. In fig lines P and R intersected at 0, if x = 45° find x, y and u



Ans. $X=45^\circ$

$\therefore Z=45^\circ \because$ Vertically opposite angles are equal

$X+y=180^\circ$

$45^\circ + y = 180^\circ$ (By linear pair)

$y=180^\circ - 45$

$y=135^\circ$

$y=u$

$u=135^\circ$ (vertically opposite angles)

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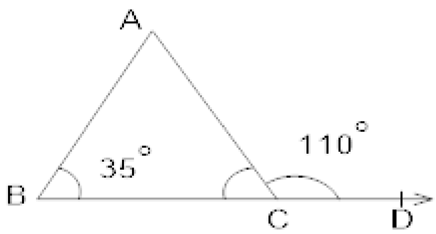
16. The exterior angle of a triangle is 110° and one of the interior opposite angle is 35°. Find the other two angles of the triangle.

Ans. The exterior angle of a triangle is equal to the sum of interior opposite angles.



$\therefore \angle ACD = \angle A + \angle B$

$110 = \angle A + 35^\circ$

$\angle A = 110^\circ - 35^\circ$

$\angle A = 75^\circ$

$\angle C = 180 - (\angle A + \angle B)$

$\angle C = 180 - (75^\circ + 35^\circ)$

$\angle C = 70^\circ$

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17. Of the three angles of a triangle, one is twice the smallest and another is three times the smallest. Find the angles.

Ans. Let the smallest angle be x°

Then other two angles are $2x^\circ$ and $3x^\circ$

$x^\circ + 2x^\circ + 3x^\circ = 180^\circ$ [sum of three angle of a triangle is 180°]

$6x^\circ = 180^\circ$

$x = \frac{180}{6}$

$= 30^\circ$

Therefore, angles are 30°, 60° and 90°

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18. Prove that if one angle of a triangle is equal to the sum of other two angles, the triangle is right angled.

Ans. Given in ΔABC $\angle B = \angle A + \angle C$

To prove: ΔABC **is right angled.**

Proof: $\angle A + \angle B + \angle C = 180^\circ$ **….. (1) [Sum of three angles of a** Δ **ABC is 180°]**

$\angle A + \angle C = \angle B$ **….. (2)**

From (1) and (2)

$\angle B + \angle B = 180^\circ$

$2\angle B = 180^\circ$

$\angle B = 90^\circ$

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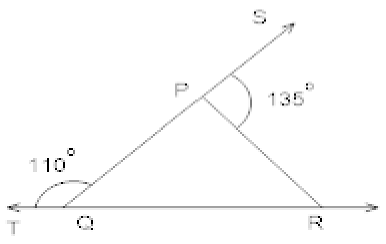
19. In fig. sides QP and RQ of ΔPQR **are produced to points S and T respectively. If** $\angle SPR = 135^\circ$ and $\angle PQT = 110^\circ$, find $\angle PRQ$.



Ans. $\angle PQT + \angle PQR = 180^\circ$

$110^\circ + \angle PQR = 180^\circ$

$\angle PQR = 180^\circ - 110^\circ$

$\angle PQR = 70^\circ$

Also $\angle SPR = \angle PQR + \angle PRQ$ [Interior angle theorem]

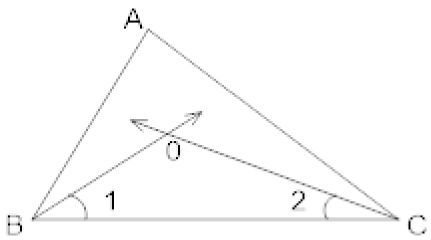
$135^\circ = 70^\circ + \angle PRQ$

$\angle PRQ = 135^\circ - 70^\circ$

$\angle PRQ = 65^\circ$

---

20. In fig the bisector of $\angle ABC$ and $\angle BCA$ intersect each other at point O prove that $\angle BOC = 90^\circ + \frac{1}{2}\angle A$



Ans. Given A ΔABC such that the bisectors of $\angle ABC$ and $\angle BCA$ meet at a point O

To Prove $\angle BOC = 90^\circ + \frac{1}{2}\angle A$

Proof: In ΔBOC

$\angle 1 + \angle 2 + \angle BOC = 180^\circ$ (1)

In ΔABC

$\angle A + \angle B + \angle C = 180^\circ$

$\angle A + 2\angle 1 + 2\angle 2 = 180^\circ$

[BO and CO bisects $\angle B$ and $\angle C$]

$\Rightarrow \frac{\angle A}{2} + \angle 1 + \angle 2 = 90^\circ$

$\angle 1 + \angle 2 = 90^\circ - \frac{\angle A}{2}$

[Divide forth side by 2]

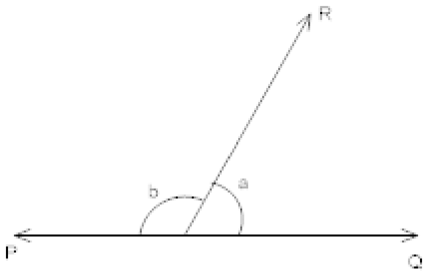
$\angle 1+\angle 2=90^0-\frac{\angle A}{2}$ in (i)

Substituting, $90^0-\frac{\angle A}{2}+\angle BOC=180^0$

$\Rightarrow \angle BOC=90^0+\frac{\angle A}{2}$

---

21. In the given figure $\angle POR$ and $\angle QOR$ form a linear pair if a – b = 80^0. Find the value of 'a' and 'b'.



Ans. $a+b=180^0 \rightarrow (1)$ [by line as pair]

$a-b=80^0 \quad \rightarrow (2)$

$2a=260^0$ [Adding e.q (1) and (2)]

$a=130^0$

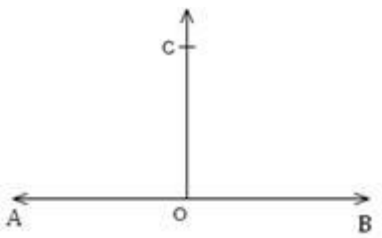
$Put\ a=130^0$ in eq (1)

$130^0+b=180^0$

$b=180^0-130^0=50^0$

---

22. If ray OC stands on a line AB such that $\angle AOC=\angle BOC$, then show that $\angle AOC=90^0$



Ans.

$\angle AOC = \angle BOC$ [Given]

$\angle AOC + \angle BOC = 180^0$ [By lines pair]

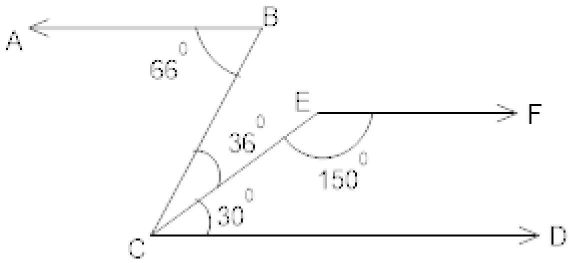
$\angle AOC + \angle AOC = 180^0$

$2\angle AOC = 180^0$

$\angle AOC = 90^0 = \angle BOC$

---

23. In the given figure show that AB || EF



Ans.

$\angle BCD = \angle BCE + \angle ECD$

$= 36^0 + 30^0 = 66^0 = \angle ABC$

$\therefore$ AB || CD [Alternate interior angles are equal]

Again $\angle ECD = 30^0 and\ \angle FEC = 150^0$

$\therefore\ \angle ECD + \angle FEC = 30^0 + 150^0 = 180^0$

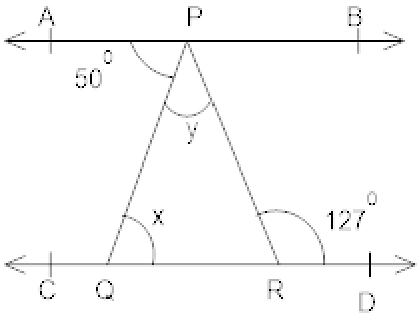
Hence EF || CD [sum of consecutive interior angle is 180^0]

$AB \parallel CD and$ CD || EF

then AB || EF

---

24. In figure if AB || CD, $\angle APQ = 50^0 and \angle PRD = 127^0$ **Find x and y.**



Ans.

$AB \parallel CD$ and PQ is a transversal

$\angle APQ = \angle PQD$ [pair of alternate angles]

$50^0 = x$

Also $AB \parallel CD$ and PR is a transversal

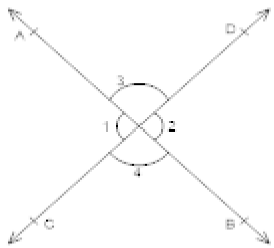
$\angle APR = \angle PRD$

$50^0 + Y = 127^0$

$Y = 127^0 - 50^0 = 77^0$

---

25. Prove that if two lines intersect each other then vertically opposite angler are equal.



Ans. Given: AB and CD are two lines intersect each other at O.

To prove: (i) $\angle 1 = \angle 2$ and (ii) $\angle 3 = \angle 4$

Proof:

$\angle 1 + \angle 4 = 180^0 \quad \rightarrow (i)$ **[By linear pair]**

$\angle 4 + \angle 2 = 180^0 \quad \rightarrow (ii)$

$\angle 1 + \angle 4 = \angle 4 + \angle 2$ [By eq (i) and (ii)]

$\angle 1 = \angle 2$

Similarly,

$\angle 3 = \angle 4$

26.The measure of an angle is twice the measure of supplementary angle. Find measure of angles.

Ans. Let the measure be x^0

Then its supplement is $180^0 - x^0$

According to question

$x^0 = 2\left(180^0 - x^0\right)$

$x^0 = 360^0 - 2x^0$

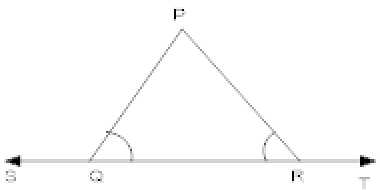
$3x = 360^0$

$x = 120^0$

The measure of the angles are 120^0 and 60^0.

---

27. In fig $\angle$ PQR = $\angle$ PRQ. Then prove that $\angle$ PQS= $\angle$ PRT.



Ans. $\angle PQS + \angle PQR = \angle PRQ + \angle PRT$ [By linear pair]

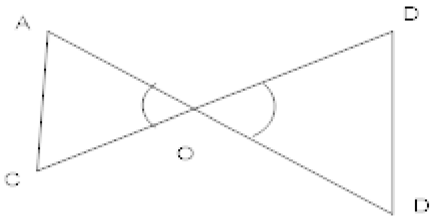
But,

$\angle PQR = \angle PRQ$ [Give]

$\therefore \angle PQS = \angle PRT$

---

28. In the given fig $\angle$ AOC = $\angle$ ACO and $\angle$ BOD = $\angle$ BDO prove that AC $\parallel$ DB



Ans. $\angle AOC = \angle ACO$ *and* $\angle BOD = \angle BDO$ [Give]

But,

$\angle AOC = \angle BOD$ [vertically opposite angles]

$\angle AOC = \angle BOD$ *and*

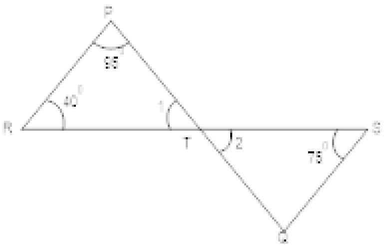
$\angle BOD = \angle BDO$

$\Rightarrow \angle ACO = \angle BDO$

$\therefore AC \parallel BD$ [By alternate interior angle property]

---

29. In figure if lines PQ and RS intersect at point T. Such that $\angle PRT = 40^0$, $\angle RPT = 95^0$ and $\angle TSQ = 75^0$, find $\angle SQT$.



Ans. *In* ΔPRT

$\angle P + \angle R + \angle 1 = 180^0$ [By angle sum property]

$95^0 + 40^0 + \angle 1 = 180^0$

$\angle 1 = 180^0 - 135^0$

$\angle 1 = 45^0$

$\angle 1 = \angle 2$ [vertically opposite angle]

$\angle 2 = \angle 45^0$

In ΔTQS $\angle 2 + \angle Q + \angle S = 180^0$

$45^0 + \angle Q + 75^0 = 180^0$

$\angle Q+120^0=180^0$

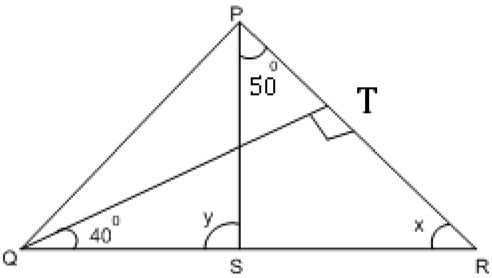
$\angle Q=180^0-120^0$

$\angle Q=60^0$

$\angle SQT=60^0$

---

30. In figure, if $QT\perp PR, \angle TQR=40^0 and\ \angle SPR=50^0$ $find\ x\ and\ y.$



Ans. $In\ \Delta TQR$

$90^\circ+40^0+x=180^0$ [Angle sum property of Δ]

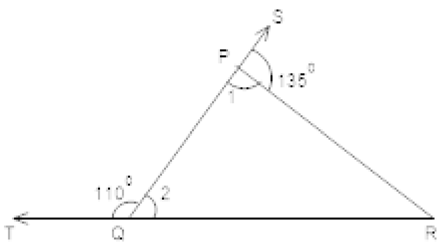
$\therefore$ x $=50^0$

Now, Y=$\angle$SPR+X

$\therefore$ Y$=30^0+50^0=80^0$

---

31. In figure sides QP and RQ of ΔPQR **are produced to points S and T respectively if** $\angle SPR=135^0 and\ \angle PQT=110^0, find\ \angle PRQ.$



Ans. $110^0+\angle 2=180^0$ [By linear pair]

$\angle 2=180^0-110^0$

$\angle 2=70^0$

$\angle 1+135^0=180^0$

$\angle 1 = 180^0 - 135^0$

$\angle 1 = 45^\circ$

$\angle 1 + \angle 2 + \angle R = 180^0$ [By angle sum property]

$45^0 + 70^0 + \angle R = 180^0$

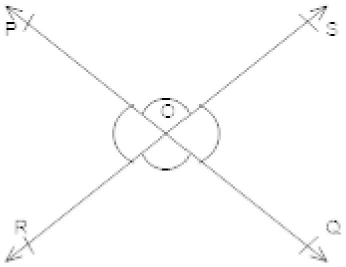
$\angle R = 180^0 - 115^0$

$\angle R = 65^0$

$\angle PRQ = 65^0$

---

32. In figure lines PQ and RS intersect each other at point O. If $\angle POR : \angle ROQ = 5:7$. Find all the angles.



Ans. $\angle POR + \angle ROQ = 180^0$ [linear pair of angle]

But, $\angle POR : \angle ROQ = 5:7$ [Give]

$\therefore \angle POR = \frac{5}{12} \times 180^0 = 75^0$

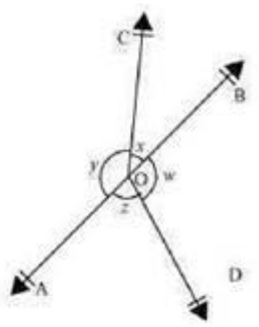
Similarly, $\angle ROQ = \frac{7}{12} \times 180^0 = 105^0$

Now $\angle POS = \angle ROQ = 105^0$ [vertically opposite angle]

And $\angle SOQ = \angle POR = 75^0$ [vertically app angle]

3 Marks Questions

1. In Fig. 6.16, if *x* + *y* = *w* + *z*, then prove that AOB is a line.



Ans . We need to prove that *AOB* is a line.

We are given that $x+y=w+z$.

We know that the sum of all the angles around a fixed point is 360°.

Thus, we can conclude that $\angle AOC+\angle BOC+\angle AOD+\angle BOD=360^\circ$, or

$y+x+z+w=360^\circ$.

But, $x+y=w+z$ (Given).

$2(y+x)=360^\circ$.

$y+x=180^\circ$.

From the given figure, we can conclude that *y* and *x* form a linear pair.

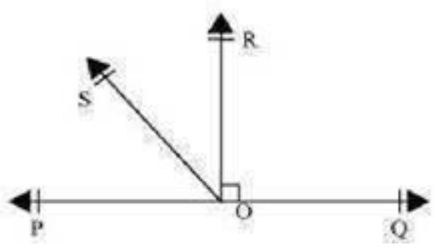
We know that if a ray stands on a straight line, then the sum of the angles of linear pair formed by the ray with respect to the line is 180°.

$y+x=180^\circ$.

Therefore, we can conclude that *AOB* is a line.

---

2. In the given figure, POQ is a line. Ray OR is perpendicular to line PQ. OS is another ray lying between rays OP and OR. Prove that $\angle ROS=\frac{1}{2}(\angle QOS-\angle POS)$.



Ans. We need to prove that $\angle ROS=\frac{1}{2}(\angle QOS-\angle POS)$.

We are given that *OR* is perpendicular to *PQ*, or

$\angle QOR = 90^\circ$.

From the given figure, we can conclude that $\angle POR$ and $\angle QOR$ form a linear pair.

We know that sum of the angles of a linear pair is 180°.

$\therefore \angle POR + \angle QOR = 180^\circ$, or

$\angle POR = 90^\circ$.

From the figure, we can conclude that $\angle POR = \angle POS + \angle ROS$.

$\Rightarrow \angle POS + \angle ROS = 90^\circ$, or

$\angle ROS = 90^\circ - \angle POS$.(*i*)

From the given figure, we can conclude that $\angle QOS$ and $\angle POS$ form a linear pair.

We know that sum of the angles of a linear pair is 180°.

$\angle QOS + \angle POS = 180^\circ$, or

$\frac{1}{2}(\angle QOS + \angle POS) = 90^\circ$.(*ii*)

Substitute (*ii*) in (*i*), to get

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

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

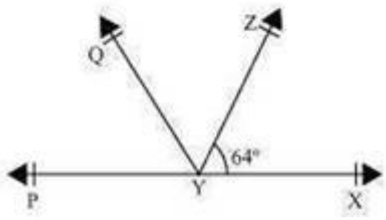
Therefore, the desired result is proved.

---

3. It is given that $\angle XYZ = 64^\circ$ and XY is produced to point P. Draw a figure from the given information. If ray YQ bisects $\angle ZYP$, find $\angle XYQ$ and reflex $\angle QYP$.

Ans . We are given that $\angle XYZ = 64^\circ$, *XY* is produced to *P* and *YQ* bisects $\angle ZYP$.

We can conclude the given below figure for the given situation:



We need to find $\angle XYQ$ and reflex $\angle QYP$.

From the given figure, we can conclude that $\angle XYZ$ and $\angle ZYP$ form a linear pair.

We know that sum of the angles of a linear pair is 180°.

$\angle XYZ + \angle ZYP = 180^\circ$.

But $\angle XYZ = 64^\circ$.

$\Rightarrow 64^\circ + \angle ZYP = 180^\circ$

$\Rightarrow \angle ZYP = 116^\circ$.

Ray *YQ* bisects $\angle ZYP$, or

$$\angle QYZ = \angle QYP = \frac{116^\circ}{2} = 58^\circ.$$

$\angle XYQ = \angle QYZ + \angle XYZ$

$= 58^\circ + 64^\circ = 122^\circ$.

Reflex $\angle QYP = 360^\circ - \angle QYP$

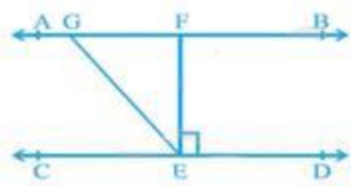
$= 360^\circ - 58^\circ$

$= 302^\circ$.

Therefore, we can conclude that $\angle XYQ = 122^\circ$ and Reflex $\angle QYP = 302^\circ$.

---

4. In the given figure, If AB || CD, $EF \perp CD$ and $\angle GED = 126^\circ$, find $\angle AGE, \angle GEF$ and $\angle FGE$.



Ans. We are given that $AB \parallel CD$, $EF \perp CD$ and $\angle GED = 126^\circ$.

We need to find the value of $\angle AGE, \angle GEF$ and $\angle FGE$ in the figure given below.

$\angle GED = 126^\circ$

$\angle GED = \angle FED + \angle GEF$.

But, $\angle FED = 90^\circ$.

$126^\circ = 90^\circ + \angle GEF \Rightarrow \angle GEF = 36^\circ$.

$\because \angle AGE = \angle GED$ (Alternate angles)

$\therefore \angle AGE = 126^\circ$.

From the given figure, we can conclude that $\angle FED$ and $\angle FEC$ form a linear pair.

We know that sum of the angles of a linear pair is 180°.

$\angle FED + \angle FEC = 180$

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

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

But $\angle FEC = \angle GEF + \angle GEC$

$\therefore 90^\circ = 36^\circ + \angle GEC$

$\Rightarrow \angle GEC = 54^\circ$.

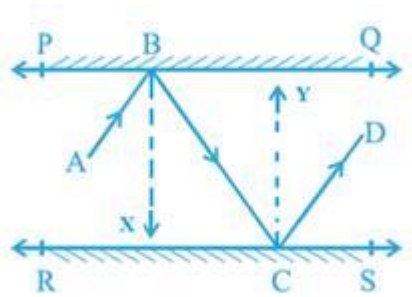
$\angle GEC = \angle FGE = 54^\circ$ (Alternate interior angles)

Therefore, we can conclude that $\angle AGE = 126^\circ, \angle GEF = 36^\circ$ and $\angle FGE = 54^\circ$.

---

5. In the given figure, PQ and 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 and strikes the mirror RS at C and again reflects back along CD. Prove that AB || CD.

Ans. We are given that *PQ* and *RS* are two mirrors that are parallel to each other.



We need to prove that $AB \parallel CD$ in the figure.

Let us draw lines *BX* and *CY* that are parallel to each other, to get

We know that according to the laws of reflection

$\angle ABX = \angle CBX$ and $\angle BCY = \angle DCY$.

$\angle BCY = \angle CBX$ (Alternate interior angles)

We can conclude that $\angle ABX = \angle CBX = \angle BCY = \angle DCY$.

From the figure, we can conclude that

$\angle ABC = \angle ABX + \angle CBX$, and

$\angle DCB = \angle BCY + \angle DCY$.

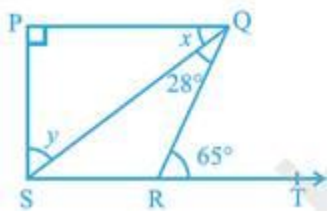
Therefore, we can conclude that $\angle ABC = \angle DCB$.

From the figure, we can conclude that $\angle ABC$ and $\angle DCB$ form a pair of alternate interior angles corresponding to the lines *AB* and *CD*, and transversal *BC*.

Therefore, we can conclude that $AB \parallel CD$.

---

6. In the given figure, if $PQ \perp PS$, PQ || SR, $\angle SQR = 28^\circ$ and $\angle QRT = 65^\circ$, then find the values of x and y.



Ans. We are given that $PQ \perp PS, PQ \parallel SR, \angle SQR = 28^\circ$ and $\angle QRT = 65^\circ$.

We need to find the values of *x* and *y* in the figure.

We know that "If a side of a triangle is produced, then the exterior angle so formed is equal to the sum of the two interior opposite angles."

From the figure, we can conclude that

$\angle SQR + \angle QSR = \angle QRT$, or

$28^\circ + \angle QSR = 65^\circ$

$\Rightarrow \angle QSR = 37^\circ$.

From the figure, we can conclude that

$x = \angle QSR = 37^\circ$ (Alternate interior angles)

From the figure, we can conclude that ΔPQS

$\angle PQS + \angle QSP + \angle QPS = 180^\circ$. (Angle sum property)

$\angle QPS = 90^\circ \quad (PQ \perp PS)$

$x + y + 90^\circ = 180^\circ$

$\Rightarrow x + 37^\circ + 90^\circ = 180^\circ$

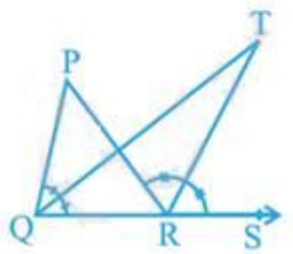
$\Rightarrow x + 127^\circ = 180^\circ$

$\Rightarrow x = 53^\circ$.

Therefore, we can conclude that $x = 53^\circ$ and $y = 37^\circ$.

---

7. In the given figure, the side QR of ΔPQR is produced to a point S. If the bisectors of $\angle PQR$ and $\angle PRS$ meet at point T, then prove that $\angle QTR = \frac{1}{2}\angle QPR$.



Ans. We need to prove that $\angle QTR = \frac{1}{2}\angle QPR$ in the figure given below.

We know that "If a side of a triangle is produced, then the exterior angle so formed is equal to the sum of the two interior opposite angles."

From the figure, we can conclude that in ΔQTR, $\angle TRS$ is an exterior angle

$\angle QTR + \angle TQR = \angle TRS$, or

$\angle QTR = \angle TRS - \angle TQR$ .....(i)

From the figure, we can conclude that in ΔQTR, $\angle TRS$ is an exterior angle

$\angle QPR + \angle PQR = \angle PRS.$

We are given that QT and RT are angle bisectors of $\angle PQR$ and $\angle PRS.$

$\angle QPR + 2\angle TQR = 2\angle TRS$

$\angle QPR = 2(\angle TRS - \angle TQR).$

We need to substitute equation (*i*) in the above equation, to get

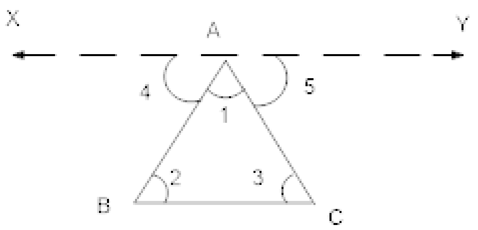
$\angle QPR = 2\angle QTR,$ or

$\angle QTR = \frac{1}{2}\angle QPR.$

Therefore, we can conclude that the desired result is proved.

---

8. Prove that sum of three angles of a triangle is 180°



Ans. *given* ; ΔABC

To prove : $\angle A + \angle B + \angle C = 180^\circ$

construction : through A draw XY || BC

Proof : $\because$ XY || BC

$\therefore \angle 2 = \angle 4 \rightarrow (1)$

$\because$ Alternate interior angle

And $\angle 3 = \angle 5 \rightarrow (2)$

Adding eq (1) and eq (2)

$\angle 2 + \angle 3 = \angle 4 + \angle 5$

Adding both sides $\angle 1$,

$\angle 1+\angle 2+\angle 3=\angle 1+\angle 4+\angle 5$

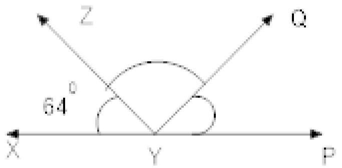
$\angle 1+\angle 2+\angle 3=180^\circ$ ($\because$ $\angle 1, \angle 4$, and $\angle 5$ forms a line)

$\angle A+\angle B+\angle C=180^\circ$

---

9. It is given that $\angle XYZ = 64^\circ$ and X Y is produced to point P, draw a fig from the given information. If ray Y Q bisects $\angle$ ZYP, find $\angle$ XYQ and reflex $\angle$ QYP.

Ans. $\angle XYZ+\angle PYZ=180^\circ$ $(linear\ \text{pair})$



$\Rightarrow 64^\circ+\angle PYZ=180^\circ$ $(given \angle XYZ=64^\circ)$

$\angle PYZ=180^\circ-64^\circ$

$\angle PYZ=116^\circ$

$\angle ZYQ=\frac{1}{2}\angle ZYP=\frac{116}{2}=58^\circ$

$\angle XYQ=\angle XYZ+\angle ZYQ$

$=64^\circ+58^\circ=122^\circ$

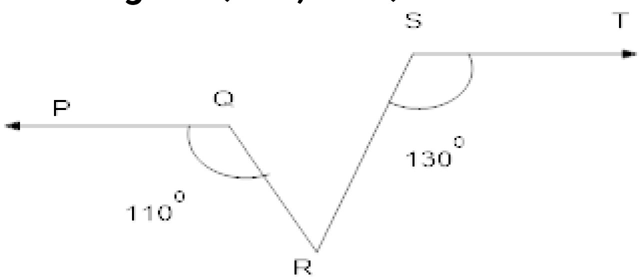
Also reflex $\angle QYP=\angle XYQ+struight\ \angle XYP$

$=122^\circ+180^\circ$

$=302^\circ$

---

10. In fig if PQ$\|$ST, $\angle$ PQR = 110° and $\angle$ RST=130° find $\angle$ QRS.



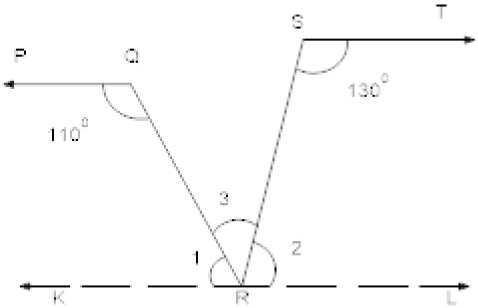
Ans. Through point R Draw line Kleist

$\because$ PQ || ST
ST || KL $\therefore$ PQ || KL
$\because$ PQ || KL
$\therefore \angle PQR+\angle 1=180^\circ$

(Sum of interior angle on the same side of transversal is 180°)

$110^\circ+\angle 1=180^\circ$
$\angle 1=70^\circ$

Similarly
$\angle 2+\angle RST=180^\circ$
$\angle 2+130^\circ=180^\circ$
$\angle 2=50^\circ$



$\angle 1+\angle 2+\angle 3=180^\circ$

$70^\circ+50^\circ+\angle 3=180^\circ$

$\angle 3=180^\circ-120^\circ$

$\angle 3=60^\circ$

$\angle QRS=60^\circ$

---

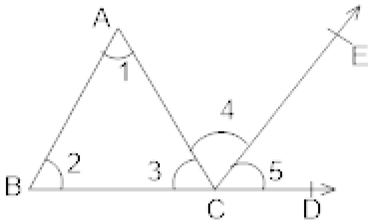
11. The side BC of ΔABC is produced from ray BD. CE is drawn parallel to AB, show that $\angle ACD=\angle A+\angle B$. Also prove that $\angle A+\angle B+\angle C=180^\circ$.

Ans. $\because$ AB $\parallel$/ CE and Ac intersect them

$\angle 1=\angle 4$ (1) [Alternate interior angles]

Also AB$\parallel$/CE and BD intersect them

$\angle 2=\angle 5$ (2) [Corresponding angles]



Adding eq (1) and eq (2)

$\angle 1 + \angle 2 = \angle 4 + \angle 5$

$\angle A + \angle B = \angle ACD$

Adding $\angle C$ on both sides, we get

$\angle A + \angle B + \angle C = \angle C + \angle ACD$

$\angle A + \angle B + \angle C = 180^\circ$

---

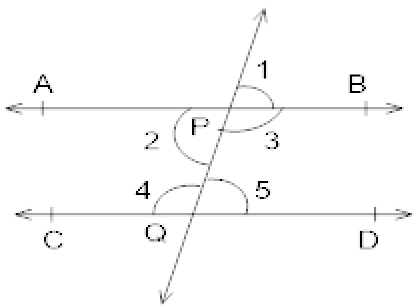
12. Prove that if a transversal intersect two parallel lines, then each pair of alternate interior angles is equal.

Ans. Given: line AB $\parallel$ CD intersected by transversal PQ

To Prove: (i) $\angle 2 = \angle 5$ (ii) $\angle 3 = \angle 4$

Proof: $\angle 1 = \angle 2$ (i) [Vertically Opposite angle]

$\angle 1 = \angle 5$ (ii) [Corresponding angles]



By (i) and (ii)

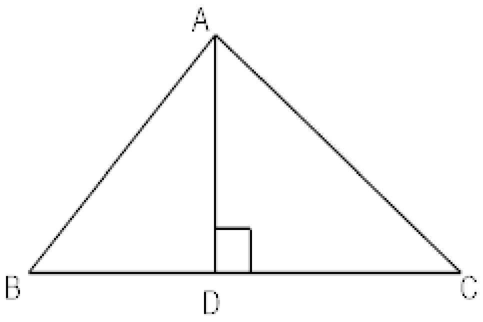
$\angle 2 = \angle 5$

Similarly, $\angle 3 = \angle 4$

Hence Proved.

---

13. In the given figure ΔABC is right angled at A. AD is drawn perpendicular to BC. Prove that $\angle BAD = \angle ACB$



Ans.

$\because$ AD $\perp BC$

$\therefore \angle ADB = \angle ADC = 90^0$

from ΔABD

$\angle ABD + \angle BAD + \angle ADB = 180^0$

$\angle ABD + \angle BAD + 90^0 = 180^0$

$\angle ABD + \angle BAD = 90^0$

$\angle BAD = 90^0 - \angle ABD \quad \rightarrow (1)$

But $\angle A + \angle B + \angle C = 180^0$ in ΔABC

$\angle B + \angle C = 90^0 \quad \because \angle A = 90^0$

$\angle C = 90^0 - \angle B \quad \rightarrow \quad (2)$

From (1) and (2)

$\angle BAD = \angle C$

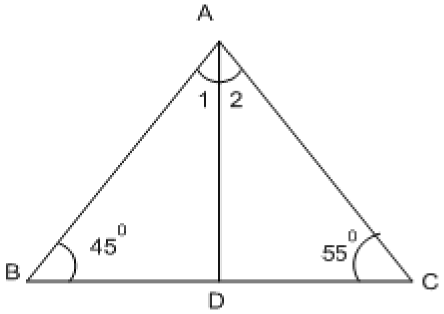
$\angle BAD = \angle ACB$ Hence proved.

---

14. In ΔABC $\angle B = 45^0, \angle C = 55^0$ *and bisector* $\angle A$ meets BC at a point D. Find $\angle ADB$ *and* $\angle ADC$

Ans. *In* ΔABC

$\angle A + \angle B + \angle C = 180^0$ [Sum of three angle of a Δ is 180^0]



$\Rightarrow \angle A + 45^0 + 55^0 = 180^0$

$\angle A = 180^0 - 100^0 = 80^0$

$\therefore$ AD bisects $\angle A$

$\angle 1 = \angle 2 = \frac{1}{2}\angle A = \frac{1}{2} \times 80^0 = 40^0$

Now in Δ ADB, We have

$\angle 1 + \angle B + \angle ADB = 180^0$

$\Rightarrow 40^0 + 45^0 + \angle ADB = 180^0$

$\Rightarrow \angle ADB = 180^0 - 85^0 = 95^0$

$\angle ADB + \angle ADC = 180^0$

Also $95^0 + \angle ADC = 180^0$

$\angle ADC = 180^0 - 95^0 = 85^0$

$\angle ADB = 95^0 \, and \, \angle ADC = 85^0$

---

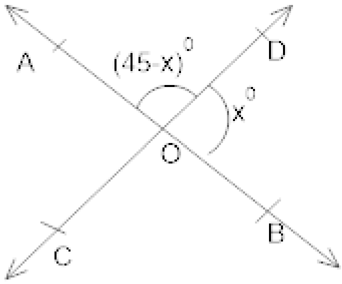
15. In figure two straight lines AB and CD intersect at a point O.
If $\angle BOD = x^0 and \angle AOD = (45 - x)^0$. Find the value of x hence find

(a) $\angle BOD$

(b) $\angle AOD$

(c) $\angle AOC$

(d) $\angle BOC$



Ans. $\angle ADB = \angle AOD + \angle DOB$ By linear pair

$180^0 = 4x - 5 + x$

$180^0 + 5 = 5x$

$5x=185$

$x=\frac{185}{5}=37^0$

$\therefore \angle AOD=4x-5$

$=4\times 37-5=148-5$

$=143^0$

$\angle BOC=143^0$

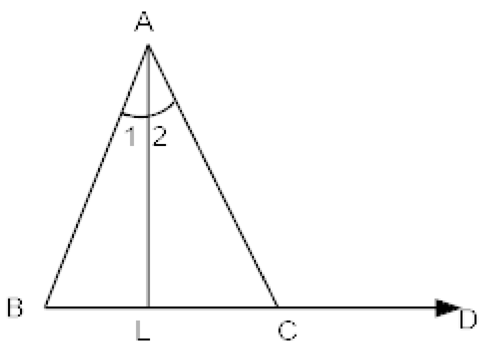
$\therefore \angle AOD$ and $\angle BOC$

$\angle BOD=x=37^0$ vertically opposite angles

$\angle BOD = \angle AOC = 37°$

---

16. The side BC of a ΔABC is produced to D. the bisector of $\angle$ A meets BC at L as shown if fig. prove that $\angle$ ABC+$\angle$ ACD=2$\angle ALC$



Ans. $In\ \Delta ABC$ we have

$\angle ACD = \angle B + \angle A \rightarrow (1)$ [Exterior angle property]

$\Rightarrow \angle ACD = \angle B + 2L1$

[$\therefore$ A$\angle$ is the bisector of $\angle A = 2L1$]

In ΔABL

$\angle ALC = \angle B + \angle BAL$ [exterior angle property]

$\angle ALC = \angle B + \angle 1$

$\Rightarrow 2\angle ALC = 2\angle B + 2\angle 1$ ...(2)

Subtracting (1) from (2)

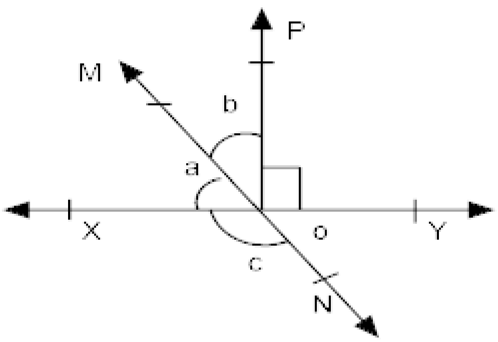
$2\angle ALC - \angle ACD = \angle B$

$2\angle ALC = \angle B + \angle ACD$

$\angle ACD + \angle ABC = 2\angle ALC$

---

17. In fig lines XY and MN intersect at O If $\angle$ POY= 90° and a:b=2:3 find $\angle$ C



Ans. Lines XY and MN intersect at O.

$\therefore \angle C = \angle XON = \angle MOY$ [vertically opposite angle]

$= \angle b + \angle POY$

But,

$\angle POY = 90^0$

$\therefore \angle C = \angle b + 90^0 \rightarrow (1)$

Also,

$\angle POX = 180^0 - \angle POY$

$= 180^0 - 90^0$

$= 90^0$

$\therefore a + b = 90^0$

But,

a:b = 2:3 [Given]

$a = \frac{2}{5} \times 90^0$

$= 36^0 \quad \rightarrow (2)$ From (1) and (2) we get

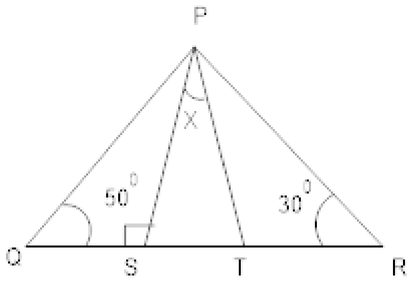
$b = 90^0 - 36^o = 54^0$

$\angle C = 54^0 + 90^0$

$= 144^0$

---

18. In fig PT is the bisector of $\angle$ QPR in ΔPQR and PS$\perp$QR, find the value of x



Ans. $\angle QPR + \angle Q + \angle R = 180^0$ [Angle sum property of Δ]

$\angle QPR = 180^0 - 50^0 - 30^0 \quad = 100^0$

$\angle QPT = \frac{1}{2} \angle QPR$

$= \frac{1}{2} \times 100^0 \quad = 50^0$

$\angle Q + \angle QPS = \angle PST$ [Exterior angle theorem]

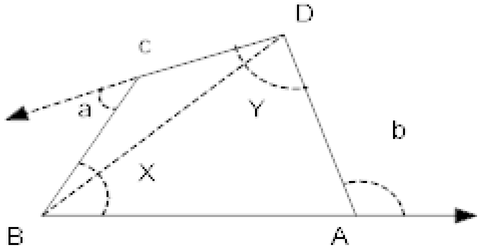
$\angle QPS = 90^0 - \angle Q$

$= 90^0 - 50^0 \quad = 40^0$

$x = \angle QPT - \angle QPS$

$= 50^0 - 40^0 \quad = 10^0$

19. The sides BA and DC of a quadrilateral ABCD are produced as shown in fig show that $\angle$ X+$\angle$ Y = $\angle$ a+$\angle$ b



Ans. Join BD

$In\Delta ABD$

$\angle b = \angle ABD + \angle BDA$ [exterior angle theorem]

$In\Delta CBD$

$\angle a = \angle CBD + \angle BDC$

$\angle a + \angle b = \angle CBD + \angle BDC + \angle ABD + \angle BDA$

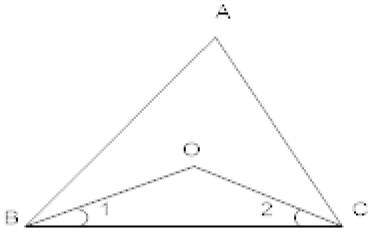
$= (\angle CBD + \angle ABD) + (\angle BDC + \angle BDA)$

$= \angle x + \angle y$

$\angle a + \angle b = \angle x + \angle y$

---

20. In the BO and CO are Bisectors of $\angle$ B and $\angle$ C of ΔABC, show that $\angle$ BOC=90°+$\frac{1}{2}$ $\angle$ A.



Ans. $\angle 1 = \frac{1}{2}\angle ABC$

And $\angle 2 = \frac{1}{2}\angle ACB$

$\therefore \angle 1 + \angle 2 = \frac{1}{2}(\angle ABC + \angle ACB)$ ...(1)

But,

$\angle ABC + ACB + \angle A = 180^0$

$\therefore \angle ABC + ACB = 180^0 - \angle A$

But,

$\frac{1}{2}[\angle ABC + ACB] = 90^0 - \frac{1}{2}\angle A$ ….(2)

From (1) and (2) we get

$\angle 1 + \angle 2 = 90^0 - \frac{1}{2}\angle A$ …..(3)

But,

$\angle BOC + \angle 1 + \angle 2 = 180^0$ [angle of a]

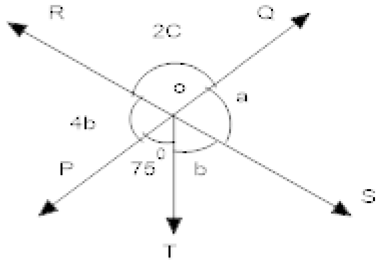
$\angle BOC = 180^0 - (\angle 1 + \angle 2)$

$= 180^0 - \left(90^0 - \frac{1}{2}\angle A\right)$

$= 90^0 + \frac{1}{2}\angle A$

---

21. In fig two straight lines PQ and RS intersect each other at o, if $\angle$ POT= 75^0 Find the values of a, b and c



Ans. PQ intersect RS at O
$\therefore \angle QOS = \angle POR$ [vertically opposite angles]
A = 4b ….(1)

Also,

$a + b + 75^0 = 180^0$ [$\because POQ$ is a straight lines]
$\therefore a + b = 180^0 - 75^0$
$= 105^0$

Using, (1)
$4b + b = 105^0$
$5b = 105^0$

Or

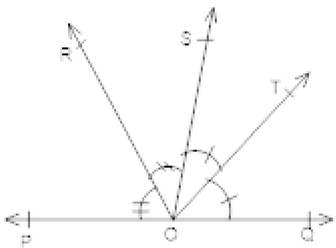
$b=\frac{105}{5}\ =21^0$
$\therefore a=4b$
$a=4\times 21$
$a=84$
Again,
$\angle QOR\ and\ \angle QOS$ form a linear pair
$\therefore\ a+2c=180^0$
Using, (2)

$84^0+2c=180^0$
$2c=180^0-84^0$
$2c=96^0$
$c=\frac{96^0}{2}=48^0$
Hence,
$a=84^0,\ b=21^0\ and\ c=48^0$

---

22. In figure ray OS stands on a line POQ, ray OR and ray OT are angle bisector of

$\angle POS\ and\ \angle SOQ$ *respectively. If* $\angle POS=x$, *find* $\angle ROT$.

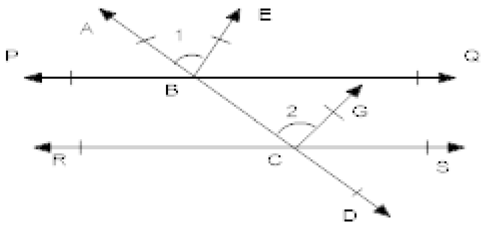


Ans. Ray OS stands on the line POQ
$\therefore\ \angle POS+\angle SOQ=180^0$
But $\angle POS=X$
$\therefore\ x+\angle SOQ=180^0$
$\angle SOQ=180^0-X$

Now ray OR bisects $\angle POS$,
Therefore $\angle ROS=\frac{1}{2}\times\angle POS=\frac{1}{2}\times x=\frac{x}{2}$
Similarly, $\angle\ SOT=\frac{1}{2}\times\angle SOQ=\frac{1}{2}\times(180^0-X)=90^\circ-\frac{x}{2}$
$\angle ROT=\angle ROS+\angle SOT=\frac{x}{2}+90^\circ-\frac{x}{2}=90^0$

---

23. If a transversal intersects two lines such that the bisectors of a pair of corresponding angles are parallel, then prove that the two lines are parallel.



Ans. Given AD is transversal intersect two lines PQ and RS

To prove PQ$\parallel$RS

Proof: BE bisects $\angle$ ABQ

$\angle = \frac{1}{2}\angle ABQ \quad \rightarrow (1)$

Similarity C G bisects $\angle$ BCS

$\therefore \angle 2 = \frac{1}{2}\angle BCS \quad \rightarrow (2)$

But $BE \parallel CG$ and AD is the transversal

$\therefore \quad \angle 1 = \angle 2$

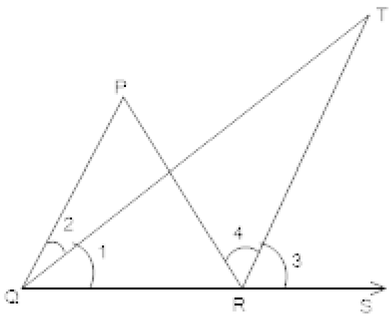
$\therefore \frac{1}{2}\angle ABQ = \frac{1}{2}\angle BCS$ [by (1) and (2)]

$\Rightarrow \angle ABQ = \angle BCS$ [$\because$corresponding angles are equal]

$\therefore PQ \parallel RS$

---

24. In figure the sides QR of ΔPQR is produced to a point S. If the bisectors of $\angle PQR$ and $\angle PRS$ meet at point T. Then prove that $\angle QRT = \frac{1}{2}\angle QPR$



Ans. Solution,

$In\ \Delta PQR$

$\angle PRS = \angle Q + \angle P$ [By exterior angle theorem]

$\angle 4 + \angle 3 = \angle 2 + \angle 1 + \angle P$

$2\angle 3 = 2\angle 1 + \angle P \quad \rightarrow (1)$

$\therefore$ QT and RT are bisectors of $\angle Q$ and $\angle PRS$

In Δ QTR

$\angle 3 = \angle 1 + \angle T \rightarrow \ (2)$ [By exterior angle theorem]

By eq (1) and (2) we get

$2[\angle 1 + \angle T] = 2\angle 1 + \angle P$

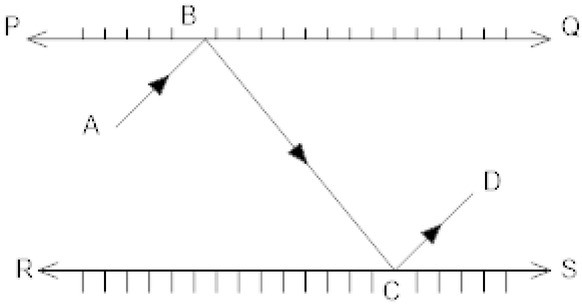
$2\angle 1 + 2\angle T = 2\angle 1 + \angle P$

$\angle T=\frac{1}{2}\angle P$

$\angle QTR=\frac{1}{2}\angle QPR$ Hence proved.

---

25. In figure PQ and RS are two mirror placed parallel to each other. An incident ray AB striker the mirror PQ at B, the reflected ray moves along the path BC and strike the mirror RS at C and again reflects back along CD. Prove that AB $\parallel$ CD.



Ans. Solution,

$Draw\ MB \perp PQ and$

$NC \perp RS.$

$\angle 1=\angle 2 \rightarrow (1)$ [angle of incident]

And $\angle 3=\angle 4 \rightarrow (2)$ [is equal to angle of reflection]

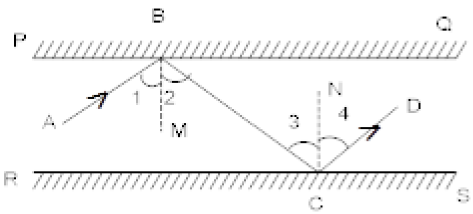
$\because \angle MBQ=\angle NCS=90^0$

$\therefore MB \parallel NC$ [By corresponding angle property]

$\therefore \angle 2=\angle 3 \rightarrow (3)$ [alternate interior angle]

By aq (1), (2) and (3)

$\angle 1=\angle 4$



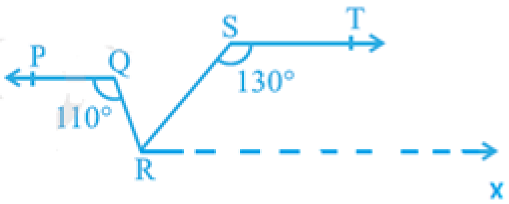
$\angle 1+\angle 2=\angle 4+\angle 3$

$\Rightarrow \angle ABC=\angle BCD$

$\therefore AB \parallel CD$ [by alternate interior angles]

4 Marks Questions

1. In the given figure, if PQ || ST, $\angle PQR=110^{\circ}$ and $\angle RST=130^{\circ}$, find $\angle QRS$. [Hint: Draw a line parallel to ST through point R.]



Ans. We are given that $PQ \parallel ST$, $\angle PQR = 110^\circ$ and $\angle RST = 130^\circ$.

We need to find the value of $\angle QRS$ in the figure.

We need to draw a line *RX* that is parallel to the line *ST*, to get

Thus, we have $ST \parallel RX$.

We know that lines parallel to the same line are also parallel to each other.

We can conclude that $PQ \parallel ST \parallel RX$.

$\angle PQR = \angle QRX$ (Alternate interior angles), or

$\angle QRX = 110^\circ$.

We know that angles on same side of a transversal are supplementary.

$\angle RST + \angle SRX = 180^\circ$

$\Rightarrow 130^\circ + \angle SRX = 180^\circ$

$\Rightarrow \angle SRX = 180^\circ - 130^\circ = 50^\circ.$

From the figure, we can conclude that

$\angle QRX = \angle SRX + \angle QRS$

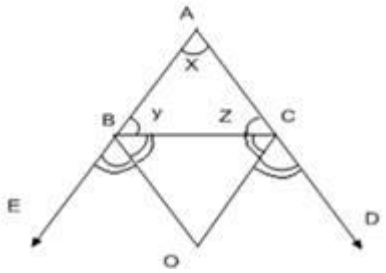
$\Rightarrow 110^\circ = 50^\circ + \angle QRS$

$\Rightarrow \angle QRS = 60^\circ.$

Therefore, we can conclude that $\angle QRS = 60^\circ$.

---

2. In fig the side AB and AC of $\triangle$ A B C Are produced to point E And D respectively. If bisector BO And CO of $\angle$ CBE And $\angle$ BCD respectively meet at point O, then prove that $\angle$ BOC = $90^\circ - \frac{1}{2}\angle$ BAC



Ans. Ray BO bisects $\angle CBE$

$\therefore \angle CBO = \frac{1}{2} \angle CBE$

$= \frac{1}{2}(180^\circ - y) \quad (\because \angle CBE + y = 180^\circ)$

$= 90^\circ - \frac{y}{2}$ ....(1)

Similarly, ray Co bisects $\angle BCD$

$\angle BCO = \frac{1}{2}\angle BCD$

$= \frac{1}{2}(180^\circ - Z)$

$= 90^\circ - \frac{Z}{2}$ ....(2)

In $\triangle$ BOC

$\angle BOC + \angle BCO + \angle CBO = 180^\circ$

$\angle BOC = \frac{1}{2}(y + z)$

But $x + y + z = 180^\circ$

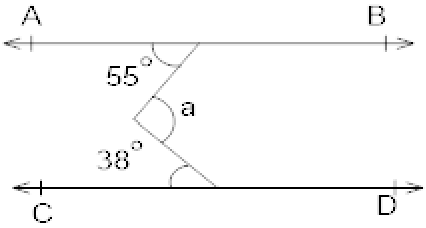
$y + z = 180^\circ - x$

$\angle BOC = \frac{1}{2}(180^\circ - x) = 90^\circ - \frac{x}{2}$

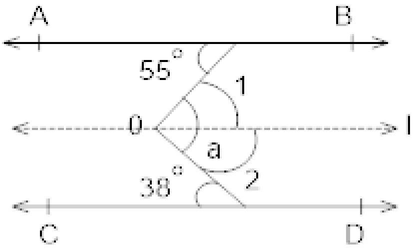
$\angle BOC = 90^\circ - \frac{1}{2} \angle BAC$

---

3. In given fig. AB $\parallel$ CD. Determine $\angle a$.



Ans. Through O draw a line l parallel to both AB and CD



Clearly

$\angle a = \angle 1 + \angle 2$

$\angle 1 = 38^o$

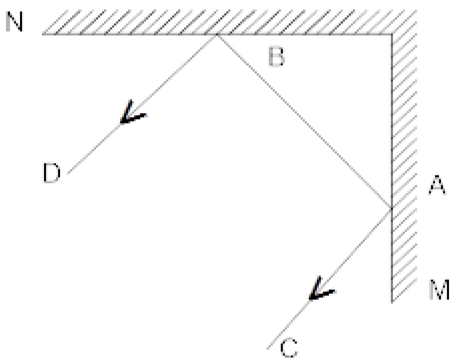
$\angle 2 = 55^o$ [Alternate interior angles]

$\angle a = 55^o + 38^o$

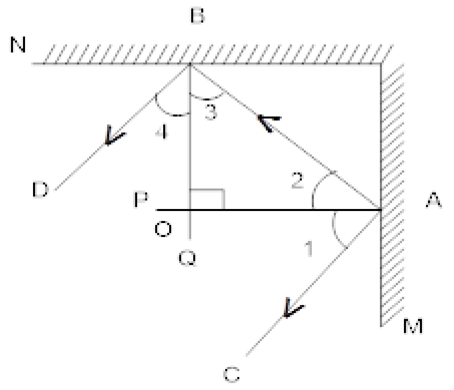
$\angle a = 93^o$

---

4. In fig M and N are two plane mirrors perpendicular to each other; prove that the incident ray CA is parallel to reflected ray BD.



Ans. Draw AP$\perp$M and BQ $\perp$N



$\therefore BQ \perp N$ and $AP \perp M$ and $M \perp N$

$\therefore \angle BOA = 90^0$

$\Rightarrow BQ \perp AP$

In Δ BOA $\angle 2+\angle 3+\angle BOA=180^0$ [By angle sum property]

$\Rightarrow \angle 2+\angle 3+90^0 = 180^0$

$\therefore \angle 2+\angle 3=90^0$

Also $\angle 1=\angle 2$ and $\angle 4=\angle 3$

$\Rightarrow \angle 1+\angle 4=\angle 2+\angle 3=90^0$

$\therefore (\angle 1+\angle 4)+(\angle 2+\angle 3) =90^0 +90^0 =180^0$

$\Rightarrow (\angle 1+\angle 2)+(\angle 3+\angle 4)=180^0$

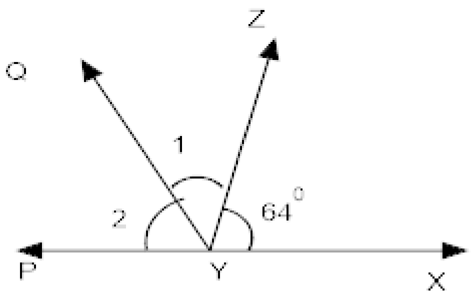
or $\angle CAB+\angle DBA=180^0$

$\therefore CA \parallel BD$ [By sum of interior angles of same side of transversal]

---

5. It is given that $\angle XYZ = 64^0$ and XY is produced to point P. Draw a figure from the given information. If ray YQ bisects $\angle ZYP$. Find $\angle XYQ$ and reflex $\angle QYP$.

Ans. Solution,



$\therefore YQ$ *bisecects* $\angle ZYP$

$\therefore \angle 1 = \angle 2$

$\angle 1 + \angle 2 + \angle 64^0 = 180^0$ [YX is a line]

$\angle 1 + \angle 1 + 64^0 = 180^0 \; 2\angle 1 = 180^0 - 64^0$

$2\angle 1 = 116^0$

$\angle 1 = 58^0$

$\therefore \angle \text{XYQ} = 64^0 + 58^0 = 122^0$

$\angle 2 + \angle \text{XYQ} = 180^0 \;\; \angle 1 = \angle 2 = \angle QYP = 58^0$

$\angle 2 + 122^0 = 180^0$

$\angle 2 = 180^0 - 122^0$

$\angle QYP = \angle 2 = 58^0$

$\text{Re}\,\mathit{flex}\ \angle Q\text{YP} = 360^0 - \angle QYP$

$= 360^0 - 58^0$

$= 302^0$