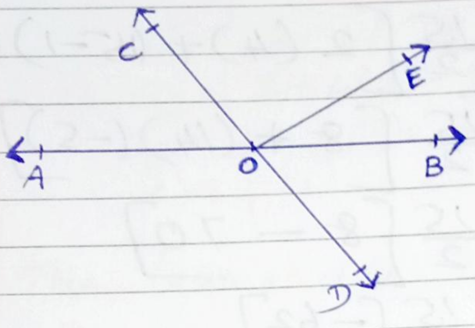
Class-9
Exercise 6.1

1



Given: $\angle BOD = 40^\circ$
$\angle AOC + \angle BOE = 70^\circ$

To find: $\angle BOE$ and reflex $\angle COE$

$\angle BOD$ and $\angle AOC$ are vertically opposite angles.

Since $\angle BOD = 40^\circ \Rightarrow \angle AOC = 40^\circ$

We have $\angle AOC + \angle BOE = 70^\circ$
$40^\circ + \angle BOE = 70^\circ$
$\angle BOE = 70^\circ - 40^\circ$
$\boxed{\angle BOE = 30^\circ}$

$\angle BOD$ and $\angle AOD$ are linear pair of angles.

$\angle AOD = 180^\circ - \angle BOD$
$= 180^\circ - 40^\circ$
$= 140^\circ$

Reflex angle $\angle COE = \angle AOC + \angle AOD + \angle BOD + \angle BOE$
$= 40^\circ + 180^\circ + 30^\circ$
$= 250^\circ$

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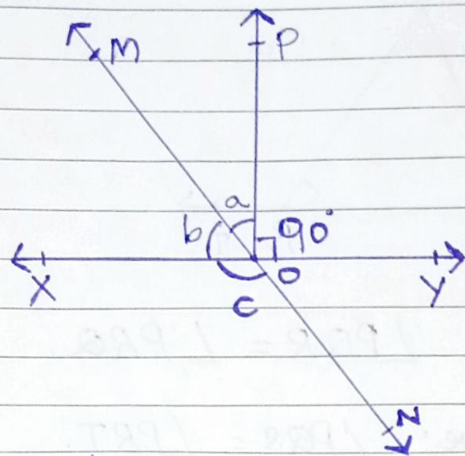
(2) XY and MN intersect at O.

$\angle POY = 90°$ and $a:b = 2:3$ find c.



Given : $\angle POY = 90°$

$a:b = 2:3$

To find : c

$\angle XOP + \angle POY = 180°$

$\angle XOP = 180° - \angle POY$

$= 180° - 90°$

$= 90°$

$\angle XOP = \angle a + \angle b$

Let $a = 2x$; $b = 3x$.

$\angle XOP = 90°$

$\Rightarrow 2x + 3x = 90°$

$5x = 90°$

$x = \frac{90°}{5}$

$= 18°$

$a = 2x = 2(18) = 36°$

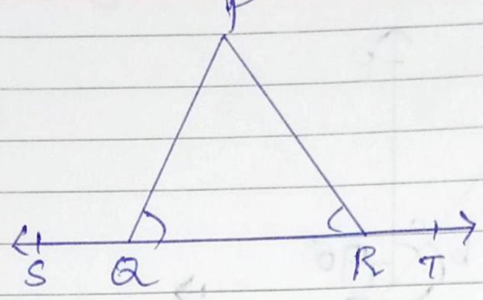
$b = 3x = 3(18) = 54°$

$\angle b$ and $\angle NOY$ are vertically opposite.

$\therefore \angle NOY = 54°$.

$\angle C = \angle XON = 180° - \angle NOY$
$= 180° - 54°$
$= 126°$

3



Given $\angle PQR = \angle PRQ$.

To Prove: $\angle PQS = \angle PRT$.

Since ST is a straight line,

$\angle PQR + \angle PQS = 180° \longrightarrow$ (1)
$\angle PRQ + \angle PRT = 180° \longrightarrow$ (2)

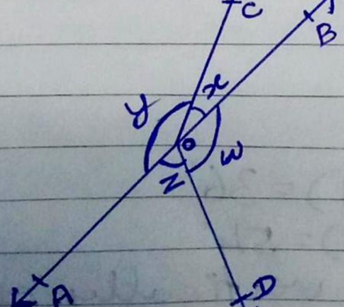
$\angle PQR + \angle PQS = \angle PRQ + \angle PRT$.

$\angle PQR + \angle PQS = \angle PQR + \angle PRT$ (Since $\angle PQR = \angle PRQ$)

$\Rightarrow \angle PQS = \angle PRT$

Hence Proved.

(4)



Given :- $x + y = w + z$
To Prove: AOB is a line.

Here $x + y + z + w$ forms a full angle.

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

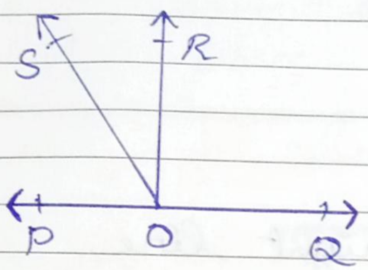
$(x+y) + (x+y) = 360^\circ$ (Since $x+y = w+z$)

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

$x+y = \frac{360^\circ}{2} = 180^\circ$

$\Rightarrow$ AB is a straight line.

(5)



Given: POQ is a line
OR $\perp$ OQ

To Prove: $\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$.

POQ is a line $\Rightarrow \angle POR + \angle ROQ = 180^\circ$

OR $\perp$ OQ $\Rightarrow \angle ROQ = 90^\circ$

$\therefore \angle POR = 180^\circ - \angle ROQ$
$= 180^\circ - 90^\circ$
$= 90^\circ$

Now $\angle ROS = \angle ROP - \angle POS$

$= 90 - \angle POS \rightarrow (1)$

we have $\angle ROS + \angle ROQ = \angle QOS$

$\Rightarrow \angle ROS = \angle QOS - \angle ROQ$

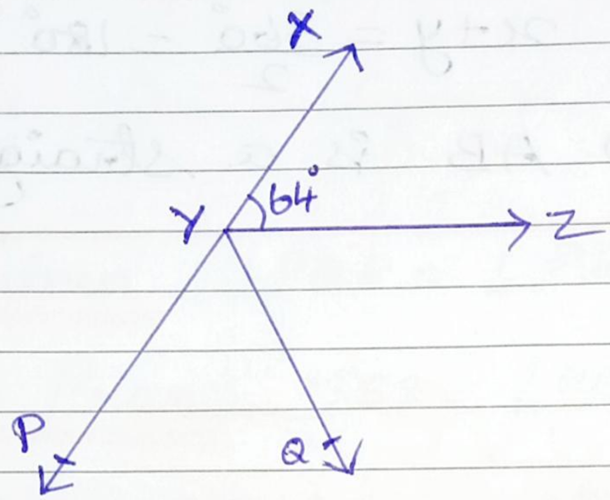
$= \angle QOS - 90^\circ \rightarrow (2)$

from (1) and (2), (Add (1) & (2))

$2\angle ROS = \angle QOS - \angle POS$

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

(6)



XYP is a straight line.

$\angle XYZ + \angle ZYQ + \angle QYP = 180°$

$64° + \angle ZYQ + \angle QYP = 180°$

$64° + 2\angle QYP = 180°$ (since YQ bisects $\angle ZYP$)

$\Rightarrow 2\angle QYP = 180° - 64°$
$= 116°$

$\angle QYP = \frac{116°}{2} = 58°$

Reflex $\angle QYP = 360° - 58°$
$= 302°$

Here $\angle XYQ = \angle XYZ + \angle ZYQ$
$= 64° + \angle QYP$ (since $\angle ZYQ = \angle QYP$)

$\angle XYQ = 64° + 58° = 122°$

Reflex $\angle QYP = 302°$ & $\angle XYQ = 122°$.

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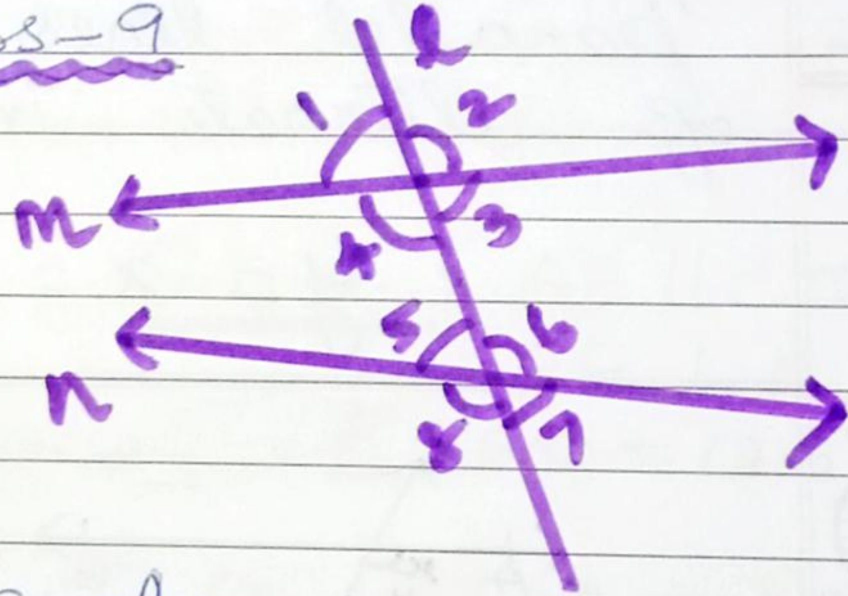


Corresponding angles

∠1 and ∠5 ∠2 and ∠6

∠4 and ∠8 ∠3 and ∠7

Alternate interior angles

∠4 and ∠6 ∠3 and ∠5

Alternate exterior angles

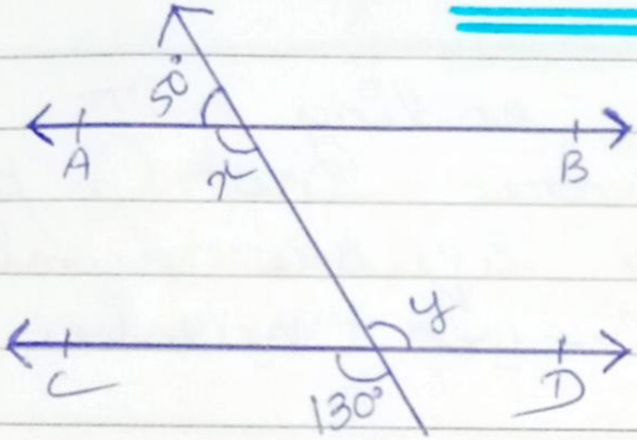
∠1 and ∠7 ∠2 and ∠8

Interior angles on same side of transversal

∠4 and ∠5 ∠3 and ∠6.

Exercise 6.2

(1)



To find x and y.

Here 130 and y are vertically opposite angles.

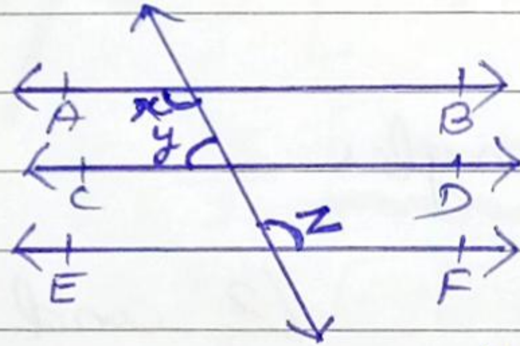
$\therefore y = 130°$

x and 50° are linear pair

$$x + 50° = 180°$$
$$x = 180 - 50°$$
$$= 130°$$

$\therefore x = 130°, \quad y = 130°$

(2)



Given : $AB \parallel CD$, $CD \parallel EF$
$y : z = 3 : 7$

Since $AB \parallel CD$ and $CD \parallel EF$
$\Rightarrow AB \parallel EF$

Thm 6.4 If a transversal intersects two parallel lines, then each pair of interior angles on same side of the transversal is supplementary.

$x + y = 180^\circ$

$x = z$ [By Thm 6.2]

$z + y = 180^\circ$

Let $y = 3a$; $z = 7a$

$7a + 3a = 180^\circ$

$10a = 180^\circ$

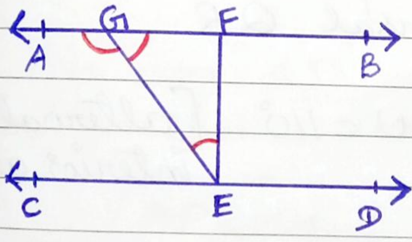
$a = 18^\circ$

$z = 7(18^\circ) = 126^\circ$

$\Rightarrow x = z = 126^\circ$

$\therefore x = 126^\circ$

3.



Given: $AB \parallel CD$

$EF \perp CD$

$\angle GED = 126^\circ$

To find: $\angle AGE$, $\angle GEF$, $\angle FGE$

$\angle AGE$ and $\angle GED$ are alternate interior angles.

Since $\angle GED = 126^\circ \Rightarrow \angle AGE = 126^\circ$

$\angle AGE$ and $\angle FGE$ are linear pair of angles.

$\angle AGE + \angle FGE = 180^\circ$

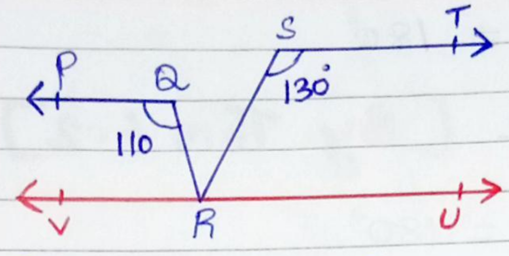
$\angle FGE = 180^\circ - \angle AGE$

$\boxed{\angle FGE = 180^\circ - 126^\circ = 54^\circ}$

Since $EF \perp CD \Rightarrow EF \perp AB \therefore \angle AFE = 90^\circ$

$\angle GEF = 180^\circ - \angle FGE - 90^\circ = 180 - 54 - 90^\circ = 36^\circ$

(4)



Given: $PQ \parallel ST$

$\angle PQR = 110°$

$\angle RST = 130°$

To Find: $\angle QRS$

Construction :- Draw $RU \parallel ST$

We have $PQ \parallel ST$, $ST \parallel RU$

$\Rightarrow PQ \parallel RU$

PQ and RU are parallel lines cut by transversal QR.

$\angle PQR = \angle QRU = 110°$ [alternate interior angles]

ST and RU are parallel lines cut by transversal SR.

$\angle RST + \angle SRU = 180°$

$130° + \angle SRU = 180°$

$\angle SRU = 180° - 130° = 50°$

$\angle QRS = \angle QRU - \angle SRU$

$= 110° - 50°$

$= 60°$

$\boxed{\therefore \angle QRS = 60°}$

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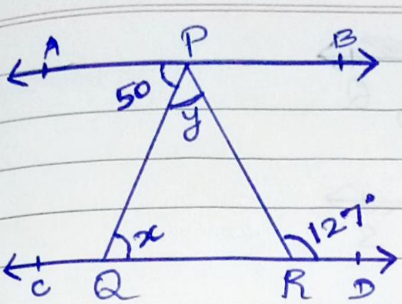

Given : AB ∥ CD

$\angle APQ = 50°$

$\angle PRD = 127°$

To Find : x and y

AB and CD are parallel lines cut by the transversal PQ

$\angle APQ$ and x are alternate interior angles.

$\therefore x = \angle APQ = 50°$

$x = 50°$

AB and CD are parallel lines cut by the transversal PR.

$\angle APR$ and $\angle PRD$ are alternate interior angles.

$\therefore \angle APR = \angle PRD = 127°$

$50° + y = 127°$

$y = 127° - 50°$

$= 77°$

$x = 50°$; $y = 77°$

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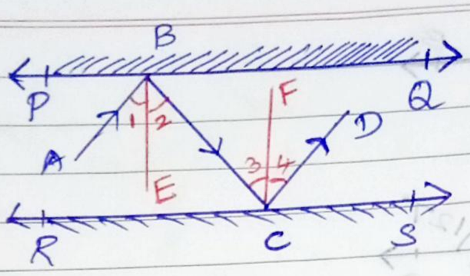


Construction : Draw $BE \perp PQ$
$CF \perp RS$

As $PQ \parallel RS$
$\therefore BE \parallel CF$

BE and CF are two parallel lines cut by the transversal BC at B and C.

$\angle 2 = \angle 3$ (alternate interior angles)

Also $\angle 1 = \angle 2$ and $\angle 3 = \angle 4$
(angle of incidence = angle of reflection)

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

$\angle ABC = \angle DCB$

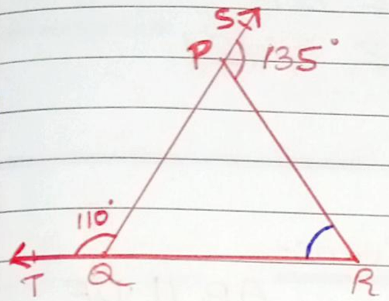
$\Rightarrow AB \parallel CD$

Angle Sum Property of a Triangle

Theorem: The sum of the angles of a triangle is 180°.

Theorem: 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.

Exercise 6.3

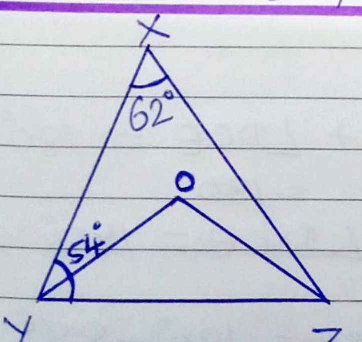


1) Given :- $\angle SPR = 135°$
$\angle PQT = 110°$

To find : $\angle PRQ$

$\angle PQT + \angle PQR = 180°$ (linear pairs)
$110° + \angle PQR = 180°$
$\Rightarrow \angle PQR = 180° - 110°$
$= 70°$
$\angle PQR = 70°$

$\angle SPR = \angle PQR + \angle PRQ$
$135° = 70° + \angle PRQ$
$135° - 70° = \angle PRQ$
ie., $\angle PRQ = 65°$



2) In ΔXYZ, By Angle sum property $\angle X + \angle Y + \angle Z = 180°$
$62° + 54° + \angle Z = 180°$
$116° + \angle Z = 180°$
$\angle Z = 180° - 116° = 64°$

$\angle OYZ = \frac{54°}{2} = 27°$ (Since OY bisects)

$\angle OZY = \frac{64°}{2} = 32°$ (Since OZ bisects)

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By angle sum property

$\angle O + \angle OZY + \angle OYZ = 180^\circ$

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

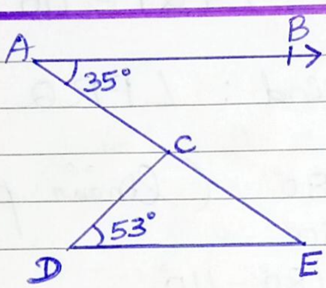
$\angle O + 59^\circ = 180^\circ$

$\angle O = 180^\circ - 59^\circ$

$= 121^\circ$

$\angle O = \angle YOZ = 121^\circ$

(3)



Given:-

AB ∥ DE

$\angle BAC = 35^\circ$

$\angle CDE = 53^\circ$

AB and DE are parallel lines cut by the transversal AE.

$\angle BAC = \angle CED$ (alternate angles)

$\Rightarrow \angle CED = 35^\circ$

In $\triangle$ CDE,

$\angle CDE + \angle CED + \angle DCE = 180^\circ$

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

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

$\angle DCE = 180^\circ - 88^\circ$

$= 92^\circ$

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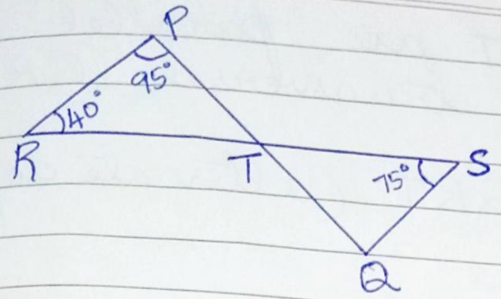


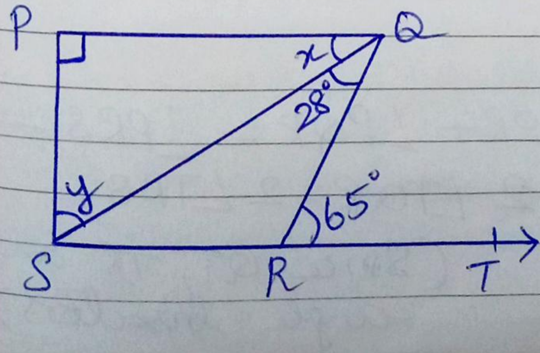
Given: PQ and RS intersect at T.
$\angle PRT = 40°$
$\angle RPT = 95°$
$\angle TSQ = 75°$

To find: $\angle SQT$

In $\triangle RPT$, $\angle P + \angle R + \angle T = 180°$
$95° + 40° + \angle T = 180°$
$135° + \angle T = 180°$
$\angle T = 180° - 135°$
$\angle PTR = \angle T = 45°$
$\angle PTR$ and $\angle STQ$ are vertically opposite angles.
$\therefore \angle STQ = 45°$

In $\triangle STQ$, $\angle STQ + \angle TSQ + \angle SQT = 180°$
$45° + 75° + \angle SQT = 180°$
$120° + \angle SQT = 180°$
$\angle SQT = 180° - 120°$
$= 60°$

(5)



Given:- $PQ \parallel RS$
$PQ \perp PS$
$\angle SQR = 28°$
$\angle QRT = 65°$
To find: x and y

PQ and ST are parallel lines cut by the transversal QR

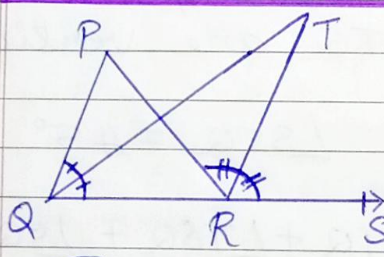
$\angle PQR = \angle QRT$ (alternate angles)

$x + 28° = 65°$
$x = 65° - 28°$
$= 37°$

$\angle P + x + y = 180°$

$\angle P = 90°$, $\angle x = 37°$
$\therefore 90° + 37° + \angle y = 180°$
$127° + \angle y = 180°$
$\angle y = 180 - 127°$
$= 53°$
$\angle x = 37°$; $\angle y = 53°$

6



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

In ΔQRT,
$\angle QTR + \angle TQR = \angle TRS$
$\Rightarrow \angle QTR = \angle TRS - \angle TQR \rightarrow$ 1

In ΔPQR
$\angle QPR + \angle PQR = \angle PRS \rightarrow$ 2
$\angle QPR + 2\angle TQR = 2\angle TRS$
(Since QT, TR are angle bisectors)

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

$\angle QPR = 2\angle QTR$ (using 1)

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

Hence Proved.