

NTSE

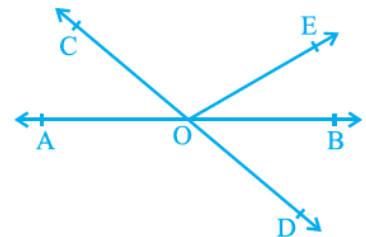
NCERT Solutions for Class 9
MATHS – Lines and Angles



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



Sol. Lines AB and CD intersect at O

$$\therefore \angle AOC = \angle BOD \quad [\text{Vertically Opposite Angles}]$$

Angles]

$$\text{But } \angle BOD = 40^\circ \dots\dots\dots(1) \quad [\text{Given}]$$

$$\therefore \angle AOC = 40^\circ \dots\dots\dots(2)$$

$$\text{Now, } \angle AOC + \angle BOE = 70^\circ$$

$$\Rightarrow 40^\circ + \angle BOE = 70^\circ \quad [\text{Using (2)} \Rightarrow \angle BOE = 70^\circ - 40^\circ]$$

$$\Rightarrow \angle BOE = 30^\circ$$

$$\text{Again, reflex } \angle COE = \angle COD + \angle BOD + \angle BOE$$

$$= \angle COD + 40^\circ + 30^\circ \dots\dots\dots(3) \quad [\text{Using (1) and (2)}]$$

$$= 180^\circ + 40^\circ + 30^\circ = 250^\circ$$

2. In figure, $\angle PQR = \angle PRQ$, then prove that $\angle PQS = \angle PRT$.

Sol. Ray QP stands on line ST

$$\therefore \angle PQS + \angle PQR = 180^\circ \dots\dots\dots(1)$$

Ray RP stands on line ST

$$\therefore \angle PRQ + \angle PRT = 180^\circ \dots\dots\dots(2)$$

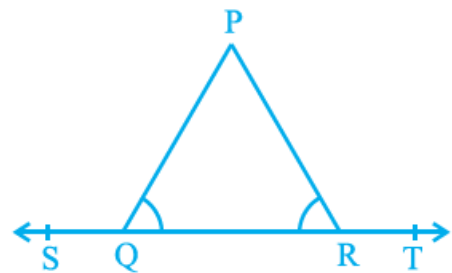
[Linear Pair Axiom]

From (1) and (2), we obtain

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

$$\Rightarrow \angle PQS = \angle PRT$$

[Since, $\angle PRQ = \angle PQR$ given]



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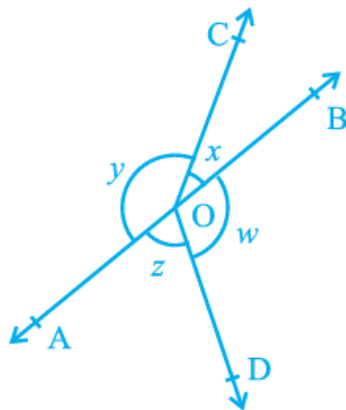
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3. In Figure, if $x + y = w + z$, then prove that AOB is a line.



Sol. $x + y = w + z$ (1)

[Given \therefore The sum of all the angles round a point is equal to 360°]

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

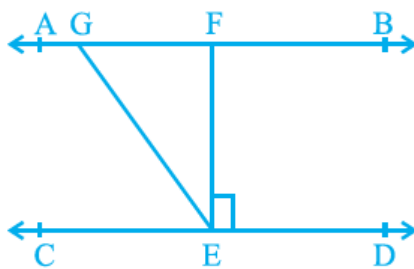
$$\Rightarrow x + y + x + y = 360^\circ \quad [\text{Using (1)}]$$

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

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

$\therefore AOB$ is a line.

4. In Figure, if $AB \parallel CD$, $EF \perp CD$ and $\angle GED = 126^\circ$, find $\angle AGE$, $\angle GEF$ and $\angle FGE$.



Sol. (i) $\angle AGE = \angle GED = 126^\circ$ [Alternate interior Angles]

(ii) $\angle GED = 126^\circ$

$$\Rightarrow \angle GEF + \angle FED = 126^\circ$$

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

[Since, $EF \perp CD$ and $\angle FED = 90^\circ$]

$$\Rightarrow \angle GEF = 126^\circ - 90^\circ = 36^\circ$$

**Success
STORY**

I still wonder how one man has such a deep understanding of an examination. It becomes the truth what ever Vipin Sir says about NTSE.

M. Pareek

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(iii) $\angle GEC + \angle GEF + \angle FED = 180^\circ$

[CD is a line]

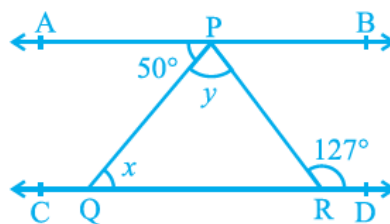
$$\Rightarrow \angle GEC + 36^\circ + 90^\circ = 180^\circ$$

$$\Rightarrow \angle GEC + 126^\circ = 180^\circ$$

$$\Rightarrow \angle GEC = 180^\circ - 126^\circ = 54^\circ$$

Now, $\angle FGE = \angle GEC = 54^\circ$

5. In Figure, if $AB \parallel CD$, $\angle APQ = 50^\circ$ and $\angle PRD = 127^\circ$, find x and y .



Sol. $x = \angle APQ = 50^\circ$

[Alternate Interior Angles]

$$\angle PRD = x + y = 127^\circ$$

[Sum of the two Interior opposite Angles]

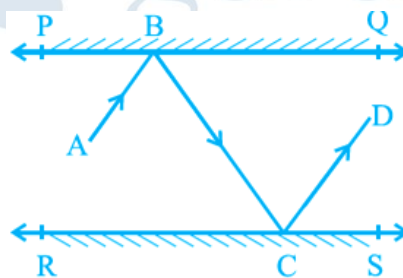
$$\Rightarrow 50^\circ + y = 127^\circ$$

[Exterior angle]

$$\Rightarrow y = 127^\circ - 50^\circ$$

$$\Rightarrow y = 77^\circ$$

6. In 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 $AB \parallel CD$.



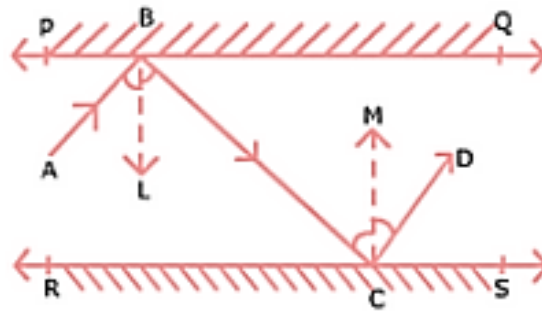
Sol. **Construction :** Draw ray $BL \perp PQ$ and ray $CM \perp RS$.

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Proof : $BL \perp PQ, CM \perp RS$ and $PQ \parallel RS$

$\therefore BL \parallel CM$

$$\angle LBC = \angle MCB \quad \dots\dots(1)$$

[Alternate Interior Angles $\angle ABL = \angle LCB \dots(2)$]

(2) [Angle of incidence = Angle of reflection]

$$\angle MCB = \angle MCD \quad \dots\dots(3)$$

[Angle of incidence = Angle of reflection]

From (1), (2) and (3), we get $\angle ABL = \angle MCD \dots\dots(4)$

Adding (1) and (4), we get

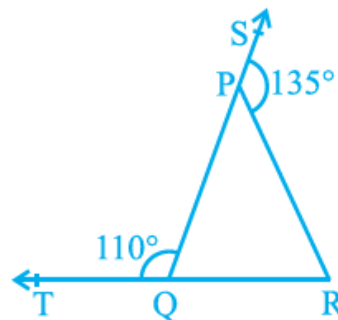
$$\angle LBC + \angle ABL = \angle MCB + \angle MCD$$

$$\Rightarrow \angle ABC = \angle BCD$$

But these are alternate interior angles and they are equal.

So, $AB \parallel CD$.

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

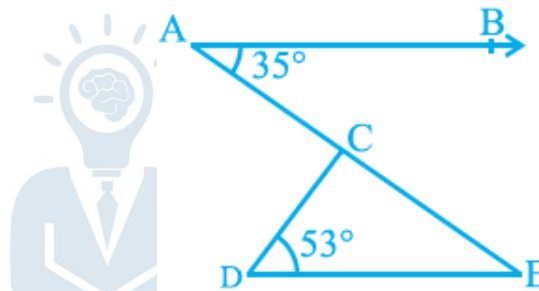


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Sol. TR is a line $\angle PQT + \angle PQR = 180^\circ$
 $\Rightarrow 110^\circ + \angle PQR = 180^\circ$
 $\Rightarrow \angle PQR = 180^\circ - 110^\circ = 70^\circ$ (1) QS is a line
 $\therefore \angle SPR + \angle QPR = 180^\circ$
 $\Rightarrow 135^\circ + \angle QPR = 180^\circ$
 $\Rightarrow \angle QPR = 180^\circ - 135^\circ = 45^\circ$ (2)
 In $\triangle PQR$, $\angle PQR + \angle QPR + \angle PRQ = 180^\circ$
 [The sum of all the angles of a triangle is 180°]
 $\Rightarrow 70^\circ + 45^\circ + \angle PRQ = 180^\circ$ [Using (1) and (2)]
 $\Rightarrow 115^\circ + \angle PRQ = 180^\circ$
 $\Rightarrow \angle PRQ = 180^\circ - 115^\circ = 65^\circ$

8. In Figure, if $AB \parallel DE$, $\angle BAC = 35^\circ$ and $\angle CDE = 53^\circ$, find $\angle DCE$.



Sol. $\angle DEC = \angle BAC = 35^\circ$ (1)
 [Alternate Interior Angles]
 $\angle CDE = 53^\circ$ (2)
 [Given]
 In $\triangle CDE$, $\angle CDE + \angle DEC + \angle DCE = 180^\circ$
 [The sum of all the angles of a triangle is 180° .]
 $\Rightarrow 53^\circ + 35^\circ = \angle CDE + \angle DEC$
 $\Rightarrow 88^\circ + \angle DCE = 180^\circ$
 $\Rightarrow \angle DCE = 180^\circ - 88^\circ = 92^\circ$

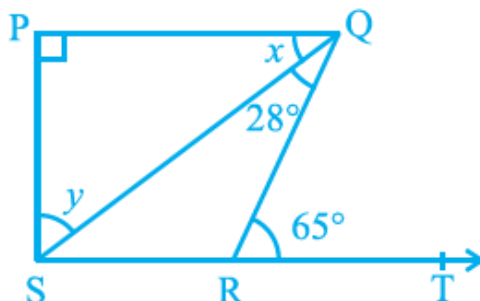
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9. In Figure, if $PQ \perp PS$, $PQ \parallel SR$, $\angle SQR = 28^\circ$ and $\angle QRT = 65^\circ$, then find the values of x and y .



Sol. $\angle QRT = \angle RST + \angle QSR$

[The exterior angle is equal to the sum of the two interior opposite angles]

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

$$\Rightarrow \angle QSR = 65^\circ - 28^\circ = 37^\circ$$

$$\Rightarrow PQ \perp PS$$

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

$$\therefore PQ \parallel SR$$

$$\therefore \angle QPS + \angle PSR = 180^\circ$$

[The sum of consecutive interior angles on the same side of the transversal is 180°]

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

$$\Rightarrow \angle PSR = 180^\circ - 90^\circ = 90^\circ$$

$$\Rightarrow \angle PSQ + \angle QSR = 90^\circ$$

$$\Rightarrow y + 37^\circ = 90^\circ$$

$$\Rightarrow y = 90^\circ - 37^\circ = 53^\circ$$

In $\triangle PQS$, $\angle PQS + \angle QSP + \angle QPS = 180^\circ$

[The sum of all the angles of a triangle is 180°]

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

$$\Rightarrow x + 53^\circ + 90^\circ = 180^\circ$$

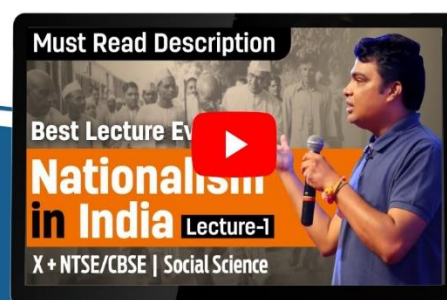
$$\Rightarrow x + 143^\circ = 180^\circ$$

$$\Rightarrow x = 180^\circ - 143^\circ = 37^\circ.$$

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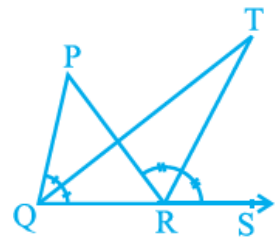
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10. In Figure, the side QR of $\triangle PQR$ is produced to a point S. If the bisectors of

$\angle PQR$ and $\angle PRS$ meet at point T, then prove that $\angle QTR = \frac{1}{2} \angle QPR$.



Sol. $\angle TRS$ is an exterior angle of $\triangle TQR$

$$\angle TRS = \angle TQR + \angle QTR \quad \dots\dots(1)$$

[Since, the exterior angle is equal to the sum of the two interior opposite angles.]

$\therefore \angle PRS$ is an exterior angle of $\triangle PQR$

$$\angle PRS = \angle PQR + \angle QPR \quad \dots\dots(2)$$

[Since, the exterior angle is equal to the sum of the two interior opposite angles.]

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

[QT is the bisector of $\angle PQR$ and RT is the bisector of $\angle PRS$]

$$\Rightarrow 2(\angle TRS - \angle TQR) = \angle QPR \quad \dots\dots(3)$$

$$\text{From (1), } \angle TRS - \angle TQR = \angle QTR \quad \dots\dots(4)$$

From (3) and (4), we obtain

$$2\angle QTR = \angle QPR$$

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

Hence proved.

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