NCERT Solutions for Class 9 Maths Chapter 6: Lines & Angles | Free PDF Download

Ex 6.1 Question 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 $\angle \mathrm{BOE}$ and reflex $\angle \mathrm{COE}$.

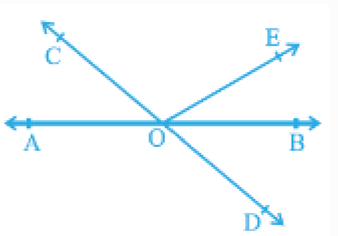


Fig. 6.13

Answer.

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 $\angle BOE = 30^\circ$.

Ex 6.1 Question 2.

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

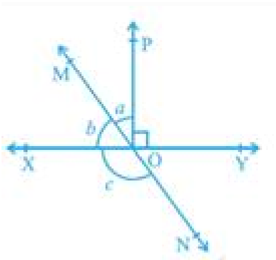


Fig. 6.14

Answer.

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

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

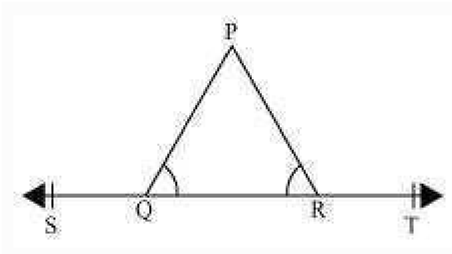
Let a be equal to $2x$ and b be equal to $3x$.
$\because a + b = 90^\circ \Rightarrow 2x + 3x = 90^\circ \Rightarrow 5x = 90^\circ$
$\Rightarrow x = 18^\circ$

Therefore $b = 3 \times 18^\circ = 54^\circ$

Now $b + c = 180^\circ$ [Linear pair]
$\Rightarrow 54^\circ + c = 180^\circ$
$\Rightarrow c = 180^\circ - 54^\circ = 126^\circ$

Ex 6.1 Question 3.

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



Answer.

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)

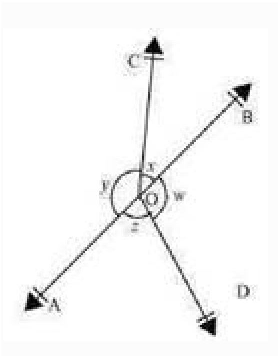
From equations (i) and (ii), we can conclude that
$\angle PQS + \angle PQR = \angle PRQ + \angle PRT$

But, $\angle PQR = \angle PRQ$.
$\therefore \angle PQS = \angle PRT$.

Therefore, the desired result is proved.

Ex 6.1 Question 4.

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



Answer.

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).
$2(y + x) = 360^\circ$.
$y + x = 180^\circ$.

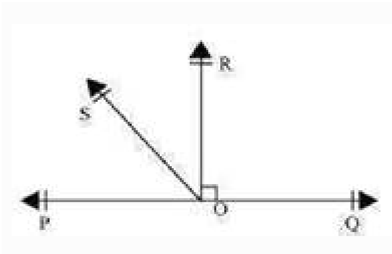
From the given figure, we can conclude that y and x form a linear pair.

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.

Ex 6.1 Question 5.

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



Answer.

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

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

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.

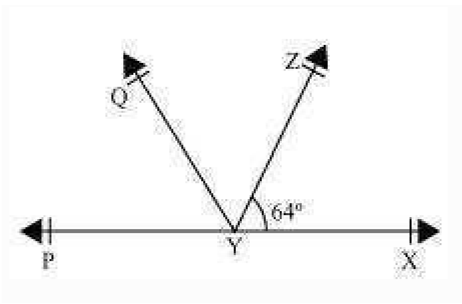
Ex 6.1 Question 6.

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

Answer

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

$\angle QYZ = \angle QYP = \dfrac{116^\circ}{2} =$

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

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

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

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

$= 302^\circ$.

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

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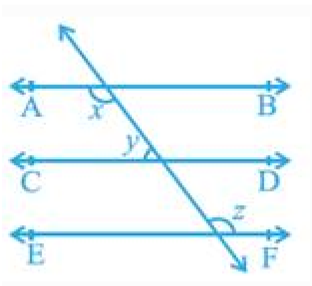
Ex 6.2 Question 1.

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



Answer.

We are given that $AB \| CD, CD \| EF$ 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 $AB \| CD \| EF$.

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
$7a + 3a = 180^\circ$
$\Rightarrow 10a = 180^\circ$
$a = 18^\circ$.

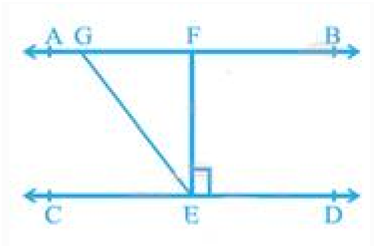
$z = 7a = 126^\circ$
$y = 3a = 54^\circ$.

Now $x + 54^\circ = 180^\circ$
$x = 126^\circ$.

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

Ex 6.2 Question 2.

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



Answer.

We are given that $AB \| CD, EF \perp CD$ and $\angle GED = 126^{\circ}$.

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

$\angle GED = 126^{\circ}$

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

$\text{But, } \angle FED = 90^{\circ}$.

$126^{\circ} = 90^{\circ} + \angle GEF$

$\Rightarrow \angle GEF = 36^{\circ}$.

$\because \angle AGE = \angle GED \text{ (Alternate angles)}$

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

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°.

$\angle FED + \angle FEC = 180^{\circ}$

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

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

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

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

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

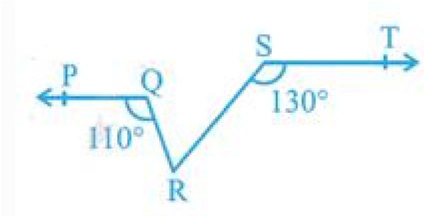
$\angle GEC = \angle FGE = 54^{\circ}$ (Alternate interior angles)

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

Ex 6.2 Question 4.

In the given figure, if $\mathbf{PQ} \| \mathbf{ST}, \angle PQR = 110^{\circ}$ and $\angle RST = 130^{\circ}$, find $\angle QRS$.

[Hint: Draw a line parallel to ST through point R.]



Answer

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

Thus, we have $ST \| RX$.

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

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

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

$\angle QRX = 110^{\circ}$.

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

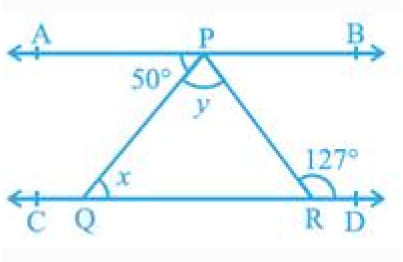
$\angle QRX = \angle SRX + \angle QRS \Rightarrow 110^{\circ} = 50^{\circ} + \angle QRS$

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

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

Ex 6.2 Question 4.

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



Answer.

We are given that $AB \| CD, \angle APQ = 50^\circ$ 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)
$\angle APR = \angle QPR + \angle APQ$.
$127^\circ = y + 50^\circ \Rightarrow y = 77^\circ$.

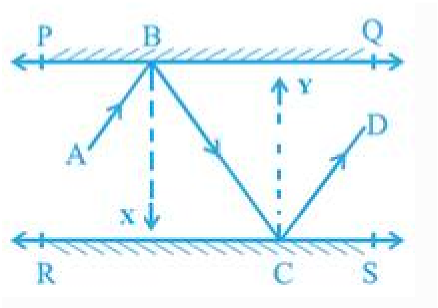
Therefore, we can conclude that $x = 50^\circ$ and $y = 77^\circ$

Ex 6.2 Question 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.

Answer.

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



We need to prove that $AB \| CD$ 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
$\angle ABX = \angle CBX \text{ and } \angle BCY = \angle DCY$.
$\angle BCY = \angle CBX$ (Alternate interior angles)

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

From the figure, we can conclude that
$\angle ABC = \angle ABX + \angle CBX, \text{ and } \angle DCB = \angle BCY + \angle DCY$.

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 $AB \| CD$