NCERT Solutions For Class 9 Maths Chapter 6- Lines and Angles

Exercise: 6.1 **(Page No: 96)**

1. In Fig. 6.13, lines AB and CD intersect at O. If ∠AOC +∠BOE = 70° and ∠BOD = 40°, find ∠BOE and reflex ∠COE.

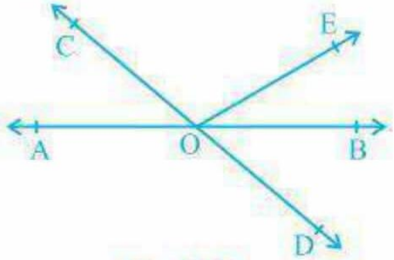


Fig. 6.13

Solution:

From the diagram, we have

(∠AOC +∠BOE +∠COE) and (∠COE +∠BOD +∠BOE) forms a straight line.

So, ∠AOC+∠BOE +∠COE = ∠COE +∠BOD+∠BOE = 180°

Now, by putting the values of ∠AOC+∠BOE = 70° and ∠BOD = 40° we get

∠COE = 110°, ∠BOE = 30° and reflex ∠COE = 360° - 110° = 250°

2. In Fig. 6.14, lines XY and MN intersect at O. If ∠POY = 90° and a : b = 2 : 3, find c.

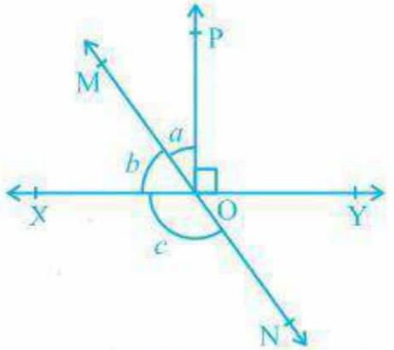


Fig. 6.14

Solution:

We know that the sum of linear pair are always equal to 180°

So,

$\angle POY + a + b = 180°$

Putting the value of $\angle POY = 90°$ (as given in the question) we get,

$a+b = 90°$

Now, it is given that $a : b = 2 : 3$ so,

Let a be 2x and b be 3x

$\therefore 2x+3x = 90°$

Solving this we get

$5x = 90°$

So, $x = 18°$

$\therefore a = 2\times18° = 36°$

Similarly, b can be calculated and the value will be

$b = 3\times18° = 54°$

From the diagram, b+c also forms a straight angle so,

$b+c = 180°$

$\Rightarrow c+54° = 180°$

$\therefore c = 126°$

3. In Fig. 6.15, $\angle PQR = \angle PRQ$, then prove that $\angle PQS = \angle PRT$.

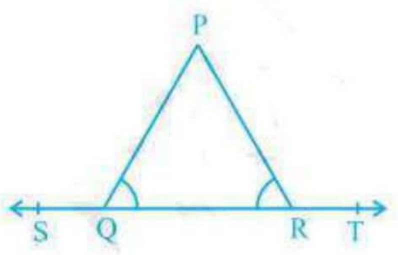


Fig. 6.15

Solution:

Since ST is a straight line so,

$\angle PQS+\angle PAR = 180°$ (linear pair) and

$\angle PRT+\angle PRQ = 180°$ (linear pair)

Now, $\angle PQS + \angle PAR = \angle PRT+\angle PRQ = 180°$

Since ∠PQR =∠PRQ (as given in the question)

∠PQS = ∠PRT. (Hence proved).

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

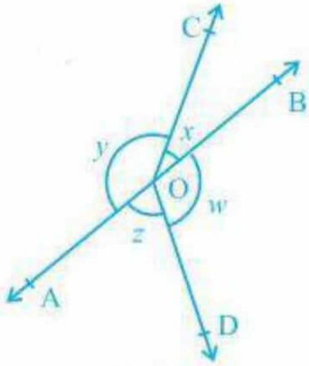


Fig. 6.16

Solution:

For proving AOB is a straight line, we will have to prove x+y is a linear pair

i.e. x+y = 180°

We know that the angles around a point are 360° so,

x+y+w+z = 360°

In the question, it is given that,

x+y = w+z

So, (x+y)+(x+y) = 360°

⇒2(x+y) = 360°

∴ (x+y) = 180° (Hence proved).

5. In Fig. 6.17, POQ is a line. Ray OR is perpendicular to line PQ. OS is another ray lying between rays OP and OR. Prove that ∠ROS = ½ (∠QOS – ∠POS).

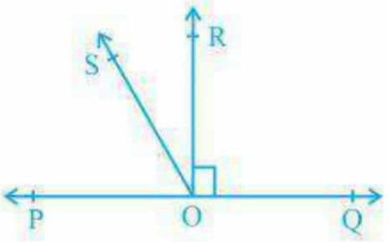


Fig. 6.17

Solution:

In the question, it is given that (OR ⊥ PQ) and ∠POQ = 180°

So, ∠POS+∠ROS+∠ROQ = 180°

Now, ∠POS+∠ROS = 180°- 90° (Since ∠POR = ∠ROQ = 90°)

∴ ∠POS + ∠ROS = 90°

Now, ∠QOS = ∠ROQ+∠ROS

It is given that ∠ROQ = 90°,

∴ ∠QOS = 90° +∠ROS

Or, ∠QOS +∠ROS = 90°

As ∠POS + ∠ROS = 90° and ∠QOS + ∠ROS = 90°, we get

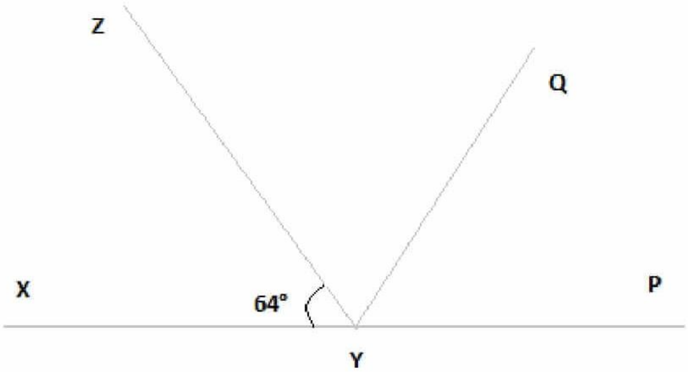
∠POS + ∠ROS = ∠QOS + ∠ROS

⇒ 2 ∠ROS + ∠POS = ∠QOS

Or, ∠ROS = ½ (∠QOS - ∠POS) (Hence proved).

6. It is given that ∠XYZ = 64° and XY is produced to point P. Draw a figure from the given information. If ray YQ bisects ∠ZYP, find ∠XYQ and reflex ∠QYP.

Solution:



Here, XP is a straight line

So, $\angle XYZ + \angle ZYP = 180°$

Putting the value of $\angle XYZ = 64°$ we get,

$64° + \angle ZYP = 180°$

$\therefore \angle ZYP = 116°$

From the diagram, we also know that $\angle ZYP = \angle ZYQ + \angle QYP$

Now, as YQ bisects $\angle ZYP$,

$\angle ZYQ = \angle QYP$

Or, $\angle ZYP = 2\angle ZYQ$

$\therefore \angle ZYQ = \angle QYP = 58°$

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

By putting the value of $\angle XYZ = 64°$ and $\angle ZYQ = 58°$ we get.

$\angle XYQ = 64° + 58°$

Or, $\angle XYQ = 122°$

Now, reflex $\angle QYP = 180° + \angle XYQ$

We computed that the value of $\angle XYQ = 122°$.

So,

$\angle QYP = 180° + 122°$

$\therefore \angle QYP = 302°$

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Exercise: 6.2 **(Page No: 103)**

1. In Fig. 6.28, find the values of x and y and then show that AB || CD.

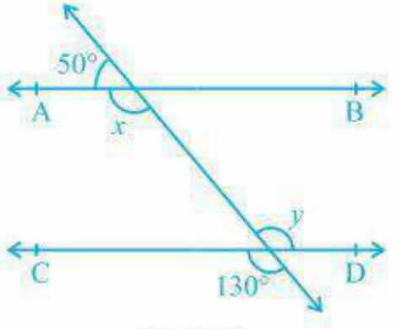


Fig. 6.28

Solution:

We know that a linear pair is equal to 180°.

So, x+50° = 180°

∴ x = 130°

We also know that vertically opposite angles are equal.

So, y = 130°

In two parallel lines, the alternate interior angles are equal. In this,

x = y = 130°

This proves that alternate interior angles are equal and so, AB || CD.

2. In Fig. 6.29, if AB || CD, CD || EF and y : z = 3 : 7, find x.

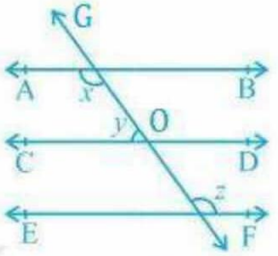


Fig. 6.29

Solution:

It is known that AB ‖ CD and CD ‖ EF

As the angles on the same side of a transversal line sums up to 180°,

$x + y = 180°$ -----(i)

Also,

$\angle O = z$ (Since they are corresponding angles)

and, $y + \angle O = 180°$ (Since they are a linear pair)

So, $y+z = 180°$

Now, let $y = 3w$ and hence, $z = 7w$ (As $y : z = 3 : 7$)

$\therefore 3w+7w = 180°$

Or, $10\ w = 180°$

So, $w = 18°$

Now, $y = 3\times18° = 54°$

and, $z = 7\times18° = 126°$

Now, angle x can be calculated from equation (i)

$x+y = 180°$

Or, $x+54° = 180°$

$\therefore x = 126°$

3. In Fig. 6.30, if AB ‖ CD, EF ⊥ CD and ∠GED = 126°, find ∠AGE, ∠GEF and ∠FGE.

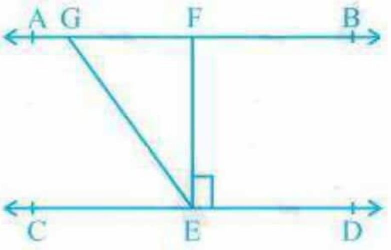


Fig. 6.30

Solution:

Since AB ‖ CD, GE is a transversal.

It is given that $\angle GED = 126°$

So, $\angle GED = \angle AGE = 126°$ (As they are alternate interior angles)

Also,

∠GED = ∠GEF +∠FED

As EF⊥ CD, ∠FED = 90°

∴ ∠GED = ∠GEF+90°

Or, ∠GEF = 126° – 90° = 36°

Again, ∠FGE +∠GED = 180° (Transversal)

Putting the value of ∠GED = 126° we get,

∠FGE = 54°

So,

∠AGE = 126°

∠GEF = 36° and

∠FGE = 54°

4. In Fig. 6.31, if PQ II ST, ∠PQR = 110° and ∠RST = 130°, find ∠QRS. [Hint : Draw a line parallel to ST through point R.]

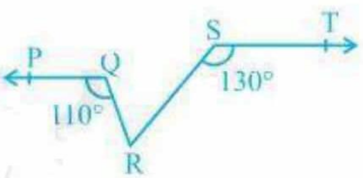
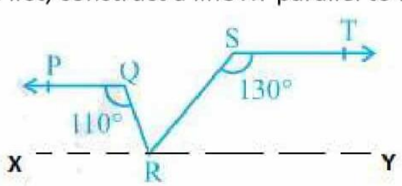


Fig. 6.31

Solution:

First, construct a line XY parallel to PQ.



We know that the angles on the same side of transversal is equal to 180°.

So, ∠PQR+∠QRX = 180°

Or,∠QRX = 180°-110°

∴ ∠QRX = 70°

Similarly,

∠RST +∠SRY = 180°

Or, ∠SRY = 180°- 130°

∴ ∠SRY = 50°

Now, for the linear pairs on the line XY-

∠QRX+∠QRS+∠SRY = 180°

Putting their respective values, we get,

∠QRS = 180° - 70° - 50°

Hence, ∠QRS = 60°

5. In Fig. 6.32, if AB II CD, ∠APQ = 50° and ∠PRD = 127°, find x and y.

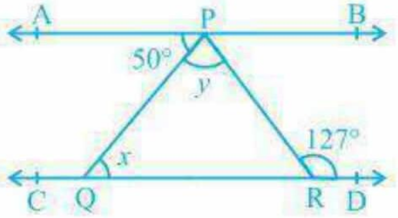


Fig. 6.32

Solution:

From the diagram,

∠APQ = ∠PQR (Alternate interior angles)

Now, putting the value of ∠APQ = 50° and ∠PQR = x we get,

x = 50°

Also,

∠APR = ∠PRD (Alternate interior angles)

Or, ∠APR = 127° (As it is given that ∠PRD = 127°)

We know that

∠APR = ∠APQ+∠QPR

Now, putting values of ∠QPR = y and ∠APR = 127° we get,

127° = 50°+ y

Or, y = 77°

Thus, the values of x and y are calculated as:

x = 50° and y = 77°

6. In Fig. 6.33,

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.

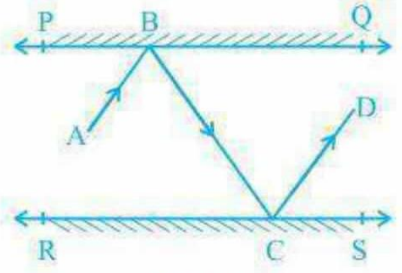


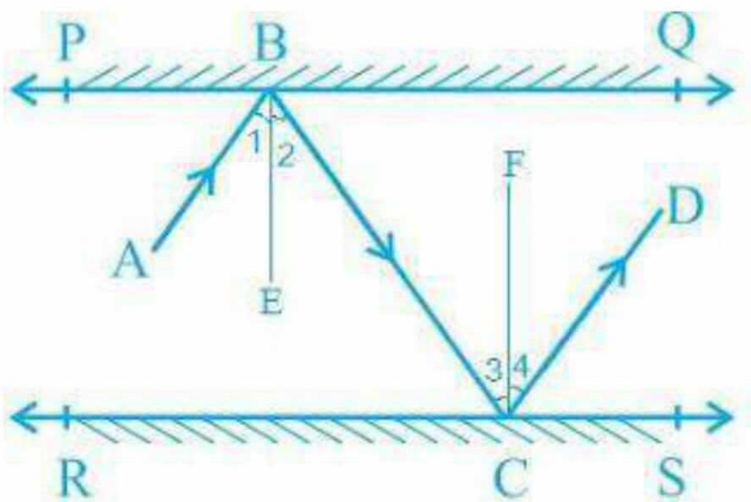
Fig. 6.33

Solution:

First, draw two lines BE and CF such that BE ⊥ PQ and CF ⊥ RS.

Now, since PQ ∥ RS,

So, BE ∥ CF



We know that,

Angle of incidence = Angle of reflection (By the law of reflection)

So,

$\angle 1 = \angle 2$ and

$\angle 3 = \angle 4$

We also know that alternate interior angles are equal. Here, BE ⊥ CF and the transversal line BC cuts them at B and C

So, $\angle 2 = \angle 3$

(As they are alternate interior angles)

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

Or, $\angle ABC = \angle DCB$

So, AB $\parallel$ CD alternate interior angles are equal)

NCERT Solutions For Class 9 Maths Chapter 6- Lines and Angles

Exercise: 6.3 **(Page No: 107)**

1. In Fig. 6.39, sides QP and RQ of ΔPQR are produced to points S and T respectively. If ∠SPR = 135° and ∠PQT = 110°, find ∠PRQ.

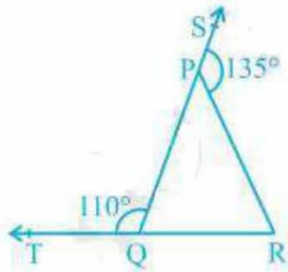


Fig. 6.39

Solution:

It is given the TQR is a straight line and so, the linear pairs (i.e. ∠TQP and ∠PQR) will add up to 180°

So, ∠TQP +∠PQR = 180°

Now, putting the value of ∠TQP = 110° we get,

∠PQR = 70°

Consider the ΔPQR,

Here, the side QP is extended to S and so, ∠SPR forms the exterior angle.

Thus, ∠SPR (∠SPR = 135°) is equal to the sum of interior opposite angles. (Triangle property)

Or, ∠PQR +∠PRQ = 135°

Now, putting the value of ∠PQR = 70° we get,

∠PRQ = 135°-70°

Hence, ∠PRQ = 65°

2. In Fig. 6.40, ∠X = 62°, ∠XYZ = 54°. If YO and ZO are the bisectors of ∠XYZ and ∠XZY respectively of Δ XYZ, find ∠OZY and ∠YOZ.

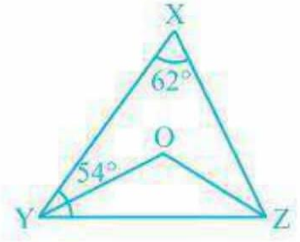


Fig. 6.40

Solution:

We know that the sum of the interior angles of the triangle.

So, $\angle X + \angle XYZ + \angle XZY = 180°$

Putting the values as given in the question we get,

$62° + 54° + \angle XZY = 180°$

Or, $\angle XZY = 64°$

Now, we know that ZO is the bisector so,

$\angle OZY = ½ \angle XZY$

$\therefore \angle OZY = 32°$

Similarly, YO is a bisector and so,

$\angle OYZ = ½ \angle XYZ$

Or, $\angle OYZ = 27°$ (As $\angle XYZ = 54°$)

Now, as the sum of the interior angles of the triangle,

$\angle OZY + \angle OYZ + \angle O = 180°$

Putting their respective values, we get,

$\angle O = 180° - 32° - 27°$

Hence, $\angle O = 121°$

3. In Fig. 6.41, if AB ǁ DE, $\angle BAC = 35°$ and $\angle CDE = 53°$, find $\angle DCE$.

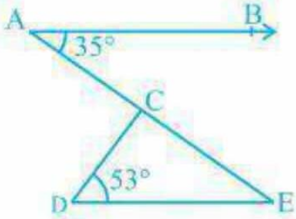


Fig. 6.41

Solution:

We know that

AE is a transversal since AB ‖ DE

Here ∠BAC and ∠AED are alternate interior angles.

Hence, ∠BAC = ∠AED

It is given that ∠BAC = 35°

⇒ ∠AED = 35°

Now consider the triangle CDE. We know that the sum of the interior angles of a triangle is 180°.

∴ ∠DCE+∠CED+∠CDE = 180°

Putting the values, we get

∠DCE+35°+53° = 180°

Hence, ∠DCE = 92°

4. In Fig. 6.42, if lines PQ and RS intersect at point T, such that ∠PRT = 40°, ∠RPT = 95° and ∠TSQ = 75°, find ∠SQT.

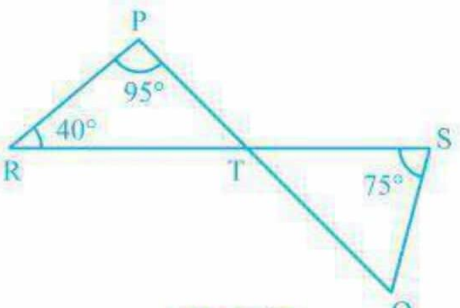


Fig. 6.42

Solution:

Consider triangle PRT.

∠PRT +∠RPT + ∠PTR = 180°

So, ∠PTR = 45°

Now ∠PTR will be equal to ∠STQ as they are vertically opposite angles.

So, ∠PTR = ∠STQ = 45°

Again, in triangle STQ,

∠TSQ +∠PTR + ∠SQT = 180°

Solving this we get,

75° + 45° + ∠SQT = 180°

∠SQT = 60°

5. In Fig. 6.43, if PQ ⊥ PS, PQ II SR, ∠SQR = 28° and ∠QRT = 65°, then find the values of x and y.

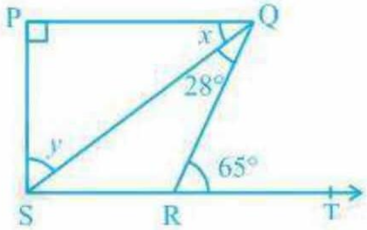


Fig. 6.43

Solution:

x +∠SQR = ∠QRT (As they are alternate angles since QR is transversal)

So, x+28° = 65°

∴ x = 37°

It is also known that alternate interior angles are same and so,

∠QSR = x = 37°

Also, Now,

∠QRS +∠QRT = 180° (As they are a Linear pair)

Or, ∠QRS+65° = 180°

So, ∠QRS = 115°

Using the angle sum property in Δ SPQ

∠SPQ +x+y= 180°

$90^0 + 37^0 + y = 180^0$

$y = 180^o - 127^o = 53^0$

Hence, y = 53°

6. In Fig. 6.44, the side QR of ΔPQR is produced to a point S. If the bisectors of ∠PQR and∠PRS meet at point T, then prove that ∠QTR = ½ ∠QPR.

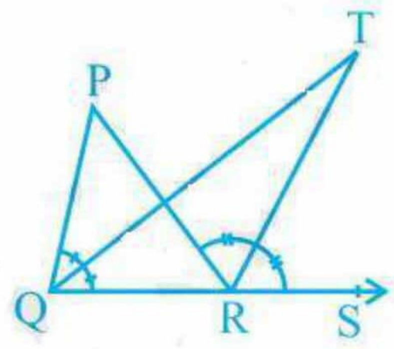


Fig. 6.44

Solution:

Consider the ΔPQR. ∠PRS is the exterior angle and ∠QPR and ∠PQR are interior angles.

So, ∠PRS = ∠QPR+∠PQR (According to triangle property)

Or, ∠PRS -∠PQR = ∠QPR -----------(i)

Now, consider the ΔQRT,

∠TRS = ∠TQR+∠QTR

Or, ∠QTR = ∠TRS-∠TQR

We know that QT and RT bisect ∠PQR and ∠PRS respectively.

So, ∠PRS = 2 ∠TRS and ∠PQR = 2∠TQR

Now, ∠QTR = ½ ∠PRS - ½∠PQR

Or, ∠QTR = ½ (∠PRS -∠PQR)

From (i) we know that ∠PRS -∠PQR = ∠QPR

So, ∠QTR = ½ ∠QPR (hence proved).