CHAPTER 6

Lines and Angles

CLASS 9TH

NCERT EXERCISE AND SOLUTIONS - MATHEMATICS

EXERCISE 6.1

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

SOLUTION:

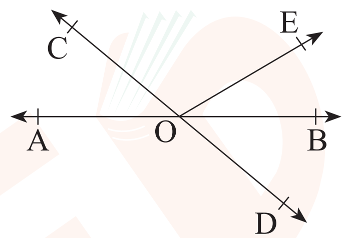


Fig. 6.13

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° and ∠BOE = 30°

So, 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.**

SOLUTION:

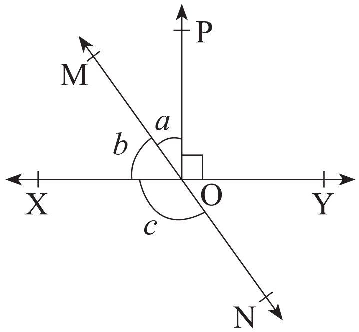


Fig. 6.14

We know that the sum of linear pair is 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, $x = 18°$

$\therefore$ $a = 2 \times 18° = 36°$

Similarly, b can be calculated, and the value will be $b = 3 \times 18° = 54°$

From the diagram, b + c also forms a straight angle, so $b + c = 180°$

$c + 54° = 180°$

$\therefore$ $c = 126°$

3. **In Fig. 6.15, ∠PQR = ∠PRQ, then prove that ∠PQS = ∠PRT.**

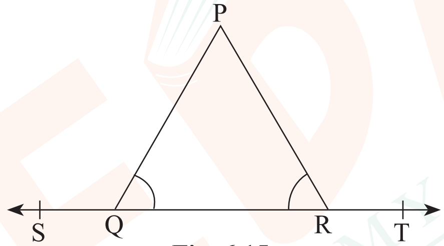


Fig. 6.15

SOLUTION:

Since ST is a straight line, so

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

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

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

Since $\angle PQR = \angle PRQ$ (as given in the question)

$\angle PQS = \angle PRT$. (Hence proved).

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

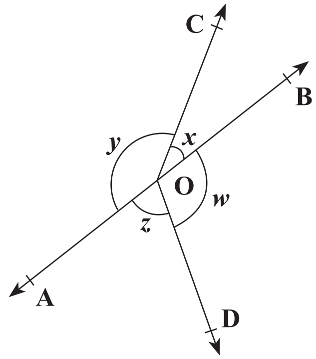


Fig. 6.16

SOLUTION:

To prove 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, $(x + y) + (x + y) = 360°$

$2(x + y) = 360°$

$\therefore$ $(x + y) = 180°$ (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 $\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$.

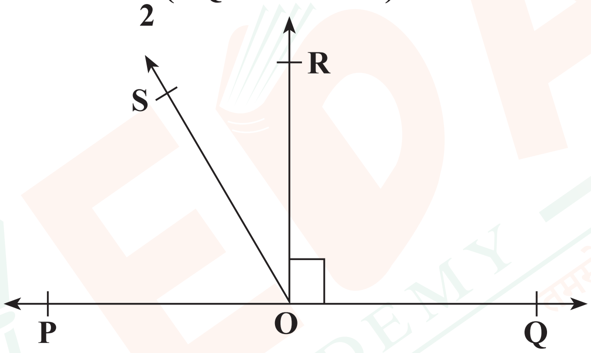


Fig. 6.17

SOLUTION:

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

We can write it as $\angle ROP = \angle ROQ = 90°$

We know that

$\angle ROP = \angle ROQ$

It can be written as

$\angle POS + \angle ROS = \angle ROQ$

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

$\angle SOR + \angle ROS = \angle QOS - \angle POS$

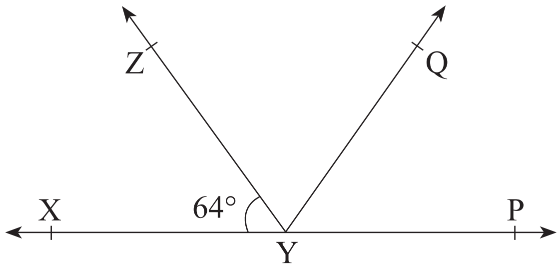
So we get

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

Or, $\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$ (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, ∠XYZ + ∠ZYP = 180°
Putting the value of ∠XYZ = 64°, we get
64° + ∠ZYP = 180°
∴ ∠ZYP = 116°
From the diagram, we also know that ∠ZYP = ∠ZYQ + ∠QYP
Now, as YQ bisects ∠ZYP,
∠ZYQ = ∠QYP
Or, ∠ZYP = 2∠ZYQ
∴ ∠ZYQ = ∠QYP = 58°
Again, ∠XYQ = ∠XYZ + ∠ZYQ
By putting the value of ∠XYZ = 64° and ∠ZYQ = 58°, we get.
∠XYQ = 64° + 58°
Or, ∠XYQ = 122°
Now, reflex ∠QYP = 180° + XYQ
We computed that the value of ∠XYQ = 122°.
So,
∠QYP = 180° + 122°
∴ ∠QYP = 302°

EXERCISE 6.2

1. In Fig. 6.23, if AB || CD, CD || EF and y : z = 3 : 7, find x.

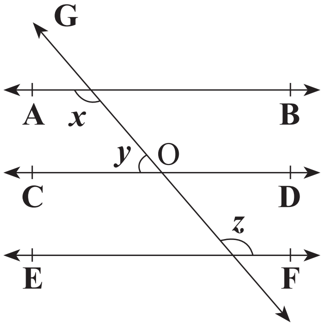


Fig. 6.23

SOLUTION:

It is known that AB || CD and CD||EF

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

x + y = 180° ——(i)

Also,

∠O = z (Since they are corresponding angles)

and, y + ∠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)

∴ 3w + 7w = 180° Or, 10 w = 180°

So, w = 18°

Now, y = 3×18° = 54° and z = 7×18° = 126°

Now, angle x can be calculated from equation (i) x + y = 180°

Or, x + 54° = 180°

∴ x = 126°

2. **In Fig. 6.24, if AB || CD, EF ⊥ CD and ∠GED = 126°, find ∠AGE, ∠GEF and ∠FGE.**

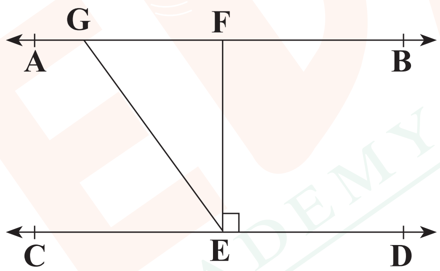


Fig. 6.24

SOLUTION:

Since AB || CD, GE is a transversal.

It is given that ∠GED = 126°

So, ∠GED = ∠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°

3. In Fig. 6.25, if PQ || ST, ∠PQR = 110° and ∠RST = 130°, find ∠QRS.
Hint: Draw a line parallel to ST through point R.]

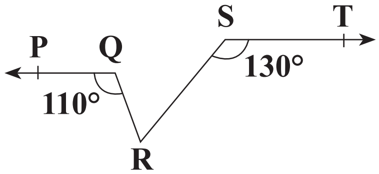
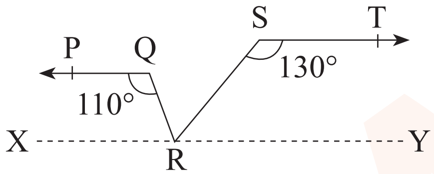


Fig. 6.25

SOLUTION:

First, construct a line XY parallel to PQ



We know that the angles on the same side of the 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°

4. In Fig. 6.26, if AB || CD, ∠APQ = 50° and ∠PRD = 127°, find x and y.

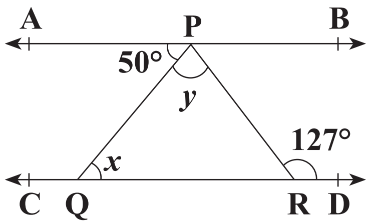


Fig. 6.26

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°

5. In Fig. 6.27, 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.

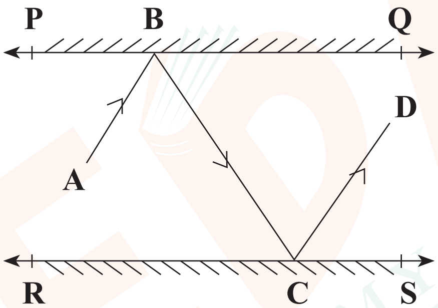


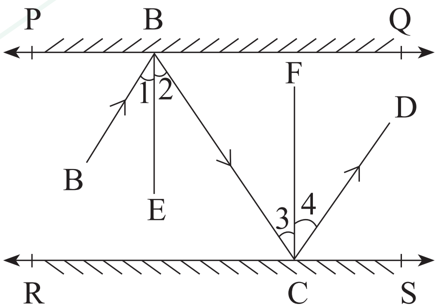
Fig. 6.27

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,

∠1 = ∠2 and

∠3 = ∠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 || CD (alternate interior angles are equal)