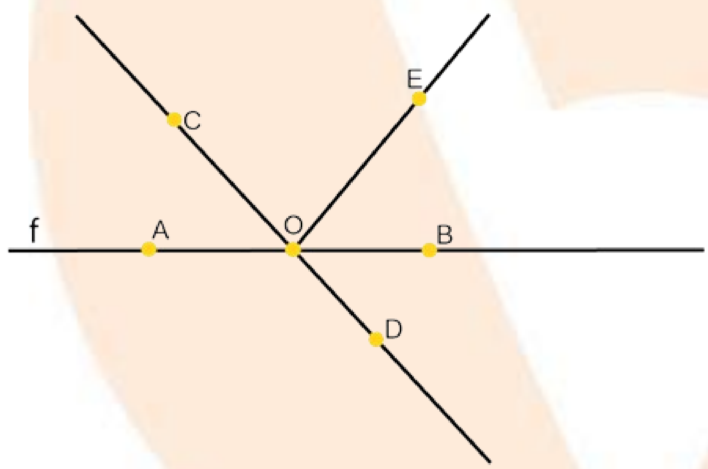
NCERT Solutions for Class 9 Maths

Chapter 6 – Lines and Angles

Exercise-6.1

1. In the given figure, lines AB and CD intersect at O. if $\angle AOC+\angle BOE=70^{o}$ **and** $\angle BOD=40^{o}$ **find** $\angle BOE$ **and reflex** $\angle COE$



Ans: AB is a straight line, OC and OE are rays from O.

We know that a straight line covers 180°

$\Rightarrow \angle AOC+\angle COE+\angle BOE=180^{\circ}$

By clubbing $\angle AOC$ and $\angle BOE$ together we can rewrite the above equation as

$\Rightarrow (\angle AOC + \angle BOE) + \angle COE = 180^\circ$

Putting $\angle AOC + \angle BOE = 70^\circ$

$\Rightarrow 70^\circ + \angle COE = 180^\circ$

$\Rightarrow \angle COE = 180^\circ 0 70^\circ$

$\Rightarrow \angle COE = 110^\circ$

Hence reflex $\angle COE = 360^\circ - 110^\circ$

reflex $\angle COE = 250^\circ$

Similarly, CD is a straight line, OB and OE are rays from O.

We know that a straight line covers 180°

$\Rightarrow \angle BOD + \angle COE + \angle BOE = 180^\circ$

$\Rightarrow \quad 40^\circ + 110^\circ + \angle BOE = 180^\circ$

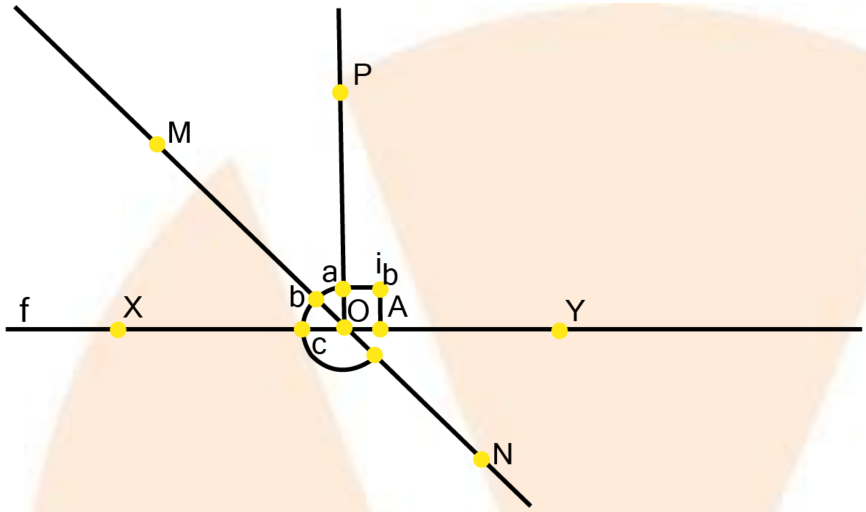
$\Rightarrow \angle BOE = 180^\circ 0 \left(40^\circ + 110^\circ\right)$

$\Rightarrow \angle BOE = 180^\circ 0 150^\circ$

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

Hence $\angle BOE = 30^\circ$ and reflex $\angle COE = 250^\circ$

2. In the given figure, lines XY and MN intersect at O. If $\angle POY = 90^o$ and a: b = 2:3, find c.



Ans: Let the common ratio between a and b be x.

$\therefore$ a = 2x , and b = 3x

XY is a straight line, OM and OP are rays from O.

We know that a straight line covers 180°

$\angle XOM + \angle MOP + \angle POY = 180^\circ$

Putting values for $\angle XOM = b$ and $\angle MOP = a$

$\Rightarrow$ b + a + $\angle POY = 180^\circ$

$\Rightarrow$ 3x + 2x + $\angle POY = 180^\circ$

$\Rightarrow$ 5x = 90°

$\Rightarrow$ x = 18°

$\therefore \quad a = 2x$

$\Rightarrow \quad a = 2\times18^\circ$

$= 36^\circ$

$\therefore \quad b = 3x$

$\Rightarrow \quad b = 3\times18^\circ$

$= 54^\circ$

Similarly, MN is a straight line, OX is a ray from O

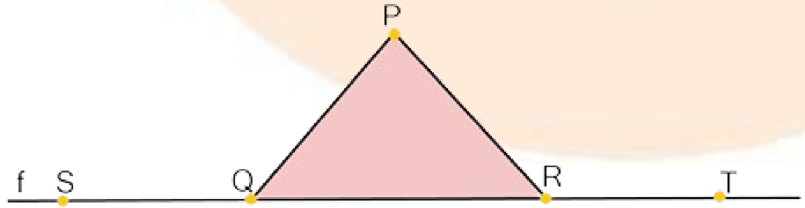
$\therefore b+c=180^\circ$

$54^o + c = 180^o$

$c = 180^\circ - 54^\circ$

$c = 126^\circ$

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



Ans: ST is a straight line, QP is a line segment from Q in ST to any point P by Linear Pair property

$\angle PQS+\angle PQR=180^o$

$\Rightarrow \angle PQR=180^o 0\angle PQS$ ......(1)

Similarly

$\angle PRT+\angle PRQ=180^\circ$

$\Rightarrow \angle PRQ=180^o 0\angle PRT$ ......(2)

Now in the question it is given that $\angle PQR=\angle PRQ$

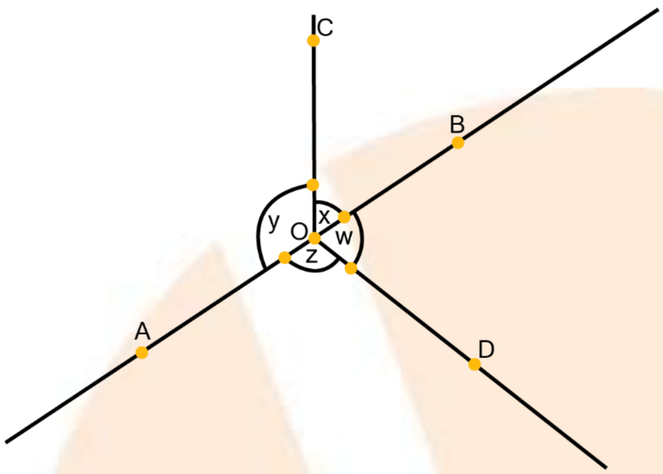
Therefore, on equating equation (1) and (2) we get

$180^o 0\angle PQS=180^o 0\angle PRT$

$\Rightarrow \angle PQS=\angle PRT$

Hence proved

4. In the given figure, if $x+y=w+z$ **then prove that AOB is a line.**



Ans: It can be observed that,

Since there are 360° around a point therefore we can write

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

It is given that,

x+y=w+z

Therefore writing x+y in place of w+z so that we can eliminate w and z, we get

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

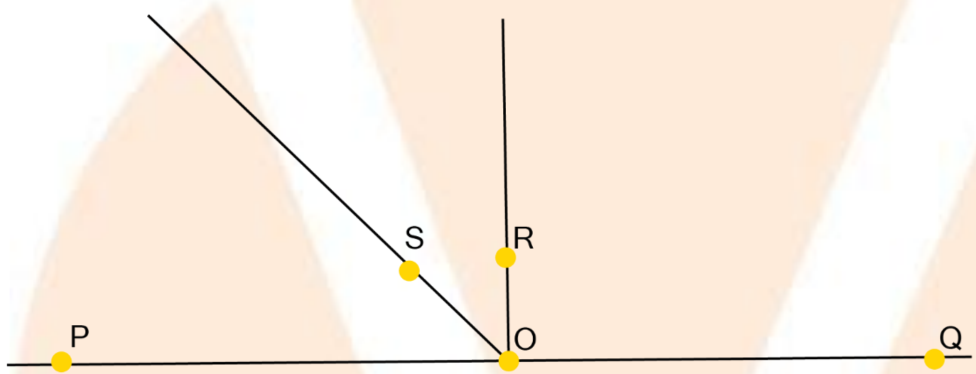
$2(x+y)=360^\circ$

$x+y=180^\circ$

Since x and y form a linear pair, hence we can say that AOB is a line.

Hence proved

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



Ans: Since $OR \perp PQ$ therefore

$\angle POR=90^{o}$

$\angle POS+ROS=90^{\circ}$

$\Rightarrow \quad \angle ROS=90^{o}0\angle POS$ ...... (1)

Similarly, $\angle QOR=90^{o}$ (Since (Tex translation failed))

$\therefore \angle QOS-\angle ROS=90^{o}$

$\Rightarrow \angle ROS=\angle QOS-90^{o}$ ......(2)

We can clearly see that on adding equation (1) and (2) 90° get canceled out

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

Which can easily be written as

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

Hence proved

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

Ans: It is given that line YQ bisects $\angle ZYP$.

Hence, $\angle QYP = \angle ZYQ$

It can easily be understood that PX is a line, YQ and YZ being rays standing on it.

$\angle XYZ + \angle ZYQ + \angle QYP = 180^o$

From above relation $\angle QYP = \angle ZYQ$ we can write

$64^o + 2\angle QYP = 180^o$

$\Rightarrow \quad 2\angle QYP = 180^o - 64^o$

$\Rightarrow \quad \angle QYP = 58^\circ$

Therefore $\angle ZYQ = 58^\circ$

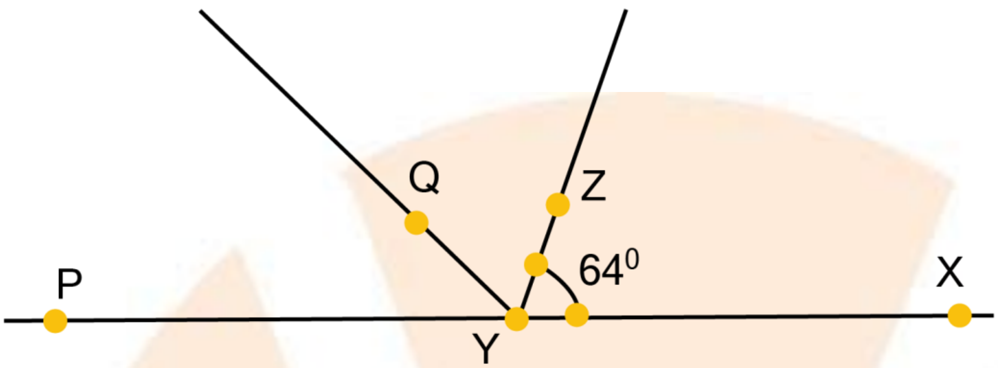
Also Reflex $\angle QYP = 302^\circ$

Now we can write $\angle XYQ$ as below

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

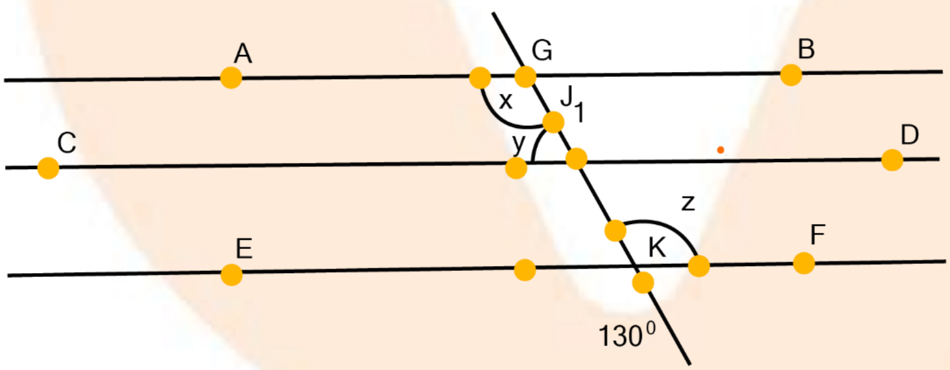
$64^\circ + 58^\circ = 122^\circ$

Therefore, we found $\angle XYQ = 122^\circ$ and so the Reflex $\angle QYP = 302^\circ$



Exercise-6.2

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



Ans: It is given that AB || CD and CD || EF

$\therefore$ AB ||CD || EF (Lines parallel to other fixed line are parallel to each other)

It can easily be understood that

$x=z$ (since alternate interior angles are equal) ...... (1)

It is given that y: z = 3: 7

Without any loss of generality, we can let $y=3a$ and $z=7a$

Also, $x+y=180^{o}$ (Co-interior angles together sum up to 180°)

From equation (1) we can write z in place of x as shown

$z+y=180^{o}$

It can further write as shown

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

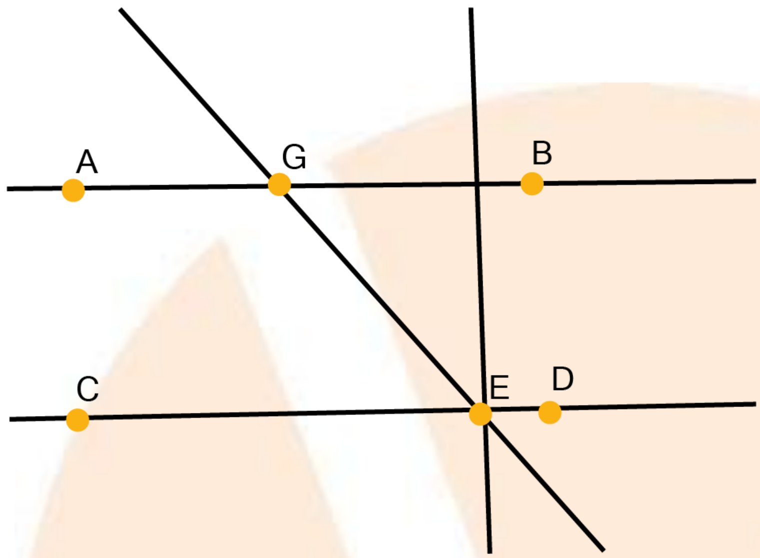
$\Rightarrow \quad 10a=180^{o}$

$\Rightarrow \quad a=18^{o}$

$\therefore \quad x=7\times 18^{o}$

$\therefore \quad x=126^{o}$

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



Ans: We are given that,

AB || CD and EF $\perp$ CD and $\angle GED = 126^{o}$

Which can be written as

$\Rightarrow \angle GEF + \angle FED = 126^{o}$

$\Rightarrow \quad \angle GEF + 90^{o} = 126^{o}$

Hence, we can obtain GEF as shown below

$\Rightarrow \angle GEF = 126^{o} - 90^{o}$

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

$\angle AGE = \angle GED = 126^{o}$ ($\angle AGE$ and $\angle GED$ are alternate interior angles)

But

$\angle AGE+\angle FGE=180^{o}$ (because this form a linear pair)

$\Rightarrow 126^{o}+\angle FGE=180^{o}$

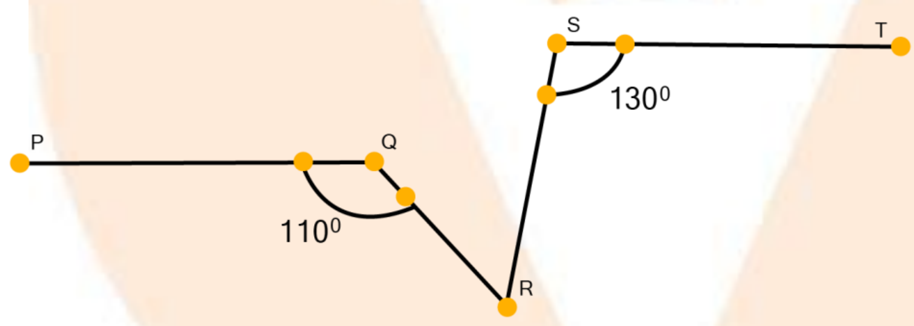
$\Rightarrow \angle FGE=180^{o}-126^{o}$

$\Rightarrow \angle FGE=54^{o}$

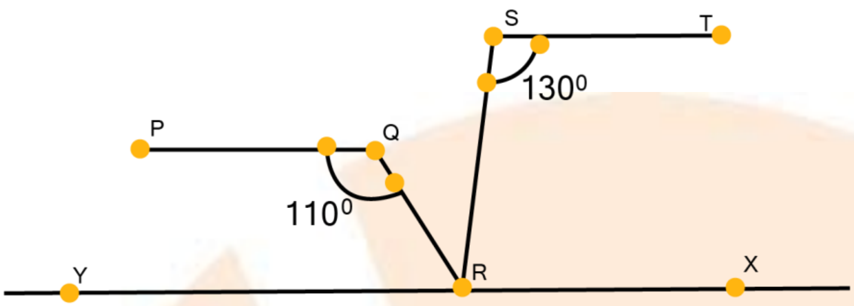
Hence, we found $\angle AGE=126^{o}$, $\angle GEF=36^{o}$, $\angle FGE=54^{o}$

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

(Hint: Draw a line parallel to ST through point R.)



Ans:



In this question we will have some construction of our own, we draw a line XY parallel to ST and so parallel to PQ passing through point R.

$\angle PQR+\angle QRX=180^{o}$ (Co-interior angles on the same side of transversal QR together sum up to 180°)

$\therefore 110^{o}+\angle QRX=180^{o}$

$\Rightarrow \angle QRX=70^{o}$

Also,

$\angle RST+\angle SRY=180^{\circ}$ (sum of Co-interior angles on the same side of transversal SR equals 180°)

$\Rightarrow \quad \angle SRY=180^{\circ}-130^{\circ}$

$\Rightarrow \quad \angle SRY=50^{\circ}$

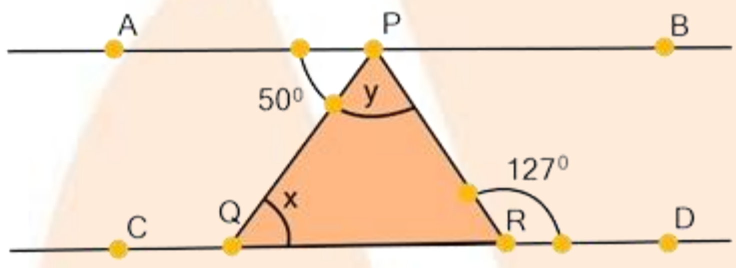
Now from the construction XY is a straight line. RQ and RS are rays from it.

$\angle QRX+\angle QRS+\angle SRY=180^{\circ}$

$\Rightarrow 70^{\circ}+\angle QRS+50^{\circ}=180^{\circ}$

Hence, we found that $\angle QRS=60^{\circ}$

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



Ans: $\angle APR = PRD$ (since alternate interior angles are equal)

$\therefore 50^{\circ} + y = 127^{\circ}$ (since $\angle APR = \angle APQ + \angle PQR$)

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

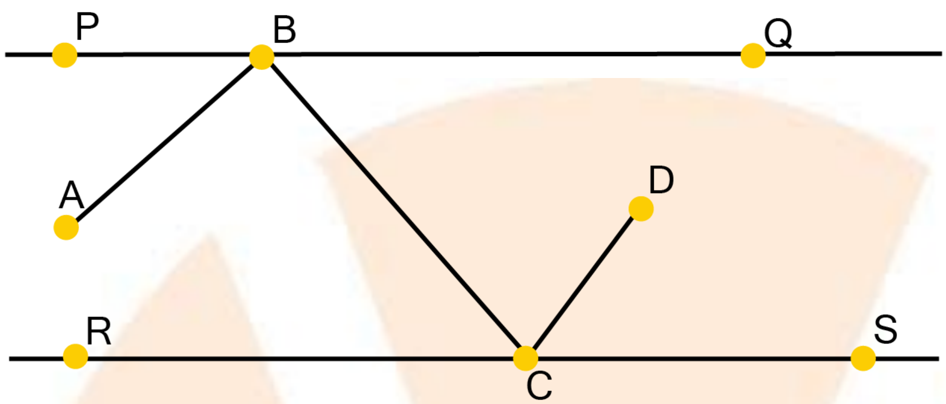
similarly,

$\angle APQ=PQR$ $\angle APQ = \angle PQR$ (since alternate interior angles are equal)

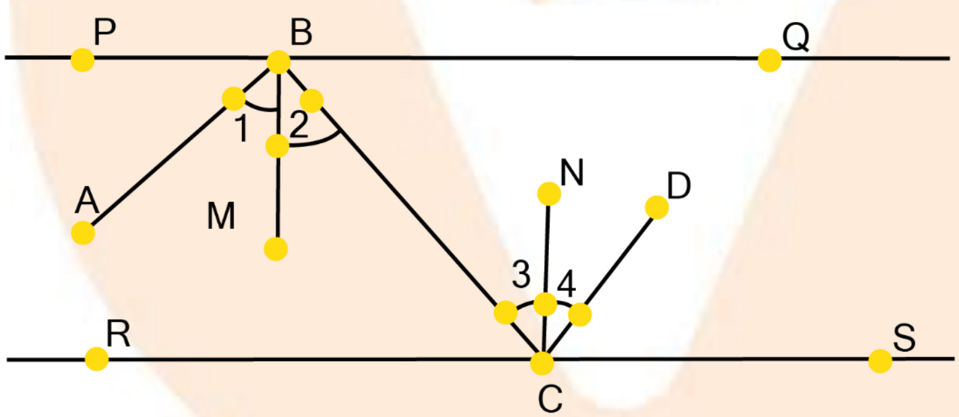
$\therefore x=50^{\circ}$

Therefore, we found that $x=50^{\circ}$ and $y=77^{\circ}$

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.



Ans:



Let us construct $BM \perp PQ$ and $CN \perp RS$.

Since $PQ \parallel RS$, and so $BM \parallel CN$

Therefore, CN and BM are two parallel lines and a transversal line BC cuts them at B and C respectively.

$\angle 2 = \angle 3$......(1) (since alternate interior angles are equal)

But, by laws of reflection in Physics

$\angle 1 = \angle 2$ and $\angle 3 = \angle 4$

Now from equation (1)

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

Therefore

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

$\angle ABC = \sum DCB$

But these are alternate interior angles.

$\therefore$ AB|| CD

Hence proved.