NCERT SOLUTIONS

CLASS - 9th

Class : 9th

Subject : Maths

Chapter : 6

Chapter Name : LINES AND ANGLES

Exercise 6.1

Q1 In Fig. 6.13, lines AB and CD intersect at O. If ∠ AOC + ∠ BOE = 70° and ∠ BOD = 40°, find ∠ BOE and reflex ∠ COE.

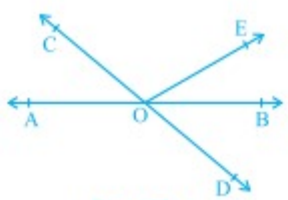

Fig. 6.13

Answer. AB is a straight line, rays OC and OE stand on it.

$\therefore \angle AOC + \angle COE + \angle BOE = 180^\circ$

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

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

$\Rightarrow \angle COE = 180^\circ - 70^\circ = 110^\circ$

Reflex $\angle COE = 360^\circ - 110^\circ = 250^\circ$

CD is a straight line. rays OE and 0B stand on it.

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

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

$\Rightarrow \angle BOE = 180^\circ - 150^\circ = 30^\circ$

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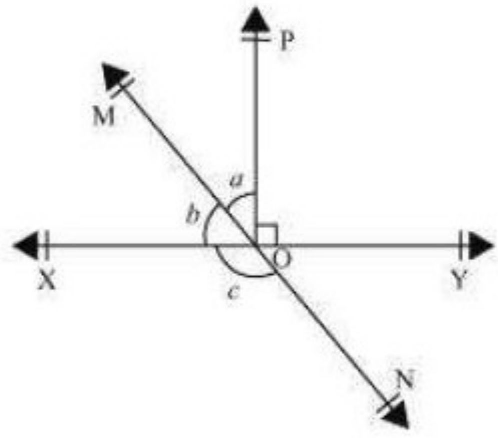
Q2 In Fig. lines XY and MN intersect at O. If ∠ POY = 90° and a : b = 2 : 3, find c.



Answer. Let the common ratio between a and b be x.
a = 2x, and b = 3x
XY is a straight line, rays OM and OP stand on it.
$\therefore \angle XOM + \angle MOP + \angle POY = 180^\circ$
$b + a + \angle POY = 180^\circ$
$3x + 2x + 90^\circ = 180^\circ$
$5x = 90^\circ$
$x = 18^\circ$
$a = 2x = 2 \times 18 = 36^\circ$
$b = 3x = 3 \times 18 = 54^\circ$
MN is a straight line. Ray OX stands on it.
$\therefore b + c = 180^\circ (\text{ Linear Pair })$
$54^\circ + c = 180^\circ$
$c = 180^\circ - 54^\circ = 126^\circ$
$\therefore c = 126^\circ$

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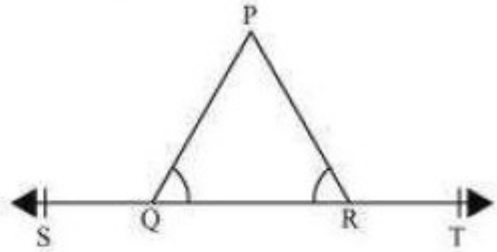
Q3 . In Fig. ∠ PQR = ∠ PRQ, then prove that ∠ PQS = ∠ PRT



Answer. In the given figure, ST isa straight line and ray QP stands on it.

$\therefore \angle PQS + \angle PQR = 180^\circ (\text{ Linear Pair })$

$\angle PQR = 180^\circ - \angle PQS (1)$

$\angle PRT + \angle PRQ = 180^\circ (\text{ Linear Pair })$

$\angle PRQ = 180^\circ - \angle PRT (2)$

It is given that $\angle PQR = \angle PRQ$.

Equating equations (1) and (2), we obtain

$180^\circ - \angle PQS = 180^\circ - \angle PRT$

$\angle PQS = \angle PRT$

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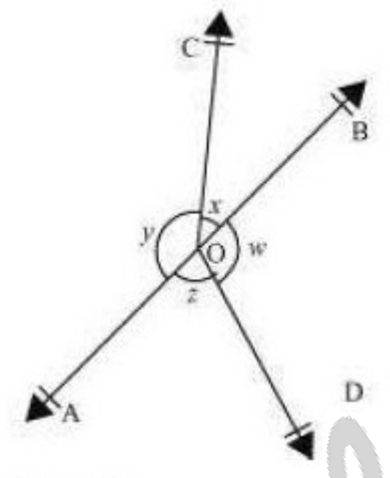
Q4 In Fig. if x + y = w + z, then prove that AOB is a line.



Answer.

It can be observed that,

$x + y + z + w = 360^\circ (\text{ Complete angle })$

It is given that,

$x + y = z + w$

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

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

$x + y = 180^\circ$

Since x and y form a linear pair, AOB is a line.

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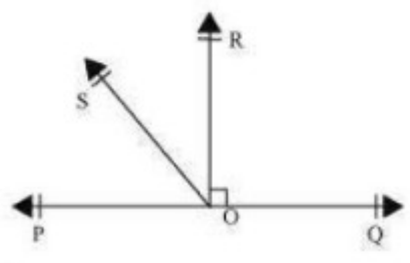
Q5 In Fig. POQ is a line. Ray OR is perpendicular to line PQ. OS is another ray lying between rays OP and OR. Prove that ∠ ROS = 1/2 (∠ QOS – ∠ POS).



Answer. It is given that $\mathrm{OR} \perp \mathrm{PQ}$

$□□\mathrm{POR} = 90^\circ$

$□□\mathrm{POS} + □\mathrm{SOR} = 90^\circ$

$□ROS = 90^\circ - □POS \ldots (1)$

$□QOR = 90^\circ (As OR□PQ)$

On adding equations (1) and (2), we obtain

$2□\mathrm{ROS} = □\mathrm{QOS} - □\mathrm{POS}$

$□\mathrm{ROS} = \frac{1}{2}(□\mathrm{QOS} - □\mathrm{POS})$

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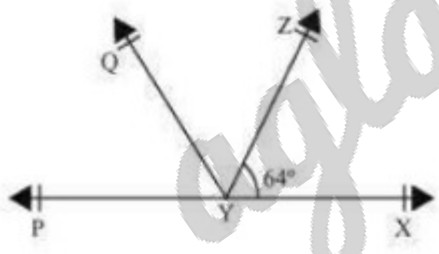
Q6 It is given that ∠ XYZ = 64° and XY is produced to point P. Draw a figure from the given information. If ray YQ bisects ∠ ZYP, find ∠ XYQ and reflex ∠ QYP.

Answer.



It is given that line YQ bisects $□\mathrm{PYZ}$

Hence, $□QYP = □ZYQ$

It can be observed that PX is a line. Rays YQ and YZ stand on it.

$□□ \times YZ + □ZYQ + □QYP = 180^\circ$

$□64^\circ + 2□QYP = 180^\circ$

$□2□QYP = 180^\circ - 64^\circ = 116^\circ$

$□□QYP = 58^\circ$

Also $□ZYQ = □QYP = 58^\circ$

Reflex $□QYP = 360^\circ - 58^\circ = 302^\circ$

$□ \times YQ = □XYZ + □ZYQ$

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

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Exercise 6.2

Q1 In Fig. 6.28, find the values of x and y and then show that AB || CD.

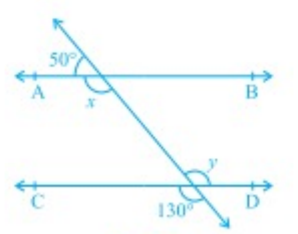

Fig. 6.28

Answer. It can be observed that,

$50^{\circ}+x=180^{\circ}($ Linear pair $)$

$x=130^{\circ} \ldots(1)$

Also, $y=130^{\circ}($ Vertically opposite angles$)$

As x and y are alternate interior angles for lines AB and CD and also measures of these angles are equal to each other, therefore, line AB II CO.

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Q2 In Fig. 6.29, if AB || CD, CD || EF and y : z = 3 : 7, find x.

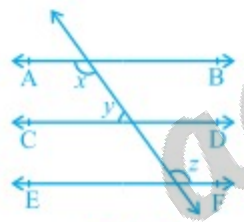

Fig. 6.29

Answer. It is given that AB II CD and CD II EF

□$AB \| CD \| EF$ (Lines parallel to the same line are parallel to each other)

It can be observed that

x = z (Alternate interior angles) ..... (1)

It is given that y: z = 3: 7

Let the common ratio between y and Z be a.

□$y=3a$ and $z=7a$

Also, $x+y=180^{\circ}$ (Co-interior angles on the same side of the transversal)

$z+y=180^{\circ}$[Using equation (1)]
$7a+3a=180^{\circ}$
$10a=180^{\circ}$
$a=180$
$□x=7a=7\times 18^{\circ}=126^{\circ}$

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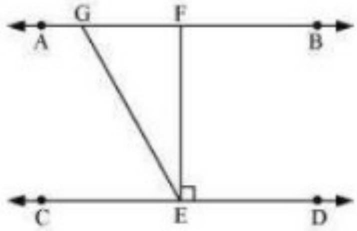
Q3 In Fig. below, if AB || CD, EF ⊥ CD and ∠ GED = 126°, find ∠ AGE, ∠ GEF and ∠FGE.



Answer. It is given that
AB || CD
EF □CD
□GED $=126^{\circ}$
$□□GEF+□FED=126^{\circ}$
$□□GEF+90^{\circ}=126^{\circ}$
$□□GEF=36^{\circ}$
$□AGE$ and $□GED$ are alternate interior angles.
$□□AGE=□GED=126^{\circ}$
However, $□AGE+□FGE=180^{\circ}$(Linear pair)
$□126^{\circ}+□FGE=180^{\circ}$
□□FGE $=180^{\circ}-126^{\circ}=54^{\circ}$
□□AGE $=126^{\circ}$, □GEF $=36^{\circ}$, □FGE $=54^{\circ}$

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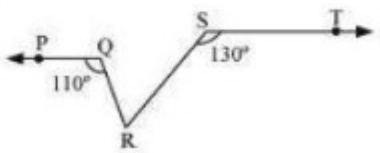
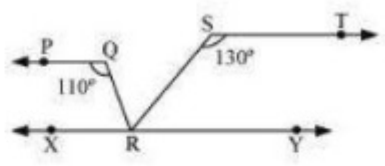
Q4 In Fig. below, if PQ || ST, ∠ PQR = 110° and ∠ RST = 130°, find ∠ QRS.
[Hint : Draw a line parallel to ST through point R.]



Answer.



Let us draw a line XY parallel to ST and passing through point R.

$\square PQR + \square QRX = 180^\circ$ (Co-interior angles on the same side of transversal QR)

$\square 110^\circ + \square QRX = 180^\circ$

$\square\square QRX = 70^\circ$

Also

$\square RST + \square SRY = 180^\circ$ (Co-interior angles on the same side of transversal SR)

$130^\circ + \square SRY = 180^\circ$

$\square SRY = 50^\circ$

XY is a straight line. RQ and RS stand on it.

$\square\square QRX + \square QRS + \square SRY = 180^\circ$

$70^\circ + \square QRS + 50^\circ = 180^\circ$

$\square QRS = 180^\circ - 120^\circ = 60^\circ$

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Q5 In Fig. 6.32 , if AB || CD, ∠ APQ = 50° and ∠ PRD = 127°, find x and y.

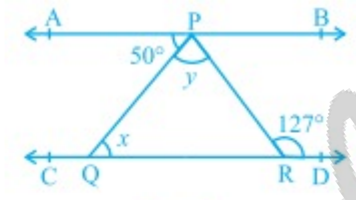

Fig. 6.32

Answer. $\square APR = \square PRD$ (Alternate interior angles)

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

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

$y = 77^\circ$

Also, $\square APQ = \square PQR$ (Alternate interior angles)

$50^\circ = x$

$\square x = 50^\circ$ and $y = 77^\circ$

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Q6 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.

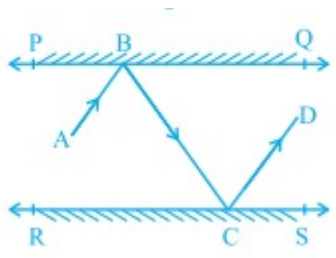
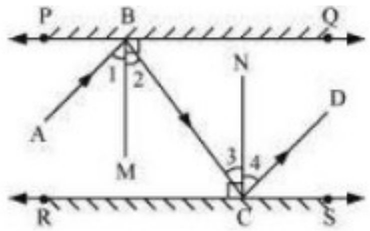


Fig. 6.33

Answer.



Let us draw BM□PQ and CN□RS

As PO || RS

Therefore, BM || CN

Thus, BM and CN are two parallel lines and a transversal line 3C cuts them at and C respectively.

□□2 = □3 (Alternate interior angles)

However, □1 = □2 and □3 = □4 (By laws of reflection)

□□1 = □2 = □3 = □4

Also, □1 + □2 = □3 + □4

□ABC = □DCB

However, these are alternate interior angles.

AB || CD

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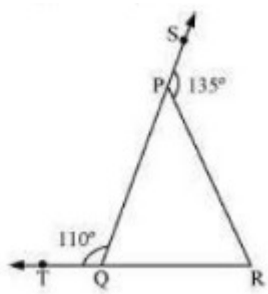
Exercise 6.3

Q1 In Fig. below, sides QP and RQ of Δ PQR are produced to points S and T respectively. If ∠ SPR = 135° and ∠ PQT = 110°, find ∠ PRQ.



Answer. It is given that,
$\square SPR=135^{\circ}$ and $\square PQT=110^{\circ}$
$\square SPR+\square QPR=180^{\circ}($ Linear pair angles)
$\square 135^{\circ}+\square QPR=180^{\circ}$
$\square\square QPR=45^{\circ}$
Also, $\square PQT+\square PQR=180^{\circ}$ (Linear pair angles)
$\square 110^{\circ}+\square PQR=180^{\circ}$
$\square\square PQR=70^{\circ}$
As the sum Of all interior angles of a triangle is 180°, therefore, for ΔPQR
$\square QPR+\square PQR+\square PRQ=180^{\circ}$
$\square 45^{\circ}+70^{\circ}+\square PRQ=180^{\circ}$
$\square\square PRQ=180^{\circ}-115^{\circ}$
$\square\square PRQ=65^{\circ}$

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Q2 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.

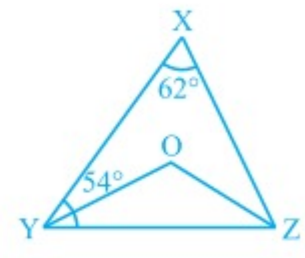

Fig. 6.40

Answer. As the sum of all interior angles of a triangle is 180^0, therefore, for ΔXYZ,
$\square X+\square XYZ+\square\times ZY=180^{\circ}$
$62^{\circ}+54^{\circ}+\square XZY=180^{\circ}$
$\square\times ZY=180^{\circ}-116^{\circ}$
$\square XZY=64^{\circ}$
$\square OYZ=\frac{64}{2}=32^{\circ}$ (OZ iS the angle bisector of ΔXYZ)
Similarly, $\square OYZ=\frac{54}{2}=27^{\circ}$
using angle sum property for ΔOYZ, we obtain
$\square OYZ+\square YOZ+\square OZY=180^{\circ}$
$27^{\circ}+\square YOZ+32^{\circ}=180^{\circ}$
$\square YOZ=180^{\circ}-59^{\circ}$
$\square YOZ=121^{\circ}$

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Q3 In Fig. 6.41, if AB || DE, ∠ BAC = 35° and ∠ CDE = 53°, find ∠ DCE.

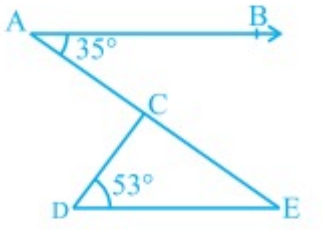

Fig. 6.41

Answer. AB II DE and AE is a transversal.

$\Box BAC = \Box CED$ (Alternate interior angles)

$\Box\Box CED = 35^\circ$

In ΔCDE, (Angle sum property of a triangle)

$\Box CDE + \Box CED + \Box DCE = 180^\circ$

$53^\circ + 35^\circ + \Box DCE = 180^\circ$

$\Box DCE = 180^\circ - 88^\circ$

$\Box DCE = 92^\circ$

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Q4 In Fig. 6.42, if lines PQ and RS intersect at point T, such that ∠ PRT = 40°, ∠ RPT = 95° and ∠ TSQ = 75°, find ∠ SQT.

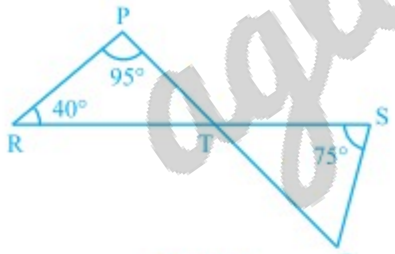

Fig. 6.42

Answer. Using angle sum property for ΔPRT, we obtain

$\Box PRT + \Box RPT + \Box PTR = 180^\circ$

$40^\circ + 95^\circ + \Box PTR = 180^\circ$

$\Box \text{PTR} = 180^\circ - 135^\circ$

$\Box \text{PTR} = 45^\circ$

$\Box STQ = \Box PTR = 45^\circ$(Vertically opposite angles)

$\Box STQ = 45^\circ$

By using angle sum property for ΔSTQ, we obtain

$\Box STQ + \Box SQT + DQST = 180^\circ$

$45^\circ + \square SQT + 75^\circ = 180^\circ$
$\square SQT = 180^\circ - 120^\circ$
$\square SQT = 60^\circ$

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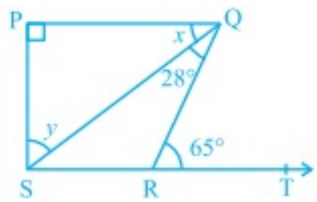
Q5 In Fig. 6.43, if PQ ⊥ PS, PQ || SR, ∠ SQR = 28° and ∠ QRT = 65°, then find the values of x and y.



Answer. It is given that PQ II SR and QR is a transversal line.
$\square PQR = \square QRT$ (Alternate interior angles)
$x + 28^\circ = 65^\circ$
$x = 65^\circ - 28^\circ$
$x = 37^\circ$
By using the angle sum property for ΔSPQ, we obtain
$\square \text{SPQ} + x + y = 180^\circ$
$90^\circ + 37^\circ + y = 180^\circ$
$y = 180^\circ - 127^\circ$
$y = 53^\circ$
$\therefore x = 37^\circ$ and $y = 53^\circ$

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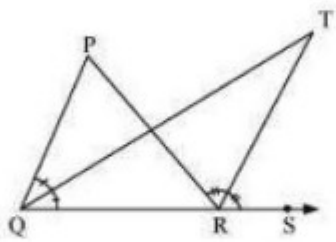
Q6 In Fig. below , the side QR of Δ PQR is produced to a point S. If the bisectors of ∠ PQR and ∠ PRS meet at point T, then prove that ∠ QTR = 1/2 ∠ QPR.



Answer.

In $\triangle QTR, \square TRS$ is an exterior angle.

$\therefore \square QTR + \square TQR = \square TRS$

$\square QTR = \square TRS - \square TQR (1)$

For ΔPQR, $\square$PRS is an external angle.

$\therefore \square QPR + \square PQR = \square PRS$

$\square QPR + 2\square TQR = 2\square TRS (As QT$ and RT are angle bisectors)

$\square QPR = 2(\square TRS - \square TQR)$

$\square QPR = 2\square QTR [By$ using equation (1)]

$\square \text{QTR} = \frac{1}{2} \square \text{QPR}$

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