RD SHARMA Solutions for Class 9 Maths Chapter 11 - Triangle and its Angles

Chapter 11 - Triangle and its Angles Exercise 11.25

Question 1

If all the three angles of a triangle are equal, then each one of them is equal to

(a) 90°

(b) 45°

(c) 60°

(d) 30°

Solution 1

Let the measure of each angle be x°.

Now, the sum of all angles of any triangle is 180°.

Thus, $x° + x° + x° = 180°$

i.e. $3x° = 180°$

i.e. $x° = 60°$

Hence, correct option is (c).

Question 2

If two acute angles of a right triangle are equal, then each acute is equal to

(a) 30°

(b) 45°

(c) 60°

(d) 90°

Solution 2

Let the measure of each acute angle of a triangle be x°.

Then, we have

$x° + x° + 90° = 180°$

i.e. $2x° = 90°$

i.e. $x° = 45°$

Hence, correct option is (b).

Question 3

An exterior angle of a triangle is equal to 100° and two interior opposite angle are equal. Each of these angles is equal to

(a) 75°

(b) 80°

(c) 40°

(d) 50°

Solution 3

Let the two interior opposite angles be $x°$ each.
Now, the exterior angle is equal to the sum of the two interior opposite angles.
$x° + x° = 180°$
$\Rightarrow 2x° = 100°$
$\Rightarrow x° = 50°$
Hence, correct option is (d).

Question 4

If one angle of a triangle is equal to the sum of the other two angles, then the triangle is
(a) an isosceles triangle
(b) an obtuse triangle
(c) an equilateral triangle
(d) a right triangle

Solution 4

Let the three angles of a triangle be A, B and C.
Now, $A + B + C = 180°$
If $A = B + C$
Then $A + (A) = 180°$
i.e. $2A = 180°$
i.e. $A = 90°$
Since, one of the angle is 90°, the triangle is a Right triangle.
Hence, correct option is (d).

Question 5

Side BC of a triangle ABC has been produced to a point D such that $\angle ACD = 120°$.
If $\angle B = \frac{1}{2}\angle A$, then $\angle A$ is equal to
(a) 80°
(b) 75°
(c) 60°
(d) 90°

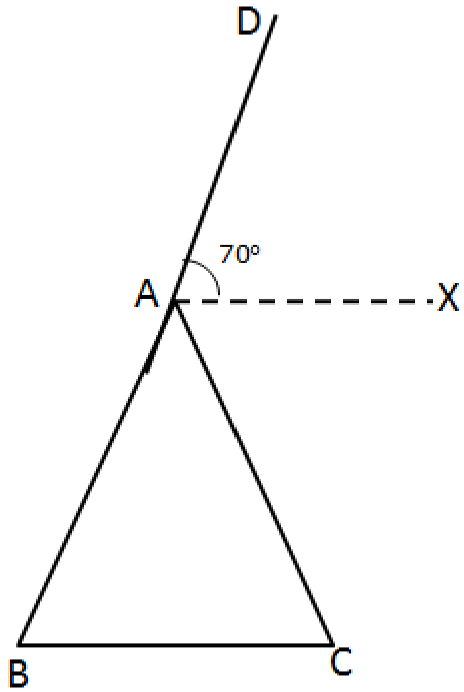
Solution 5

$\angle B = \frac{1}{2}\angle A$
$\angle ACD$ is an exterior angle.
$\Rightarrow \angle A + \angle B = \angle ACD$
$\Rightarrow \angle A + \frac{1}{2}\angle A = 120°$
$\Rightarrow \frac{3\angle A}{2} = 120°$
$\Rightarrow 3\angle A = 240°$
$\Rightarrow \angle A = 80°$
Hence, correct option is (a).

Question 6

In ΔABC, $\angle B = \angle C$ and ray AX bisects the exterior angle $\angle DAC$. If $\angle DAX = 70°$, then $\angle ACB =$
(a) 35°
(b) 90°
(c) 70°
(d) 55°

Solution 6



AX is bisector of $\angle DAC$.
$\Rightarrow \angle DAX = \angle XAC = 70°$
$\Rightarrow \angle DAC = 2 \times 70 = 140°$
Now, $\angle A = 180° - \angle DAC = 180° - 140° = 40°$
In $\triangle ABC$,
$\angle A + \angle B + \angle C = 180°$
$\Rightarrow 40° + \angle B + \angle C = 180°$
$\Rightarrow 40° + \angle C + \angle C = 180°$ ....($\angle B = \angle C$)
$\Rightarrow 2\angle C = 140°$
$\Rightarrow \angle C = 70°$
i.e. $\angle ACB = 70°$
Hence, correct Option is (c).

Question 7

In a triangle, an exterior angle at a vertex is 95° and its one of the interior opposite angle is 55°, then the measure of the other interior angle is
(a) 55°
(b) 85°
(c) 40°
(d) 9.0°

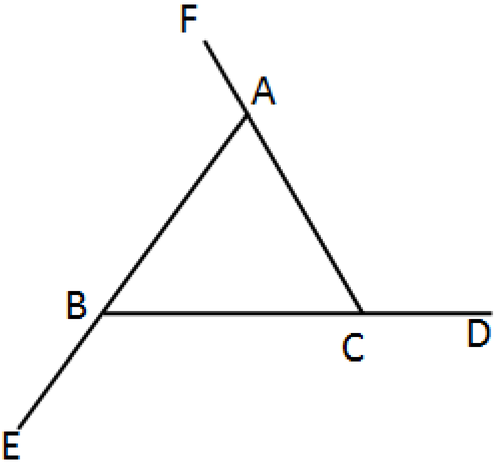
Solution 7

Let the other interior opposite angle be x°.
Then, we have
$x° + 55° = 95°$
$\Rightarrow x° = 95° - 55° = 40°$
Hence, corrcet option is (c).

Question 8

If the sides of a triangle are produced in order, then the sum of the three exterior angles so formed is
(a) 90°
(b) 180°
(c) 270°
(d) 360°

Solution 8

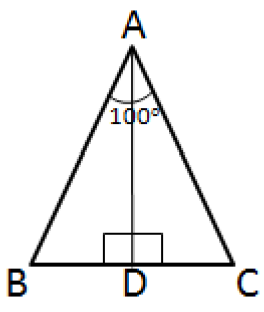


In $\triangle ABC$,
$\angle A + \angle B + \angle C = 180°$
Now, $\angle FAB = 180° - \angle A$ ....(1)
$\angle DCA = 180° - \angle C$ ....(2)
$\angle EBC = 180° - \angle B$ ....(3)
Adding equations (1), (2) and (3)
$\angle FAB + \angle DCA + \angle EBC = 180° - \angle A + 180° - \angle C + 180° - \angle B$
$= 540° - (\angle A + \angle B + \angle C)$
$= 540° - 180°$
$\Rightarrow$ Sum of All exterior angles $= 360°$
Hence, correct option is (d).

Question 9

In $\triangle ABC$, if $\angle A = 100°$, AD bisects $\angle A$ and AD $\perp$ BC. Then, $\angle B =$
(a) 50°
(b) 90°
(c) 40°
(d) 100°

Solution 9



$AD \perp BC$ and AD bisects $\angle A$.

$\Rightarrow \angle BAD = \angle CAD = 50°$

In Right $\triangle ADB$

$\angle BAD = 50°, \ \angle ADB = 90°$

Also sum of all interior angles $= 180°$

$\Rightarrow \angle BAD + \angle ADB + \angle B = 180°$

$\Rightarrow \angle B = 180° - 50° - 90°$

$\Rightarrow \angle B = 40°$

Hence, correct option is (c).

Question 10

An exterior angle of a triangle is 108° and its interior opposite angles are in the ratio 4 : 5. The angles of the triangle are

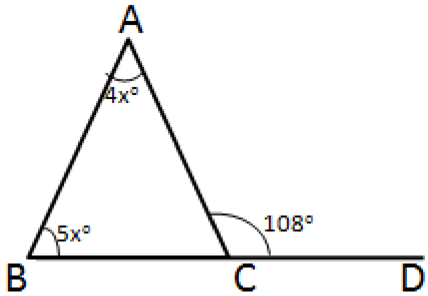
(a) 48°, 60°, 72°

(b) 50°, 60°, 70°

(c) 52°, 56°, 72°

(d) 42°, 60°, 76°

Solution 10



From figure, we have

$\angle A + \angle B = \angle ACD$

$\Rightarrow 4x° + 5x° = 108°$

$\Rightarrow 9x° = 108°$

$\Rightarrow x = 12°$

So, $\angle A = 48°, \angle B = 60°$

$\Rightarrow \angle C = 180° - 48° - 60° = 72°$

Hence, correct option is (a).

Question 11

In a $\triangle ABC$, if $\angle A = 60°, \angle B = 80°$ and the bisectors of $\angle B$ and $\angle C$ meet at at O, then $\angle BOC =$

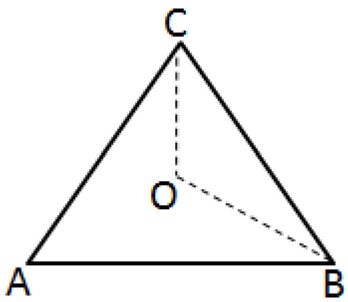
(a) 60°

(b) 120°

(c) 150°

(d) 30°

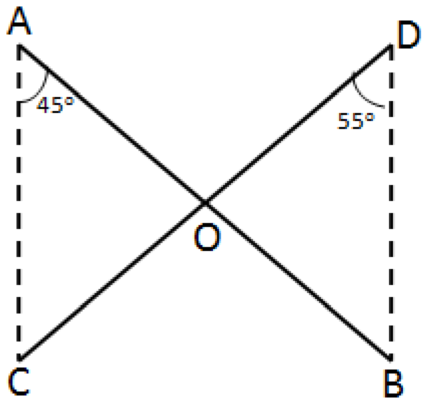
Solution 11



O is point where bisectors of $\angle C$ & $\angle B$ meets.
$\angle A + \angle B + \angle C = 180°$
$60° + 80° + \angle C = 180°$
$\angle C = 40°$
$\frac{\angle C}{2} = 20°$
$\frac{\angle C}{2} = 20° = \angle BCO$ ......(1)
$\frac{\angle B}{2} = \frac{80°}{2} = 40° = \angle OBC$ ......(2)
In $\triangle BOC$
$\angle BCO + \angle OBC + \angle BOC = 180°$
From (1) and (2)
$20° + 40° + \angle BOC = 180°$
$\Rightarrow \angle BOC = 180° - 60° = 120°$
Hence, correct option is (b).

Question 12
Line sgements AB and CD intersect at O such that AC || DB. If $\angle CAB = 45°$ and $\angle CDB = 55°$, then $\angle BOD$ =
(a) 100°
(b) 80°
(c) 90°
(d) 135°

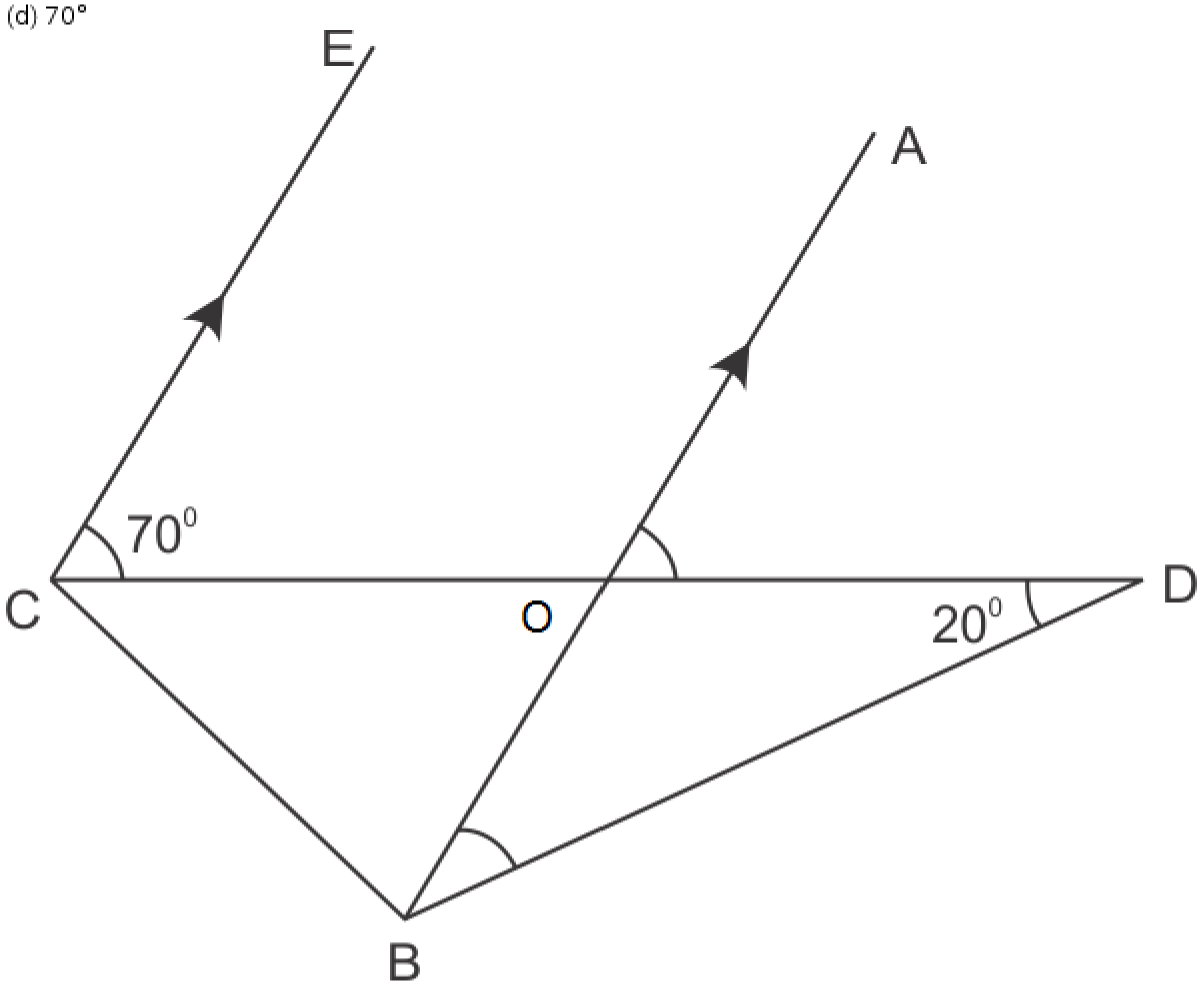
Solution 12



AC || BD
And, AB is transverse to these parallel lines
So $\angle CAB = \angle ABD$ (Alternate angles)
$\Rightarrow \angle ABD = 45°$
Now In $\triangle BOD$
$\angle BOD + \angle ODB + \angle DBA = 180°$
$\angle DBA = \angle ABD = 45°$, $\angle ODB = 55°$
So $\angle BOD = 180° - 45° - 55°$
$= 80°$
Hence, correct option is (b).

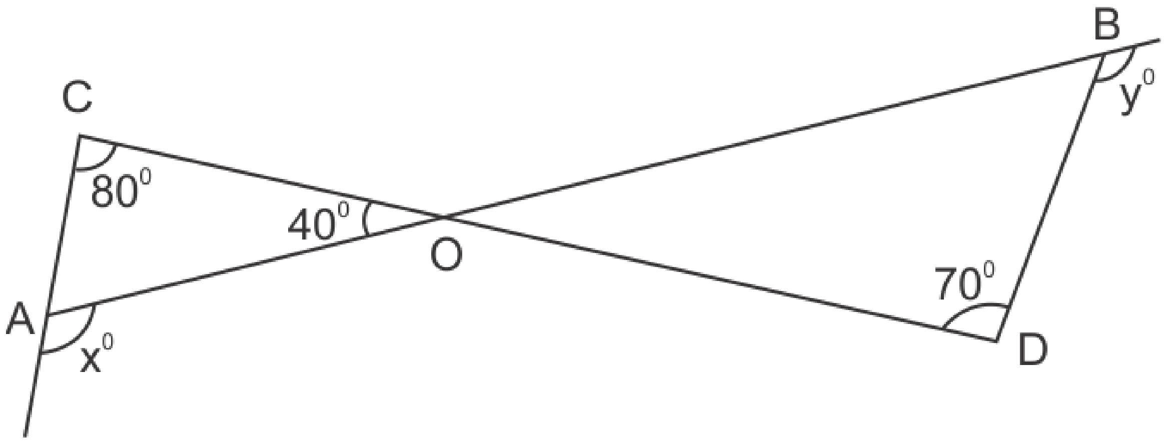
Chapter 11 - Triangle and its Angles Exercise 11.26
Question 13

In figure, if EC || AB, ∠ECD = 70° and ∠BDO = 20°, then ∠OBD is
(a) 20°
(b) 50°
(c) 60°
(d) 70°



Solution 13
EC || AB and CD is transverse to it.
Now ∠ECD = ∠AOD = 70° (Corresponding angles)
In △OBD
∠OBD + ∠BOD + ∠ODB = 180°
∠BOD = 180° − ∠AOD = 180° − 70° =110°
∠ODB = 20° (Given)
So ∠OBD = 180° − ∠BOD − ∠ODB
= 180° − 110° − 20°
= 50°
Hence, correct option is (b).

Question 14
In figure, x + y =
(a) 270°
(b) 230°
(c) 210°
(d) 190°



Solution 14

In $\triangle ACO$

$\angle ACO + \angle COA + \angle OAC = 180°$

Now, $\angle OAC = 180 - x°$

$\Rightarrow 80° + 40° + \cancel{180} - x° = \cancel{180°}$

$\Rightarrow x° = 120°$

$\angle BOD = \angle COA = 40°$ (Opposite angles)

$\angle BDO = 70°$

In $\triangle OBD$,

$\angle OBD = 180° - 40° - 70° = 70°$

Also, $y° = 180° - \angle OBD = 180° - 70° = 110°$

$\Rightarrow x° + y° = 120° + 110° = 230°$

Hence, correct option is (b).

Question 15

If the measures of angles of a triangle are in the ratio of 3 : 4 : 5, what is the measure of the smallest angle of the triangle?

(a) 25°
(b) 30°
(c) 45°
(d) 60°

Solution 15

The measures of angles of a triangle are in ratio 3 : 4 : 5.

Let the angles be 3x, 4x and 5x.

In any triangle, sum of all angles = 180°

$\Rightarrow 3x + 4x + 5x = 180°$

$\Rightarrow 12x = 180°$

$\Rightarrow x = 15°$

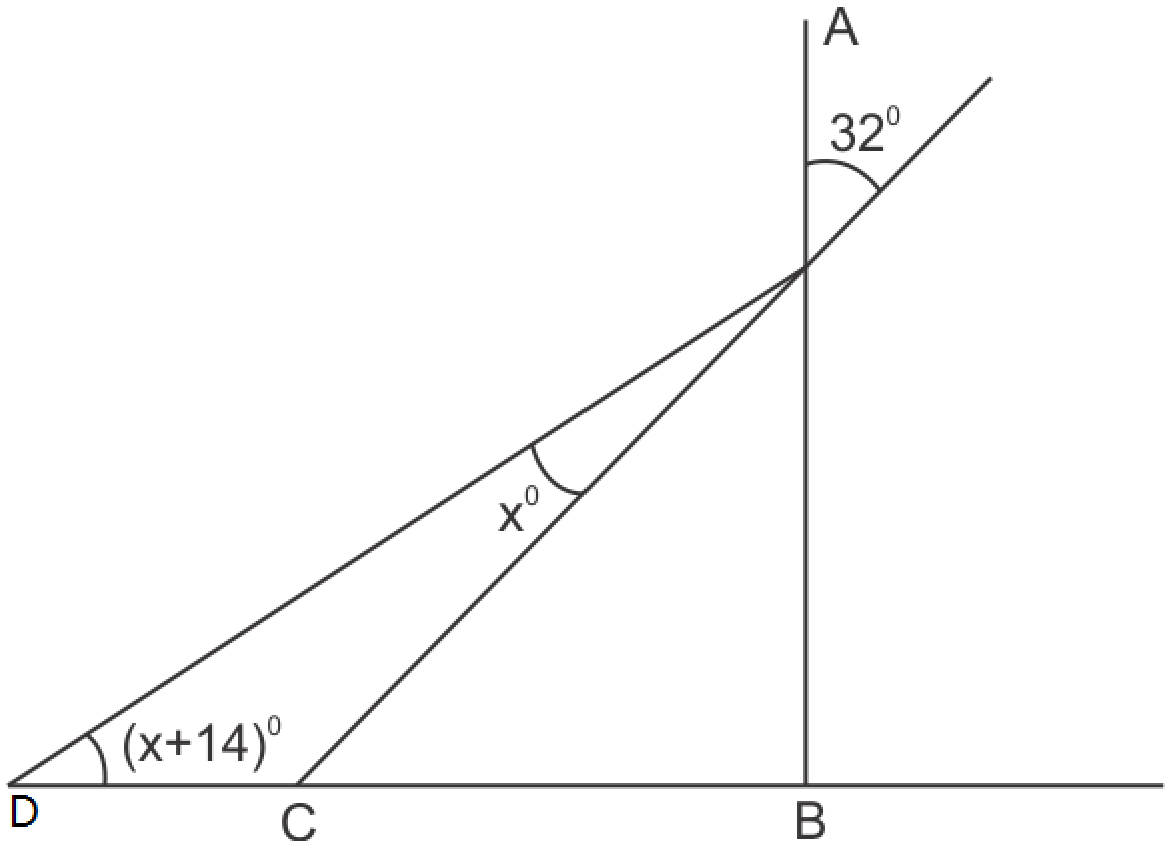
So, smallest angle $= 3 \times 15° = 45°$

Hence, correct option is (c).

Question 16

In figure, if $AB \perp BC$, then $x =$

(a) 18
(b) 22
(c) 25
(d) 32



Solution 16

$AB \perp BC$

$\Rightarrow \angle ABC = 90°$

$\angle CAB = 32°$ (Opposite angles)

Now, in $\triangle ABD$

$\angle DAB = x° + 32°$

$\angle ABD = 90°$

$\angle BDA = x° + 14°$

In a $\triangle$, sum of all angles $= 180°$

$\Rightarrow \angle DAB + \angle ABD + \angle BDA = 180°$

$\Rightarrow x° + 32° + 90° + x° + 14° = 180°$

$\Rightarrow 2x° = 180° - 136°$

$\Rightarrow 2x° = 44$

$\Rightarrow x° = 22°$

Hence, correct option is (b).

Chapter 11 - Triangle and its Angles Exercise 11.27

Question 17

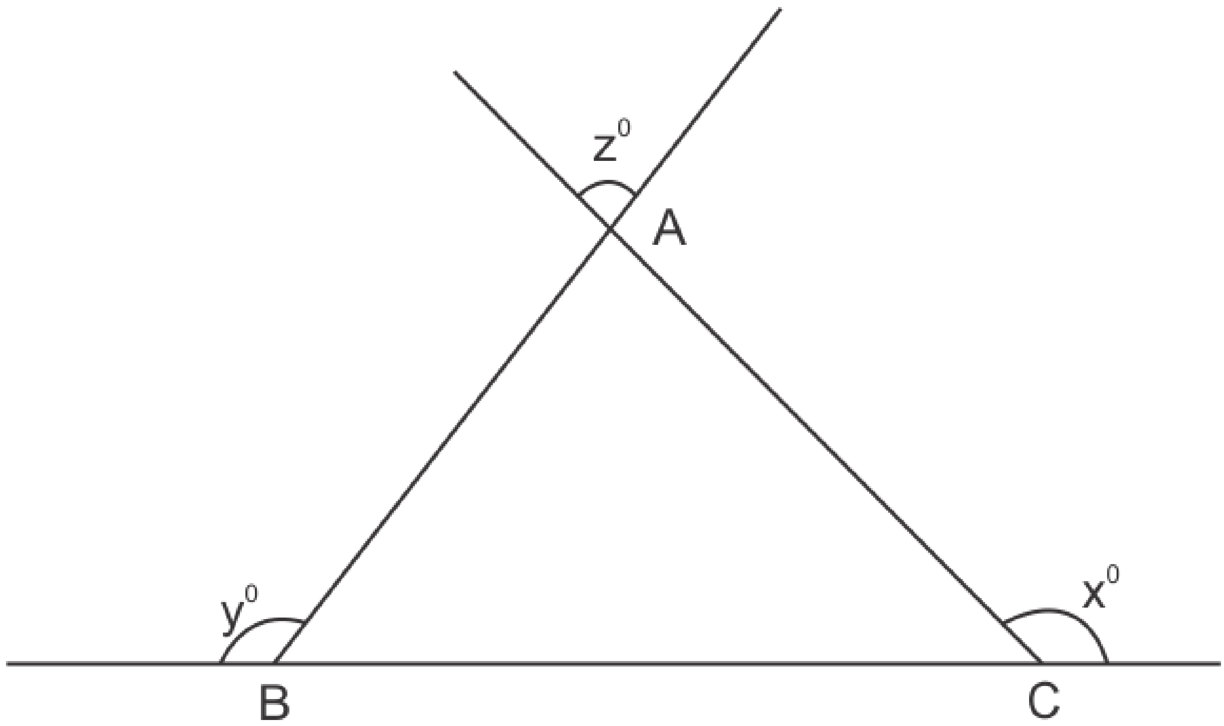
In figure, what is z in terms of x and y?

(a) x +y + 180°

(b) x + y - 180°

(c) 180° - (x + y)

(d) x + y + 360°



Solution 17

From figure

$\angle A = z°$

$\angle ACB = 180 - x°$

$\angle ABC = 180 - y°$

Now, in $\triangle ABC$

$\angle A + \angle B + \angle C = 180°$

$\Rightarrow z° + \cancel{180} - y° + 180 - x° = \cancel{180°}$

$\Rightarrow z° = x° + y° - 180°$

Hence, correct option is (b).

Question 18

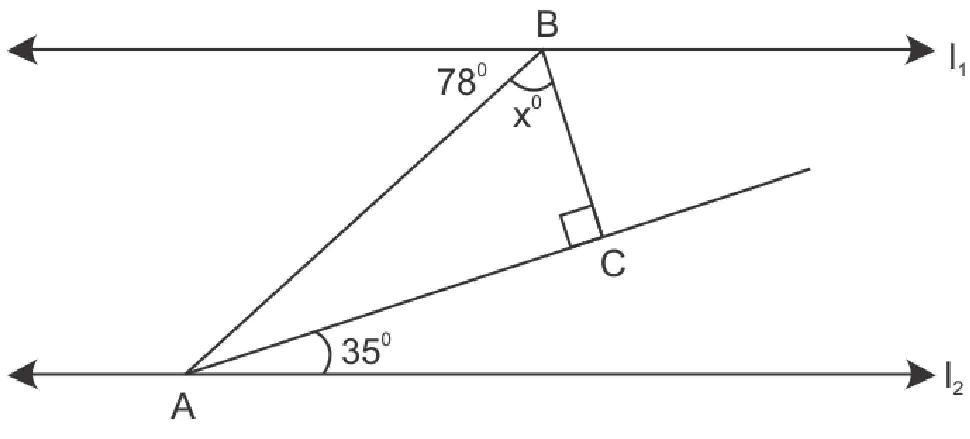
In figure, for which value of x is $l_1 \parallel l_2$?

(a) 37

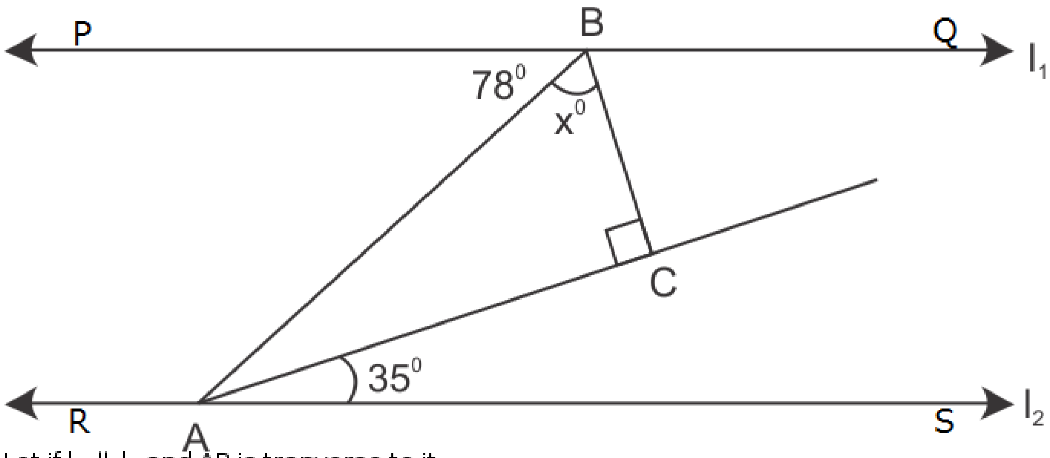
(b) 43

(c) 45

(d) 47



Solution 18



Let if $l_1 \parallel l_2$ and AB is tranverse to it.

Then,

$\angle PBA$ should be equal to $\angle BAS$ (Alternate angles)

So if $l_1 \parallel l_2$, then $\angle BAS = 70°$

$\Rightarrow \angle BAC = 78° - 35° = 43°$ ....(1)

Now, in $\triangle ABC$

$x° + \angle C + \angle BAC = 180°$

$\Rightarrow x° + 90° + 43° = 180°$

$\Rightarrow x° = 180° - 90° - 43° = 47°$

$\Rightarrow x° = 47°$

So if $x° = 47°$ then $l_1 \parallel l_2$

Hence, correct option is (d).

Question 19

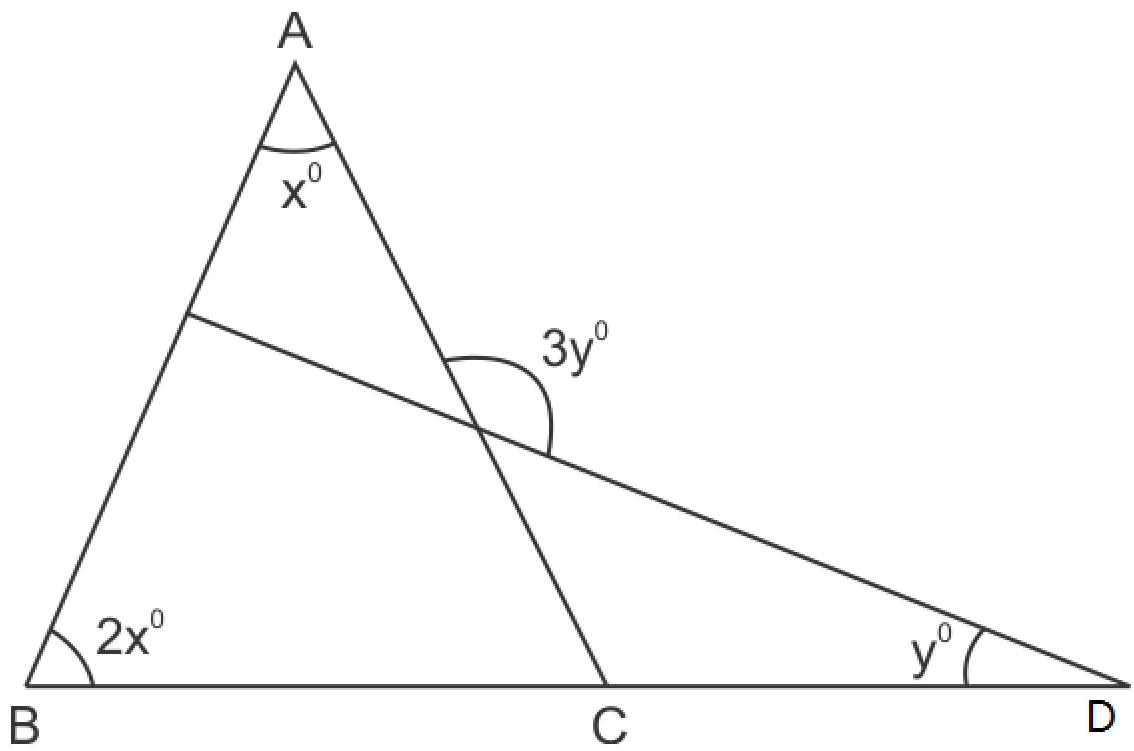
In figure, what is y in terms of x?

(a) $\frac{3}{2}x$

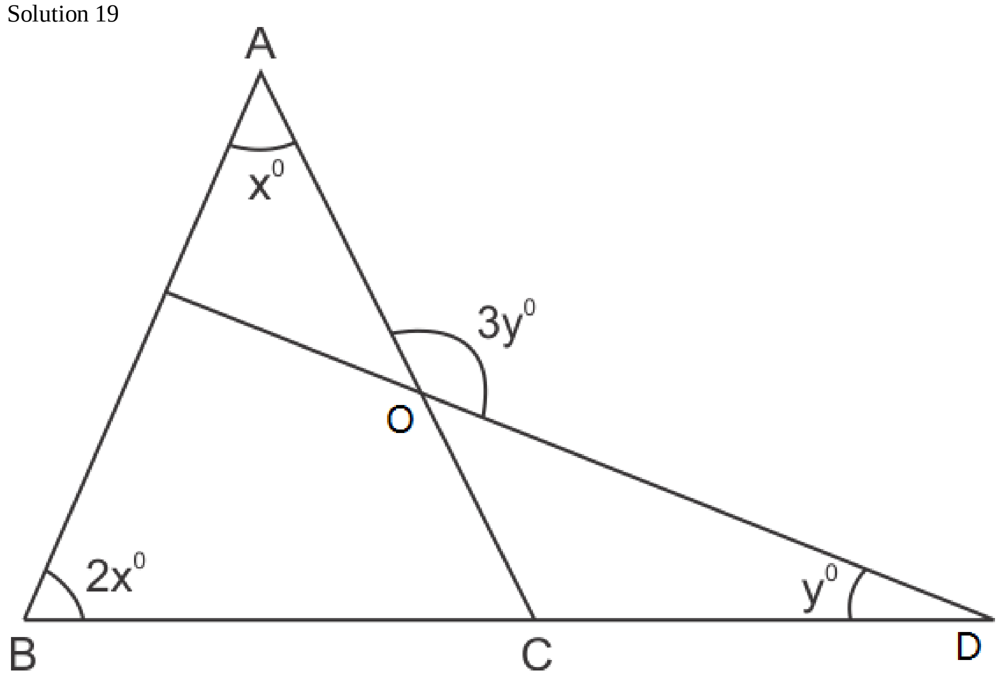
(b) $\frac{4}{3}x$

(c) x

(d) $\frac{3}{4}x$



Solution 19



From Figure,

$\angle DOC = 180° - \angle AOD$ (Both are Supplementary)

$\Rightarrow \angle DOC = 180° - 3y°$

Also, $\angle ACB = 180° - \angle A - \angle B$

$\Rightarrow \angle ACB = 180° - x° - 2x° = 180° - 3x°$

And $\angle ACD = 180° - \angle ACB$

$= 180° - (180° - 3x°)$

$\Rightarrow \angle ACD = 3x°$

Now, in $\triangle OCD$

$\angle DOC + \angle OCD + \angle D = 180°$

$180° - 3y° + 3x° + y° = 180°$ $[\angle OCD = \angle ACD]$

$\Rightarrow 2y° = 3x°$

$\Rightarrow y = \frac{3}{2}x°$

Hence, correct option is (a).

Question 20

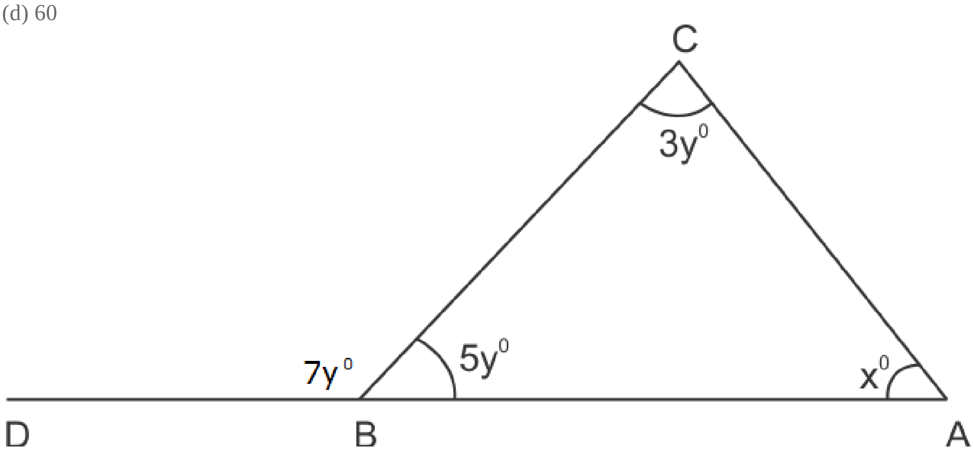
In figure, what is the value of x?

(a) 35

(b) 45

(c) 50

(d) 60



Solution 20

In $\triangle ABC$,

$\angle BCA + \angle CAB + \angle ABC = 180°$

$\Rightarrow 3y° + x° + 5y° = 180°$

$\Rightarrow 8y° + x° = 180°$ ...(1)

Also, $5y° = 180° - 7y°$

$\Rightarrow 12y° = 180°$

$\Rightarrow y° = 15°$

From (1), $x° = 180° - 8y°$

$\Rightarrow x° = 180° - 8 \times 15°$

$\Rightarrow x° = 60°$

Hence, correct option is (d).

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Question 21

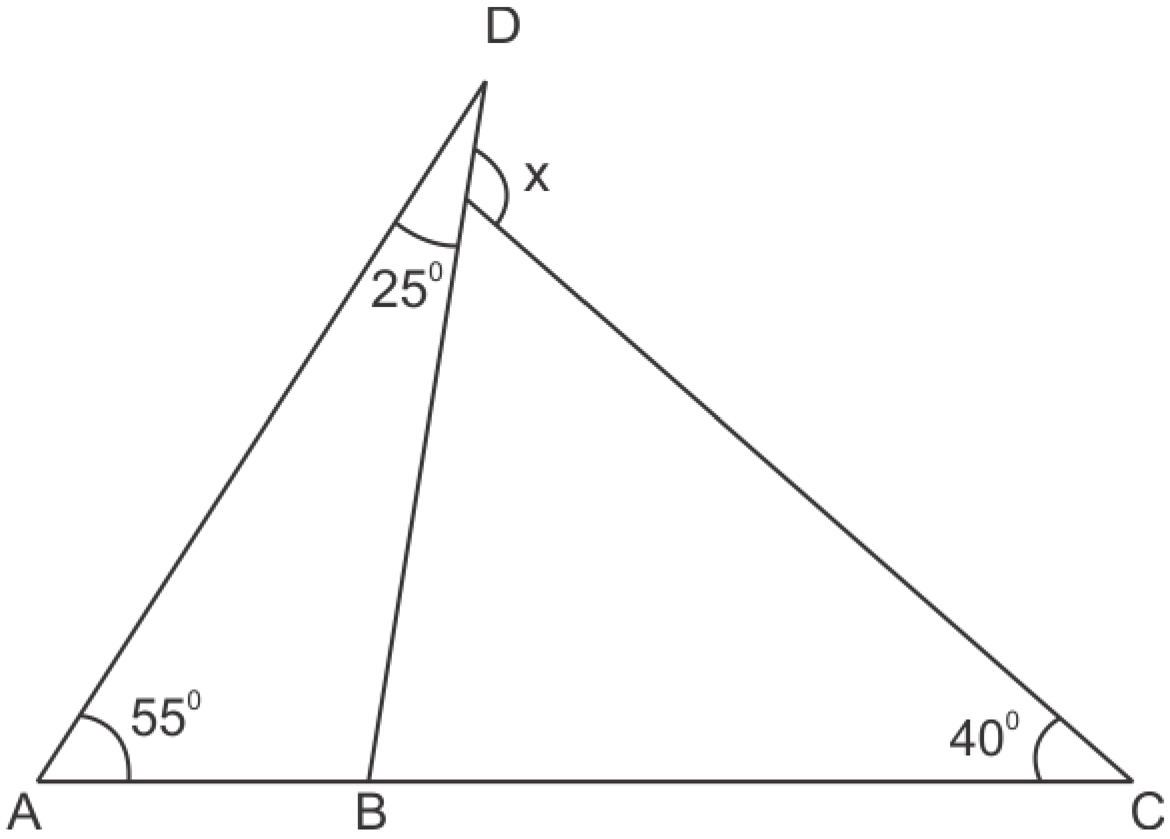
In figure, the value of x is

(a) 65°

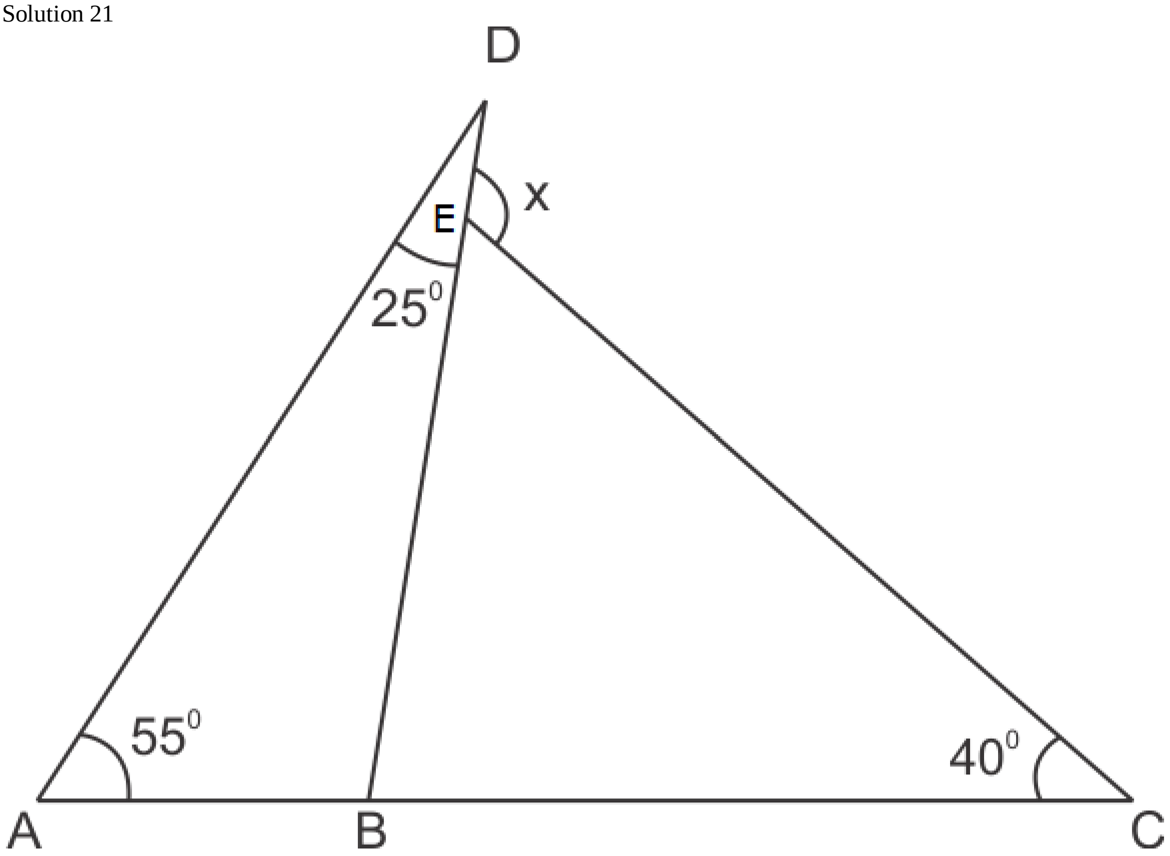
(b) 80°

(c) 95°

(d) 120°

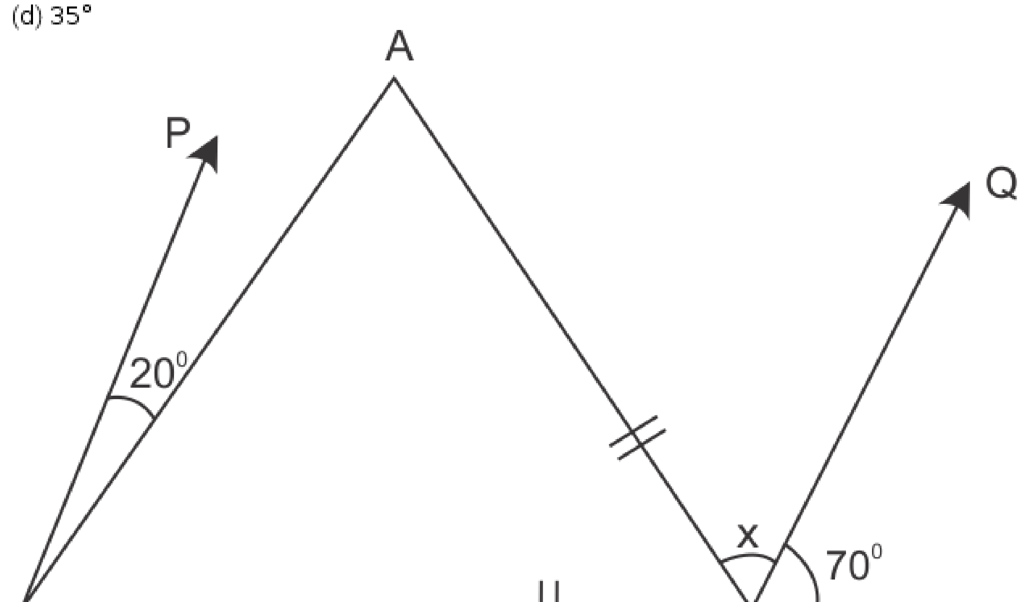


Solution 21

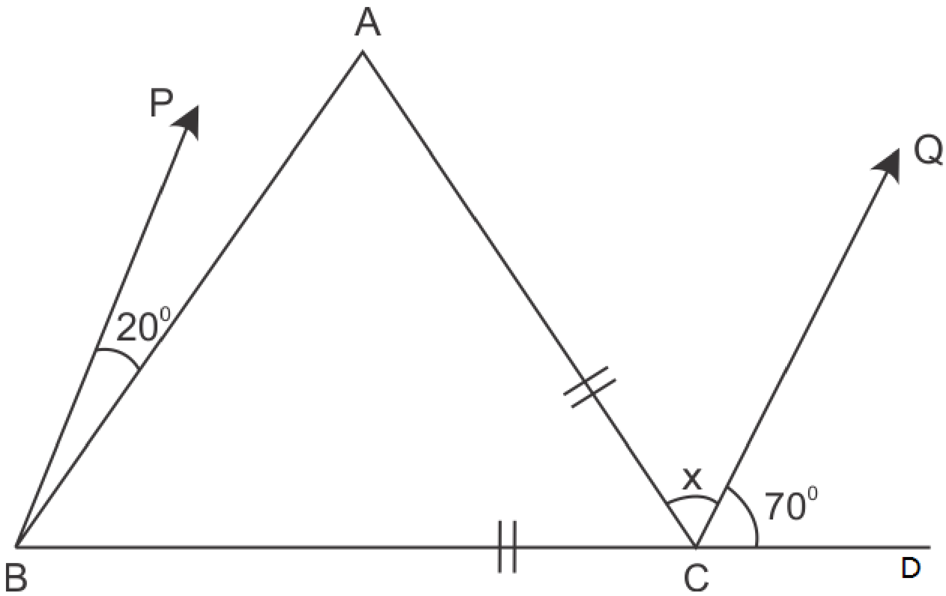


In $\triangle ABD$
$\angle A + \angle B + \angle D = 180°$
$\Rightarrow 55° + \angle DBA + 25° = 180°$
$\Rightarrow \angle DBA = 180° - 55° - 25°$
$= 180° - 80°$
$\Rightarrow \angle DBA = 100°$
So, $\angle DBC = 180° - \angle DBA$
$= 180° - 100°$
$\Rightarrow \angle DBC = 80°$
Now, in $\triangle EBC$
$\angle E + \angle EBC + \angle C = 180°$
$\Rightarrow \angle E + 80° + 40° = 180° \quad (\angle DBC = \angle EBC)$
$\Rightarrow \angle E = 180° - 120° = 60°$
Also, $x = 180° - \angle E = 180° - 60°$
$\Rightarrow x = 120°$
Hence, correct option is (d).

Question 22
In figure, if $BP \parallel CQ$ and $AC = BC$, then the measure of x is
(a) 20°
(b) 25°
(c) 30°
(d) 35°



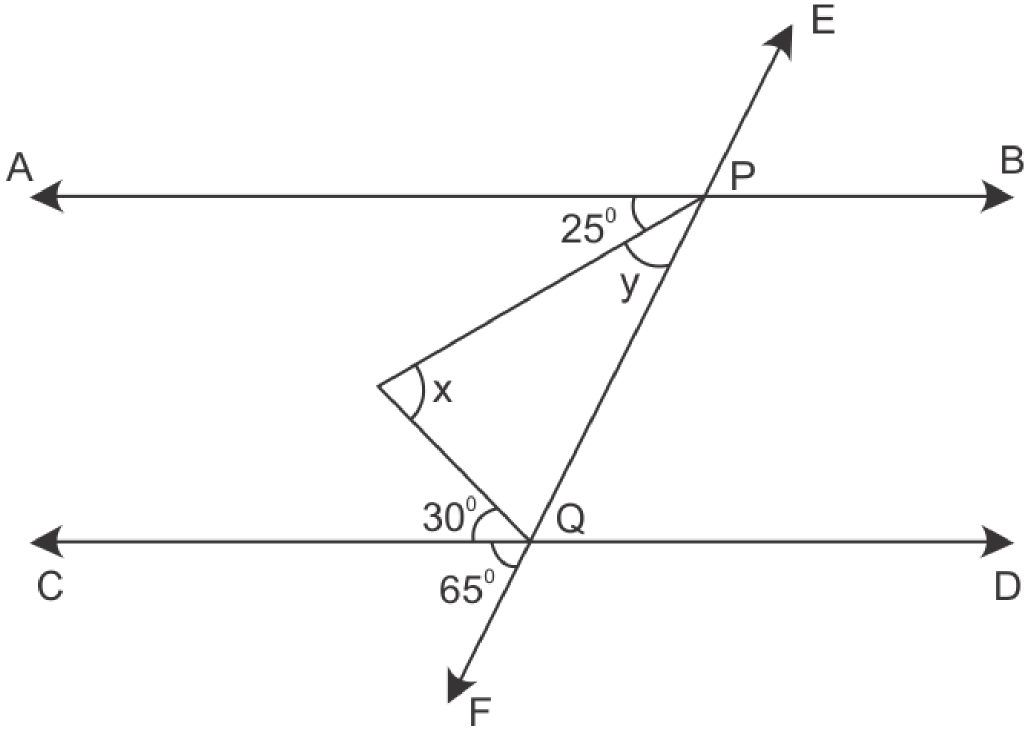
Solution 22



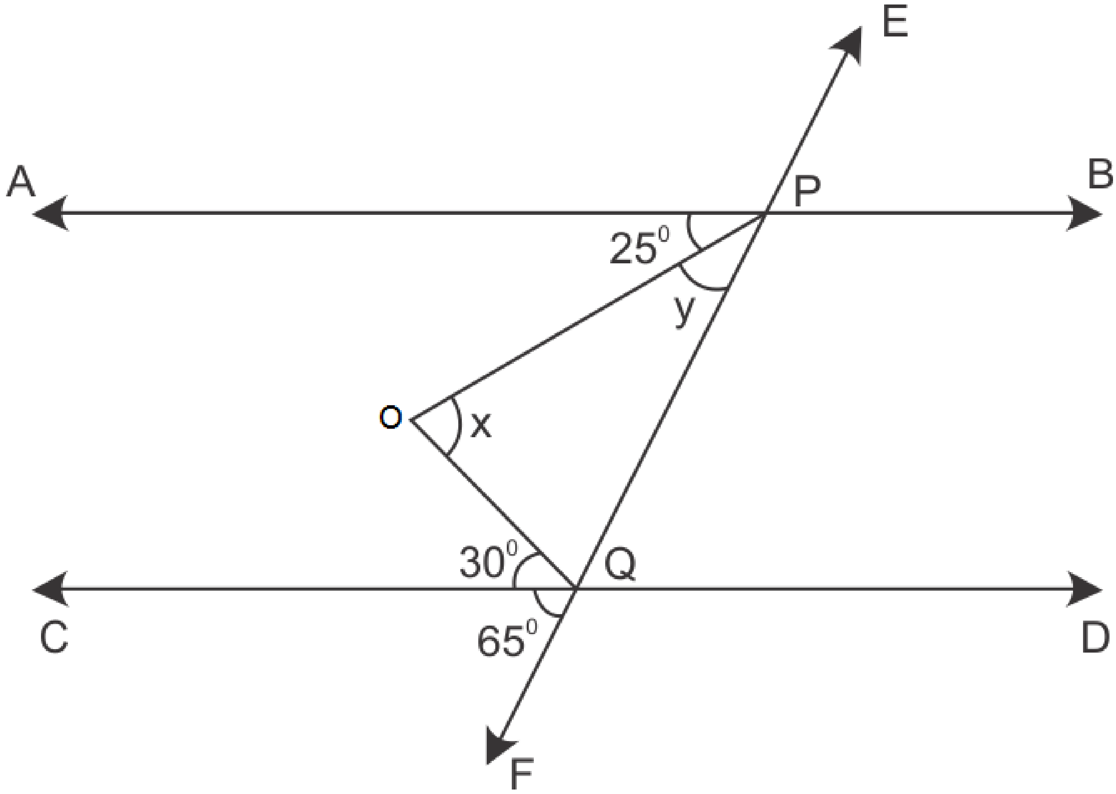
$\angle PBC = \angle QCD$ (Corresponding angles, OP $\parallel$ CQ and BC is transverse)
$\Rightarrow \angle PBC = 70°$
Now, $\angle PBA + \angle ABC = \angle PBC$
$\Rightarrow 20° + \angle ABC = 70°$
$\Rightarrow \angle ABC = 50°$
In $\triangle ABC$,
$\angle ABC + \angle BAC + \angle ACB = 180°$ ....(1)
Now, $\angle ABC = \angle BAC = 50°$ (isosceles $\triangle$)
And, $\angle ACB = 180° - (70° + x)$
From (1),
$50° + 50° + \cancel{180°} - (70° + x) = \cancel{180°}$
$\Rightarrow x = 30°$
Hence, correct option is (c).

Question 23

In figure, AB and CD are $\parallel$ lines and transversal EF intersects them at P and Q respectively, If $\angle APR = 25°$, $\angle RQC = 30°$ and $\angle CQF = 65°$, then
(a) $x = 55°$, $y = 40°$
(b) $x = 50°$, $y = 45°$
(c) $x = 60°$, $y = 35°$
(d) $x = 35°$, $y = 60°$



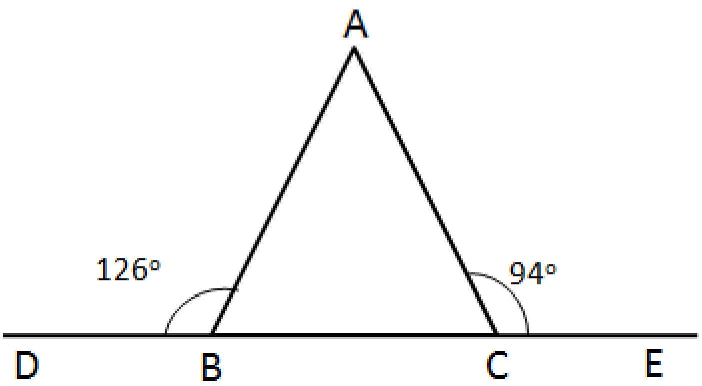
Solution 23



$\angle OQP = 180° - \angle OQF$
$= 180° - (30° + 65°)$
$\Rightarrow \angle OQP = 85°$ ....(1)
$\angle APQ = \angle CQF$ (Corresponding angles)
$\Rightarrow 25° + y° = 65°$
$\Rightarrow y° = 65° - 25°$
$\Rightarrow y° = 40°$
Now in $\triangle OPQ$
$\angle O + \angle OPQ + \angle PQO = 180°$
$\Rightarrow x° + 40° + 85° = 180°$
$x° = 180 - 85° - 40° = 55°$
$\Rightarrow x° = 55°, y = 40°$
Hence, correct option is (a).

Question 24
The base BC of triangle ABC is produced both ways and the measure of exterior angles formed are 94° and 126°. Then, $\angle BAC$ =
(a) 94°
(b) 54°
(c) 40°
(d) 44°

Solution 24

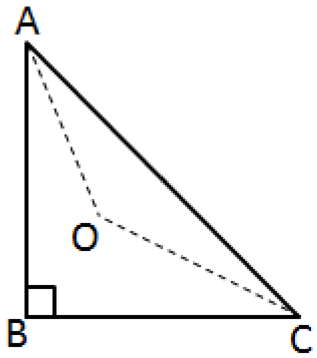


$\angle ABC = 180° - 126° = 54°$
$\angle ACB = 180 - 94° = 86°$
Now, in $\triangle ABC$
$\angle BAC + \angle ABC + \angle ACB = 180°$
$\Rightarrow \angle BAC = 180° - \angle ABC - \angle ACB$
$= 180° - 54° - 86°$
$\Rightarrow \angle BAC = 40°$
Hence, correct option is (c).

Chapter 11 - Triangle and its Angles Exercise 11.29

Question 25
If the bisectors of the acute angles of a right triangle meet at O, then the angle at O between the two bisectors is
(a) 45°
(b) 95°
(c) 135°
(d) 90°

Solution 25



In $\triangle ABC$,

$\angle A + \angle B + \angle C = 180°$

$\Rightarrow \angle A + 90° + \angle C = 180°$

$\Rightarrow \angle A + \angle C = 90° \quad ....(1)$

Now, in $\triangle AOC$,

$\angle COA + \angle OAC + \angle OCA = 180°$

$\Rightarrow \angle COA + \frac{\angle A}{2} + \frac{\angle C}{2} = 180°$ {AO and CO bisects angle $\angle A$ and $\angle C$}

$$\Rightarrow \angle COA = 180 - \left(\frac{\angle A + \angle C}{2}\right)$$

$$= 180° - \left(\frac{90°}{2}\right) \quad \text{\{From (1)\}}$$

$$= 100° - 45°$$

$$= 135°$$

Hence, correct option is (c).

Question 26

The bisects of exterior angles at B and C of $\triangle ABC$ meet at O. If $\angle A = x°$, then $\angle BOC =$

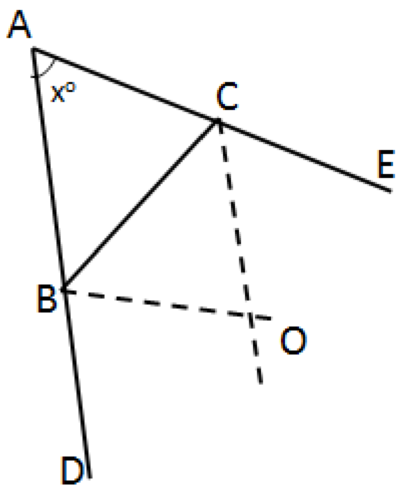
(a) $90° + \frac{x°}{2}$

(b) $90° - \frac{x°}{2}$

(c) $180° + \frac{x°}{2}$

(d) $180° - \frac{x°}{2}$

Solution 26



In $\triangle ABC$,

$\angle A + \angle B + \angle C = 180°$

$\Rightarrow \angle B + \angle C = 180 - x°$ ....(1)

$\angle CBD = 180° - \angle B$ ....(2)

$\angle ECB = 180° - \angle C$ ....(3)

$\Rightarrow \frac{\angle CBD}{2} = \angle OBC = 90° - \frac{\angle B}{2}$ ....(4) [From eq (2)]

$\frac{\angle ECB}{2} = \angle OCB = 90° - \frac{\angle C}{2}$ ....(5) [From eq (3)]

Now, in $\triangle BOC$

$\angle OBC + \angle OCB + \angle BOC = 180°$

$\Rightarrow \angle BOC = 180° - (\angle OBC + \angle OCB)$

From eq (4) and (5),

$$\angle BOC = 180° - \left(90° - \frac{\angle B}{2} + 90° - \frac{\angle C}{2}\right)$$

$$= 180° - \left(180° - \frac{\angle B}{2} - \frac{\angle C}{2}\right)$$

$$= \frac{\angle B + \angle C}{2} \quad \text{[From eq (1)]}$$

$$= \frac{180° - x°}{2}$$

$$\Rightarrow \angle BOC = 90° - \frac{x°}{2}$$

Hence, correct option is (b).

Question 27

In a $\triangle ABC$, $\angle A = 50°$ and BC is produced to a point D. If the bisectors of $\angle ABC$ and $\angle ACD$ meet at E, then $\angle E =$

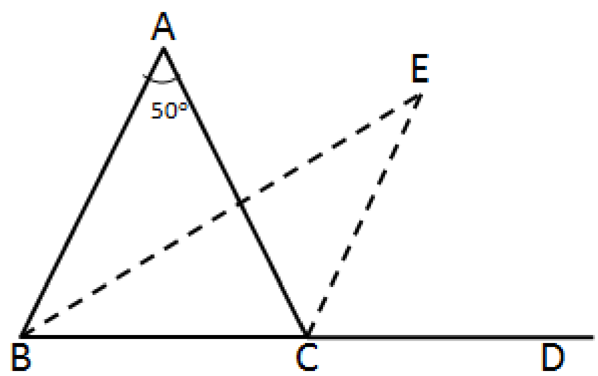
(a) 25°

(b) 50°

(c) 100°

(d) 75°

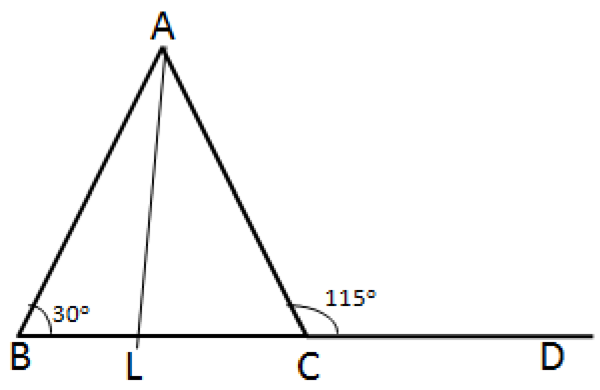
Solution 27



BE and CE are bisectors of $\angle B$ and $\angle ACD$.
In $\triangle ABC$,
$\angle A + \angle B + \angle C = 180°$
$\Rightarrow \angle B + \angle C = 180° - 50° = 130°$ ....(1)
Now, in $\triangle BEC$
$\angle CBE + \angle BEC + \angle ECB = 180°$ ...(2)
$\angle CBE = \frac{\angle B}{2}$, $\angle BEC = \angle E$, $\angle ECB = \angle C + \angle ACE$
Now, $\angle ACD = 180° - \angle C$
$\angle ACE = \frac{\angle ACD}{2} = \frac{180° - \angle C}{2} = 90° - \frac{\angle C}{2}$
So, $\angle ECB = \angle C + 90° - \frac{\angle C}{2}$
$\Rightarrow \angle ECB = 90° + \frac{\angle C}{2}$
Now putting all values in eq (2)
$\frac{\angle B}{2} + \angle E + 90° + \frac{\angle C}{2} = 180°$
$\Rightarrow \angle E = 180° - 90° - \left(\frac{\angle B + \angle C}{2}\right)$
$= 90° - \left(\frac{\angle B + \angle C}{2}\right)$
$= 90° - \frac{130°}{2}$ [From eq (1)]
$\Rightarrow \angle E = 25°$
Hence, correct option is (a).

Question 28
The side BC of $\triangle ABC$ is produced to a point D. The bisector of $\angle A$ meets side BC in L.
If $\angle ABC = 30°$ and $\angle ACD = 115°$, then $\angle ALC =$
(a) $85°$
(b) $72\frac{1}{2}°$
(c) $145°$
(d) None

Solution 28



$\angle C = 180° - \angle ACD = 180° - 115° = 65°$

In $\triangle ABC$,

$\angle A + \angle B + \angle C = 180°$

$\Rightarrow \angle A = 180 - 30° - 65°$

$\Rightarrow \angle A = 85°$

Now in $\triangle ALC$

$\angle ALC + \angle LAC + \angle C = 180°$

$\Rightarrow \angle ALC = 180° - \angle LAC - \angle C$

$$= 180° - \frac{\angle A}{2} - \angle C$$

$$= 180° - \frac{85°}{2} - 65°$$

$$= \frac{145°}{2}$$

$$= 72\frac{1}{2}°$$

Hence, correct option is (b).

Question 29

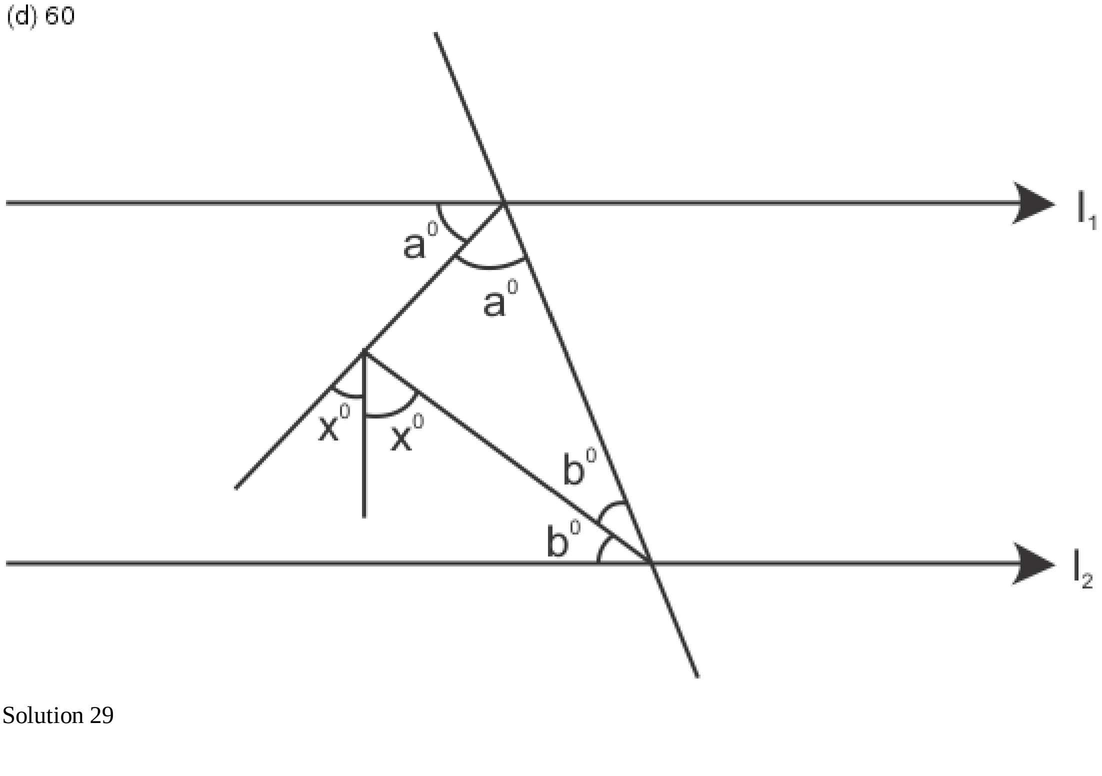
In figure, if $l_1 \parallel l_2$, the value of x is

(a) $22\frac{1}{2}$

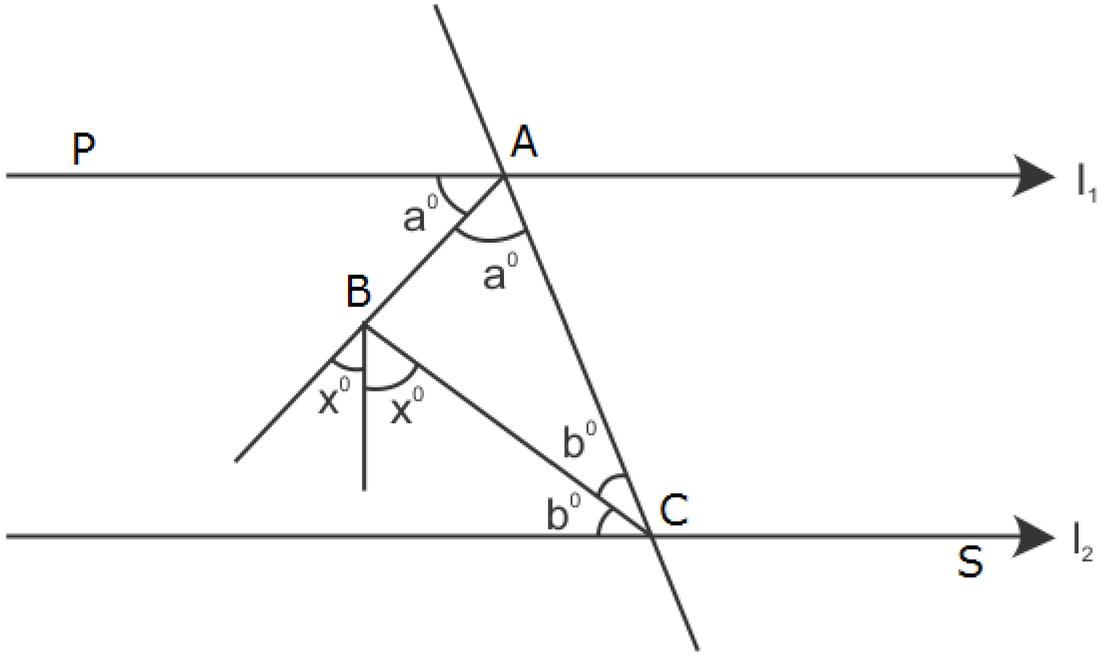
(b) 30

(c) 45

(d) 60

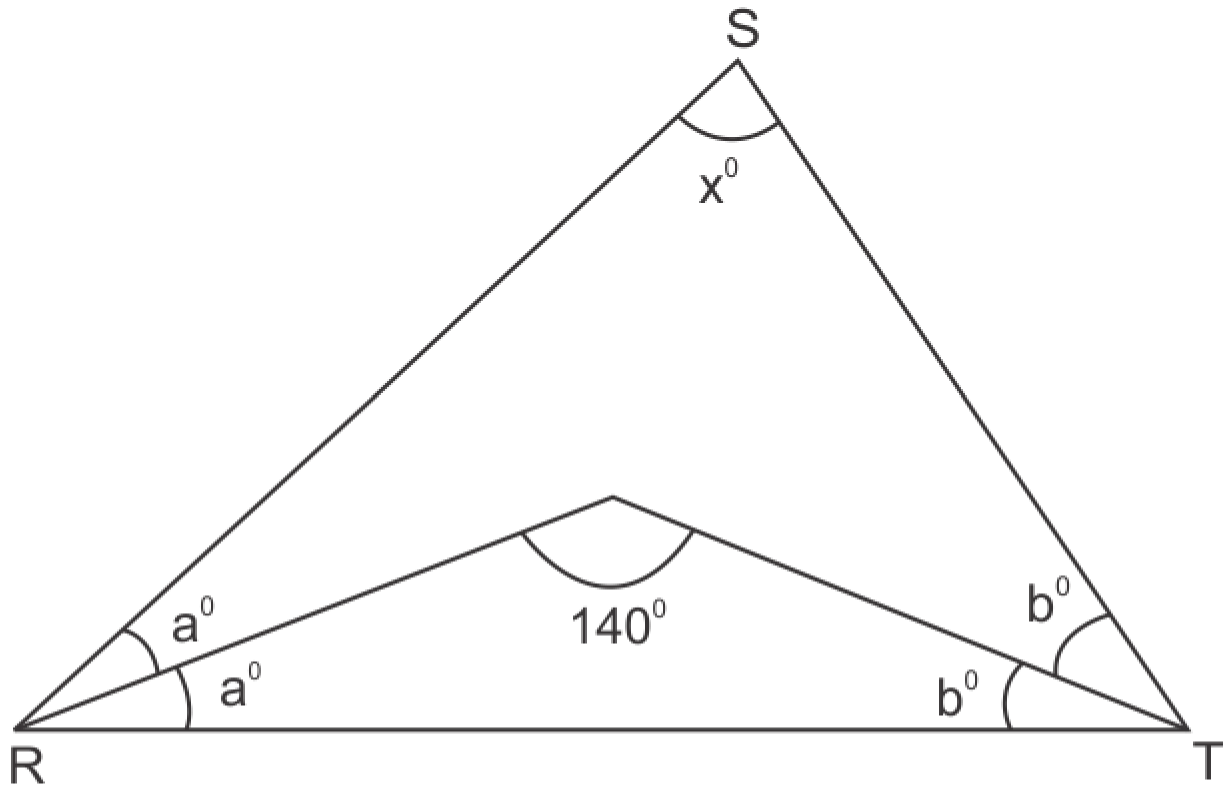


Solution 29

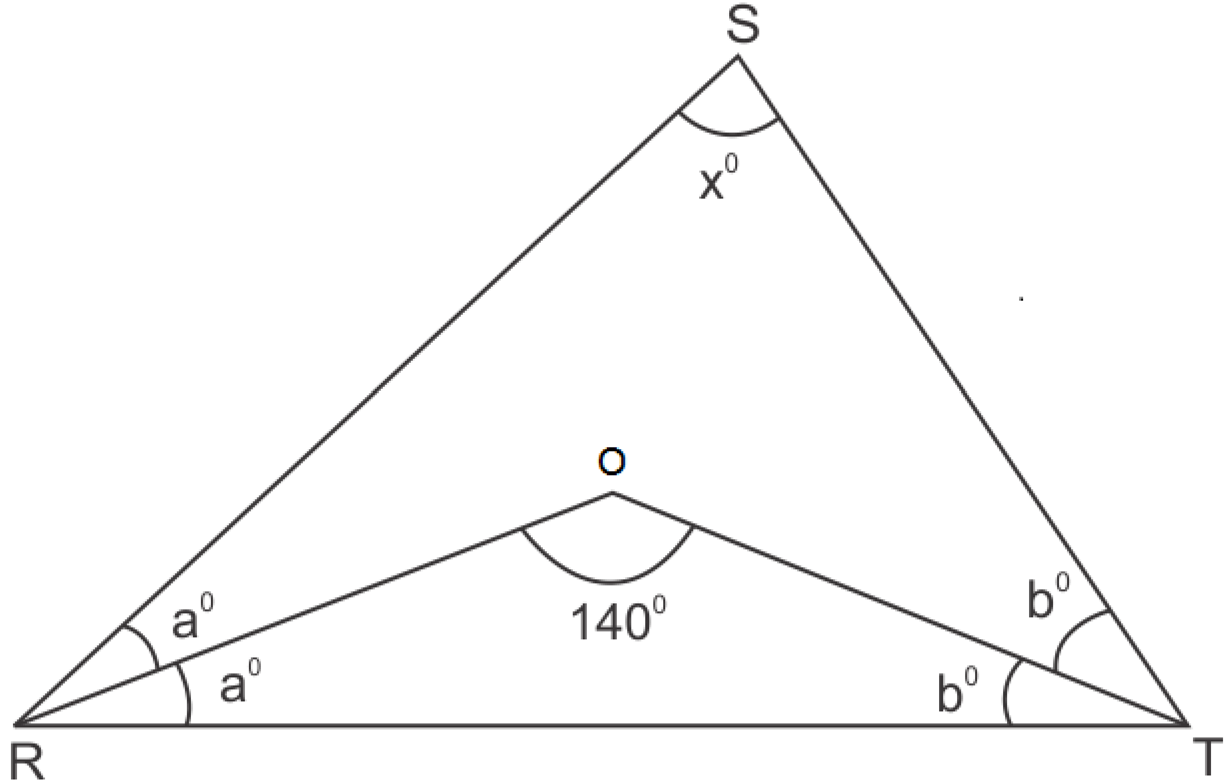


From figure,
$\angle ACS = 180° - 2b°$
Also $\angle ACS = \angle PAC = 2a°$ (alternate angles)
$\Rightarrow 2a° = 180° - 2b°$
$\Rightarrow a° + b° = 90°$
Now, in $\triangle ABC$
$a° + b° + \angle ABC = 180°$
$\angle ABC = 180° - 2x°$
$\Rightarrow a° + b° + \cancel{180°} - 2x° = \cancel{180°}$
$\Rightarrow 2x° = a° + b° = 90°$
$\Rightarrow x° = 45°$
Hence, correct option is (c).

Question 30
In $\triangle RST$, what is the value of x?
(a) 40
(b) 90°
(c) 80°
(d) 100°



Solution 30



In $\triangle RST$
$\angle R + \angle S + \angle T = 180°$
$\Rightarrow 2a° + x° + 2b° = 180°$
$\Rightarrow x° = 180° - 2(a + b)°$ ....(1)
Now, in $\triangle ROT$
$\angle ORT + \angle ROT + \angle OTR = 180°$
$\Rightarrow a° + 140° + b° = 180°$
$\Rightarrow (a + b)° = 180° - 140° = 40°$ ...(2)
From eq (1) and (2)
$x° = 180° - 2(40°)$
$\Rightarrow x = 100°$
Hence, correct option is (d).

Chapter 11 - Triangle and its Angles Exercise Ex. 11.1

Question 1

In a $\triangle ABC$, if $\angle A = 55°$, $\angle B = 40°$, find $\angle C$.

Solution 1

In the $\triangle ABC$

$\angle A + \angle B + \angle C = 180°$ (sum of all angles of a triangle)

$\Rightarrow 55° + 40° + \angle C = 180°$

$\Rightarrow \angle C = 180° - 55° - 40°$

$\Rightarrow \angle C = 180° - 95° = 85°$

$\therefore \angle C = 85°$

Question 2

If the angles of a triangle are in the ratio 1 : 2 : 3, determine three angles.

Solution 2

Let the angles be x, 2x, 3x

$\therefore x + 2x + 3x = 180°$ (sum of all angles of a Δ)

$\Rightarrow 6x = 180°$

$\Rightarrow x = 30°$

Since $x = 30°$

$2x = 2 \times 30° = 60°$

$3x = 3 \times 30° = 90°$

$\therefore$ angle are $30°, 60°, 90°$

Question 3

The angles of a triangle are $(x - 40)°$, $(x - 20)°$ and $\left(\frac{1}{2}x - 10\right)°$. Find the value of x.

Solution 3

$$(x-40)^\circ + (x-20)^\circ + \left(\frac{1}{2}x - 10\right)^\circ = 180^\circ \text{ (sum of all angles of a } \triangle)$$

$$\Rightarrow \frac{5}{2}x - 70^\circ = 180^\circ$$
$$\Rightarrow \frac{5}{2}x = 250^\circ$$
$$\Rightarrow x = 100^\circ$$

Question 4

Two angles of a triangle are equal and the third angle is greater than each of those angles by 30^o. Determine all the angles of the triangle.

Solution 4

Let first angle be x°

second angle $= x^\circ$

and third angle $= (x+30)^\circ$

$$\Rightarrow x^\circ + x^\circ (x+30)^\circ = 180^\circ \quad \text{[Sum of all angles of a } \triangle]$$
$$\Rightarrow \quad 3x + 30 = 180$$
$$\Rightarrow \quad 3x = 150$$
$$\Rightarrow \quad x = 50$$

$\therefore$ first angle $= 50^\circ$

second angle $= 50^\circ$

third angle $= (50+30)^\circ = 80^\circ$

Question 5

If one angle of a triangle is equal to the sum of the other two, show that triangle is right angle.

Solution 5

Given $\angle B = \angle A + \angle C$

Now, in $\triangle ABC$

$\angle A + \angle B + \angle C = 180^\circ$ (sum of all angles of a $\triangle$)

$$\Rightarrow \quad \angle B + \angle B = 180^\circ$$
$$\Rightarrow \quad 2\angle B = 180^\circ$$
$$\Rightarrow \quad \angle B = 90^\circ$$

$\therefore$ ABC is a right angled triangle.

Question 6

Can a triangle have:

(i) Two right angles?

(ii) Two obtuse angles?

(iii) Two acute angles?

(iv) All angles more than 60^o?

(v) All angles less than 60^o?

(vi) All angles equal to 60^o?

Justify your answer in each case.

Solution 6

(i) No

As two right angles would sum up to 180^o, and we know that the sum of all three angles of a triangle is 180^o, so the third angle will become zero. This is not possible, so a triangle cannot have two right angles.

(ii) No

A triangle cannot have 2 obtuse angles, since then the sum of those two angles will be greater than 180^o which is not possible as the sum of all three angles of a triangle is 180^o.

(iii) Yes

A triangle can have 2 acute angles.

(iv) No

The sum of all the internal angles of a triangle is 180^o. Having all angles more than 60^o will make that sum more than 180^o, which is impossible.

(v) No

The sum of all the internal angles of a triangle is 180^o. Having all angles less than 60^o will make that sum less than 180^o, which is impossible.

(vi) Yes

The sum of all the internal angles of a triangle is 180^o. So, a triangle can have all angles as 60^o. Such triangles are called equilateral triangles.

Question 7

The angles of a triangle are arranged in ascending order of magnitude.

If the difference between two consecutive angles is 10^0, find the three angles.

Solution 7

Let three angles be: $(x-10)^0$, x and $(x+10)^0$

$\therefore x^0 + (x-10)^0 + (x+10)^0 = 180^0$ [Sum of all angles of a $\triangle$]

$\Rightarrow 3x = 180^0$

$\Rightarrow x = 60^0$

Since $x = 60^0$

$(x-10^0) = 60^0 - 10^0 = 50^0$

$(x+10^0) = 60^0 + 10^0 = 70^0$

$\therefore$ first angle $= 50^0$

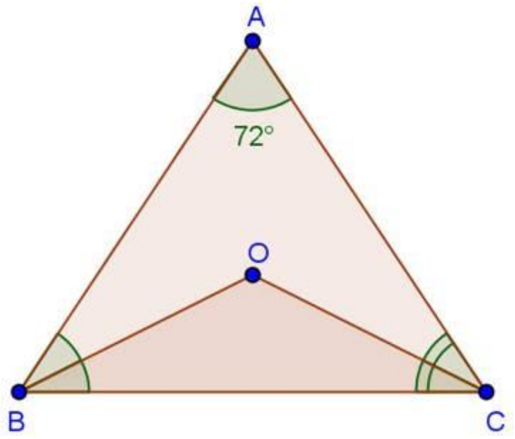
second angle $= 60^0$

third angle $= 70^0$

Question 8

ABC is a triangle in which $\angle A = 72°$, the internal bisectors of angle B and C meet in O. Find the magnitude of $\angle BOC$.

Solution 8



In ΔABC

$\angle A + \angle B + \angle C = 180°$

$\Rightarrow 72° + \angle B + \angle C = 180°$

$\Rightarrow \angle B + \angle C = 108°$

$\Rightarrow \frac{1}{2}\angle B + \frac{1}{2}\angle C = \frac{1}{2}108°$

$\Rightarrow \angle OBC + \angle OCB = 54° \qquad ---(1)$

Now in ΔBOC

$\angle OBC + \angle OCB + \angle BOC = 180°$

$\Rightarrow \quad 54° + \angle BOC = 180°$

$\Rightarrow \quad \angle BOC = 180° - 54°$

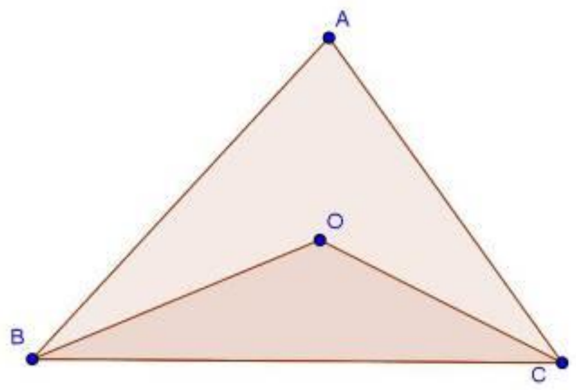
$= 126°$

$\therefore \angle BOC = 126°$

Question 9

The bisectors of the base angles of a triangle can not enclose a right angle in any case.

Solution 9



In $\triangle ABC$

$\angle A + \angle B + \angle C = 180°$ [Sum of all angles of a $\triangle$]

$\Rightarrow \frac{1}{2}\angle A + \frac{1}{2}\angle B + \frac{1}{2}\angle C = 90°$

$\Rightarrow \frac{1}{2}\angle A + \angle OBC + \angle OCB = 90°$ [$\because OB$, OC bisects $\angle B$ and $\angle C$]

$\Rightarrow \angle OBC + \angle OCB = 90° - \frac{1}{2}\angle A$

Now in $\triangle BOC$

$\angle BOC + \angle OBC + \angle OCB = 180°$

$\Rightarrow \angle BOC + 90° - \frac{1}{2}\angle A = 180°$

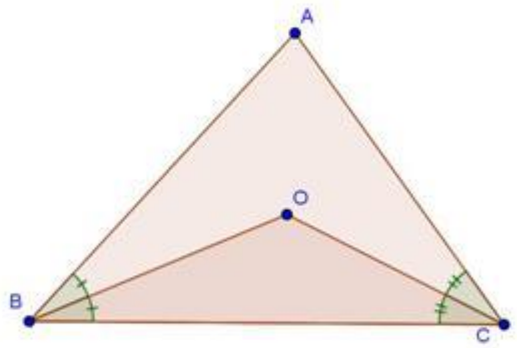
$\Rightarrow \angle BOC = 90° - \frac{1}{2}\angle A$

Hence, bisectors of base angle can not enclose a right angle.

Question 10

The bisectors of base angles of a triangle enclose an angle of 135°, prove that triangle is a right triangle.

Solution 10



Given $\angle BOC = 135^o$

But we know that $\angle BOC = 90^o + \frac{1}{2}\angle A$

$\Rightarrow 135^o = 90^o + \frac{1}{2}\angle A$

$\Rightarrow \frac{1}{2}\angle A = 45^o$

$\Rightarrow \angle A = 90^o$

From this we come to know that ΔABC is right angled triangle right angled at A

Question 11

In a ΔABC, $\angle ABC = \angle ACB$ and the bisectors of $\angle ABC$ and $\angle ACB$ intersect at O such that $\angle BOC = 120°$. Show that $\angle A = \angle B = \angle C = 60°$.

Solution 11

$In\ \Delta ABC$

$\angle ABC = \angle ACB$ (given)

$\Rightarrow \frac{1}{2}\angle ABC = \frac{1}{2}\angle ACB$

$\Rightarrow \angle OBC = \angle OCB \qquad [\because OB, OC \text{ bisects } \angle B \text{ and } \angle C]$

Now

$\angle BOC = 90^\circ + \frac{1}{2}\angle A$

$\Rightarrow 120^\circ = 90^\circ + \frac{1}{2}\angle A$

$\Rightarrow 30^\circ = \frac{1}{2}\angle A$

$\Rightarrow \angle A = 60^\circ$

Nowin ΔABC

$\angle A + \angle ABC + \angle ACB = 180^\circ$ (sum of all angles of a Δ)

$\Rightarrow \quad 60^\circ + 2\angle ABC = 180^\circ$

$\Rightarrow \quad 2\angle ABC = 120^\circ$

$\Rightarrow \quad \angle ABC = 60^\circ$

Since $\angle ABC = \angle ACB$,

$\therefore \angle ACB = 60^\circ$

Henceproved.

Question 12

If each angle of a triangle is less than the sum of the other two, show that the triangle is acute angled.

Solution 12

$\because \angle A < \angle B + \angle C$

$\Rightarrow \angle A + \angle A < \angle A + \angle B + \angle C$

$\Rightarrow 2\angle A < 180^\circ$ (sum of all angles of a Δ)

$\Rightarrow \angle A < 90^\circ$

Similarly $\angle B \angle 90^\circ$ and $\angle C \angle 90^\circ$.

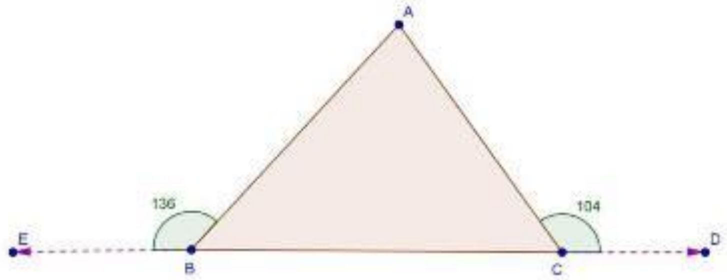
Hence, the triangle is acute angled.

Chapter 11 - Triangle and its Angles Exercise Ex. 11.2

Question 1

The exterior angles, obtained on producing both the base of a triangle both ways are 104º and 136º. Find all the angles of the triangle.

Solution 1



$\angle ACD = \angle ABC + \angle BAC$ [Exterior angle property]

Now $\angle ABC = 180^\circ - 136^\circ = 44^\circ$ [linear pair]

$\angle ACB = 180^\circ - 104^\circ = 76^\circ$ [linear pair]

Now,

In $\triangle ABC$

$\angle A + \angle ABC + \angle ACB = 180^\circ$ [sum of all angles of a $\triangle$]

$\Rightarrow \quad \angle A + 44^\circ + 76^\circ = 180^\circ$

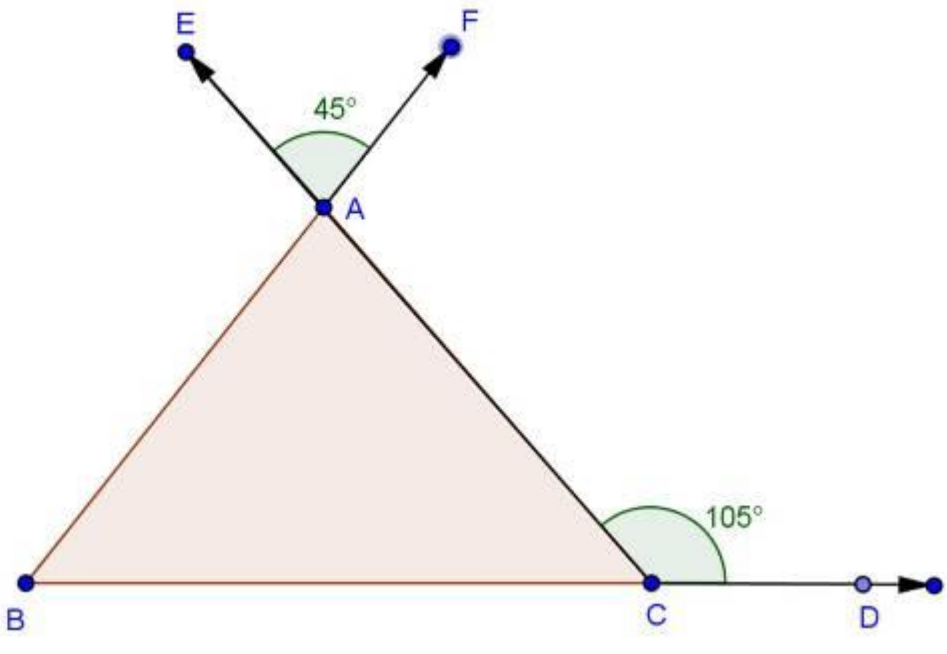
$\Rightarrow \quad \angle A + 120^\circ = 180^\circ$

$\Rightarrow \quad \angle A = 60^\circ$

Question 2

In *fig*. 9.30, the sides BC, CA and AB of a $\triangle ABC$ have been produced to D, E and F respectively. If $\angle ACD = 105^\circ$ and $\angle EAF = 45^\circ$, find all the angles of the $\triangle ABC$.

In fig., the sides BC, CA and AB of a ΔABC have been produced to D, E, and F respectively. If $\angle$ACD = 105° and $\angle$EAF = 45°, find all the angles of the ΔABC.



Solution 2

$\angle BAC = \angle EAF = 45^\circ$ [vertically opposite angles]

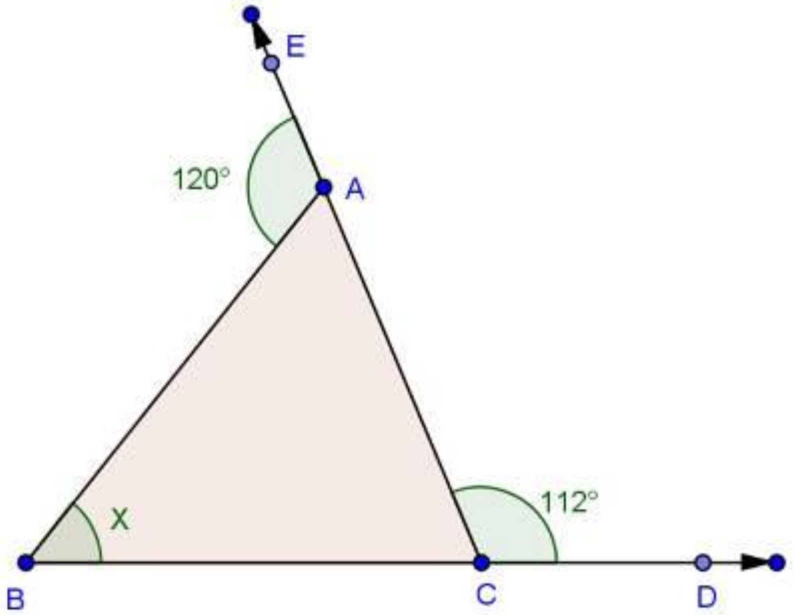
$\angle ABC = 105^\circ - 45^\circ$ [Exterior angle property]

$= 60^\circ$

$\angle ACD = 180^\circ - 105^\circ = 75^\circ$ [linear pair]

Question 3(i)

Compute the value of x in the figure:



Solution 3(i)

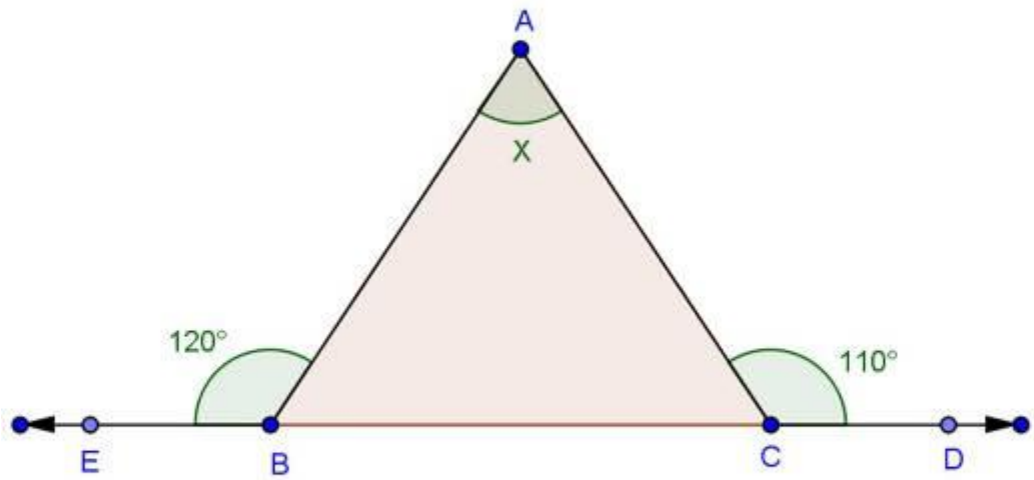
(i) $\angle BAC = 180^\circ - 120^\circ = 60^\circ$ (linear pair)

$\angle ACB = 180^\circ - 112^\circ = 68^\circ$ (linear pair)

$\therefore x = 180^\circ - \angle BAC - \angle ACB = 180^\circ - 60^\circ - 68^\circ = 52^\circ$ (sum of all angles of a $\triangle$)

Question 3(ii)

Compute the value of x in the figure:



Solution 3(ii)

(ii) $\angle ABC = 180^\circ - 120^\circ = 60^\circ$ (linear pair)

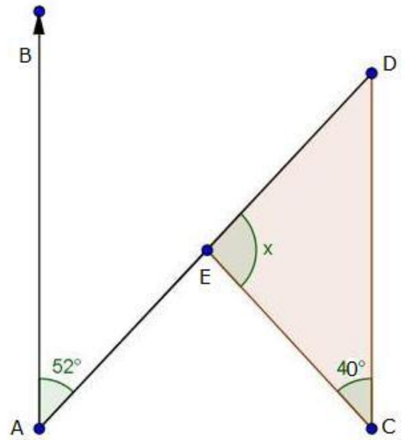
$\angle ACB = 180^\circ - 110^\circ = 70^\circ$ (linear pair)

$\therefore \angle BAC = x = 180^\circ - \angle ABC - \angle ACB$

$= 180^\circ - 60^\circ - 70^\circ = 50^\circ$ (sum of all angles of a $\triangle$)

Question 3(iii)

Compute the value of x in the figure:



Solution 3(iii)

(iii) $\angle BAE = \angle EDC = 52^\circ$ (alternate angles)

$\therefore \angle DEC = x = 180^\circ - 40^\circ - \angle EDC$

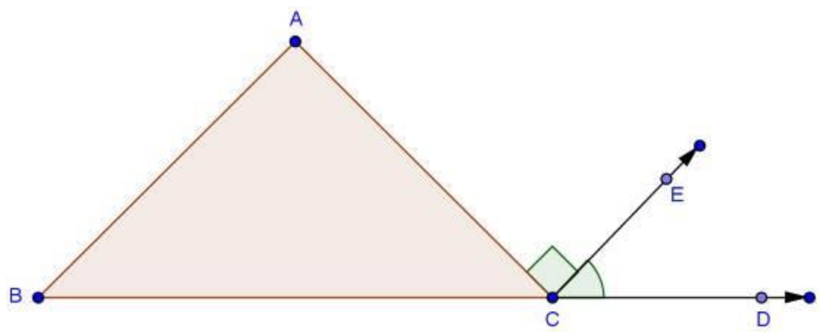
$= 180^\circ - 40^\circ - 52^\circ$

$= 180^\circ - 92^\circ$

$= 88^\circ$ (sum of all angles of a $\triangle$)

Question 4

In fig., AC $\perp$ CE and $\angle$A : $\angle$B : $\angle$C = 3 : 2 : 1, find the value of $\angle$ECD.



Solution 4

$\angle A : \angle B : \angle C = 3 : 2 : 1$

Let the angles be $3x$, $2x$ and x

$\Rightarrow 3x + 2x + x = 180^\circ$ [Angle sum property]

$\Rightarrow 6x = 180^\circ$

$\Rightarrow x = 30^\circ = \angle ACB$

$\therefore \angle ECD = 180^\circ - \angle ACB - 90^\circ$ [linear pair]

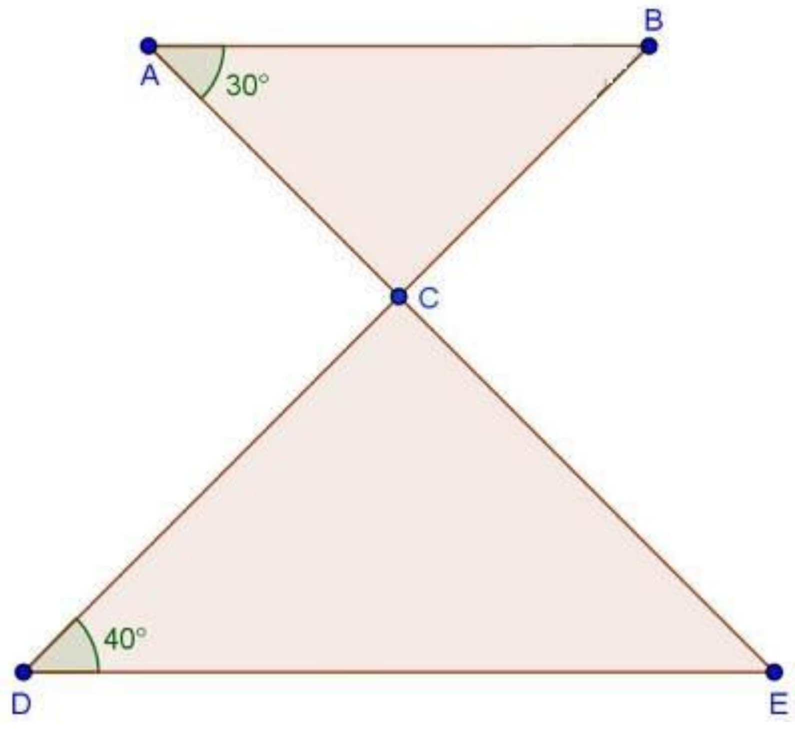
$= 180^\circ - 30^\circ - 90^\circ$

$= 60^\circ$

$\therefore \angle ECD = 60^\circ$

Question 5

In fig. AB $\parallel$ DE. Find $\angle$ACD.



Solution 5

$Since\ AB \parallel DE$

$\therefore \angle ABC = \angle CDE = 40^\circ$ (alternate angles)

$\therefore \angle ACB = 180^\circ - \angle ABC - \angle BAC$

$= 180^\circ - 40^\circ - 30^\circ$

$= 110^\circ$

$\therefore \angle ACD = 180^\circ - 110^\circ$ (linear pair)

$= 70^\circ$

Question 6

Which of the following statements are true (T) and which are false (F):

(i) Sum of the three angles of a triangle is 180°.

(ii) A triangle can have two right angles.

(iii) All the angles of a triangle can be less than 60°.

(iv) All the angles of a triangle can be greater than 60°.

(v) All the angles of a triangle can be *equal* to 60°.

(vi) A triangle can have two obtuse angles.

(vii) A triangle can have at most one obtuse angles.

(viii) If one angle of a triangle is obtuse, then it cannot be a right angled triangle.

(ix) An exterior angle of a triangle is less than either of its interior opposite angles.

(x) An exterior angle of a triangle is equal to the sum of the two interior opposite angles.

(xi) An exterior angle of a triangle is greater than the opposite interior angles.

Solution 6

(i) (T)

(ii) (F)

(iii) (F)

(iv) (F)

(v) (T)

(vi) (F)

(vii) (T)

(viii) (T)

(ix) (F)

(x) (T)

(xi) (T)

Question 7

Fill in the blanks to make the following statements true:

(i) Sum of the angle of triangle is _______ .

(ii) An exterior angle of a triangle is equal to the two _______ opposite angles.

(iii) An exterior angle of a traingle is always ________ than either of the interior oppsite angles.

(iv) A traingle cannot have more than _______ right angles.

(v) A triangles cannot have more than _______ obtuse angles.

Solution 7

(i) 180^o

(ii) interior

(iii) greater

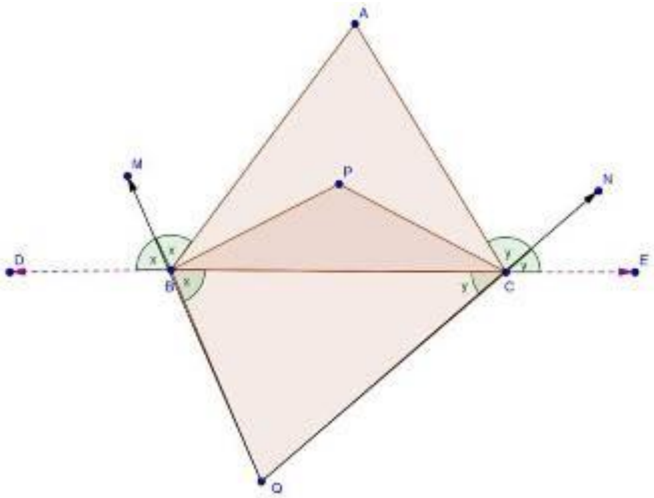
(iv) one

(v) one

Question 8

In a $\triangle ABC$, the internal bisectors of $\angle B$ and $\angle C$ meet at P and the external bisectors of $\angle B$ and $\angle C$ meet at Q. Prove that $\angle BPC + \angle BQC = 180^\circ$.

Solution 8



Let $\angle ABD = 2x$ and $\angle ACE = 2y$

$\angle ABC = 180° - 2x$ (linear pair)

$\angle ACB = 180° - 2y$ (linear pair)

$\angle A + \angle ABC + \angle ACB = 180°$ (sum of all angles of a Δ)

$\Rightarrow \angle A + 180° - 2x + 180° - 2y = 180°$

$\Rightarrow -\angle A + 2x + 2y = 180°$

$\Rightarrow x + y = 90° + \frac{1}{2}\angle A$

Now in ΔBQC

$x + y + \angle BQC = 180°$ (sum of all angles of a Δ)

$\Rightarrow 90° + \frac{1}{2}\angle A + \angle BQC = 180°$

$\Rightarrow \angle BQC = 90° - \frac{1}{2}\angle A$ --- (1)

and we know that $\angle BPC = 90° + \frac{1}{2}\angle A$ --- (2)

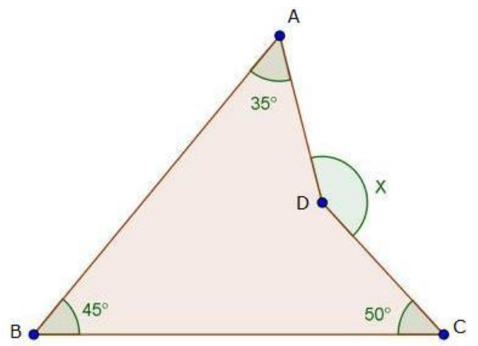
adding (1) and (2) we get

$\angle BPC + \angle BQC = 180°$.

Hence proved.

Question 9

Compute the value of x in the figure:



Solution 9

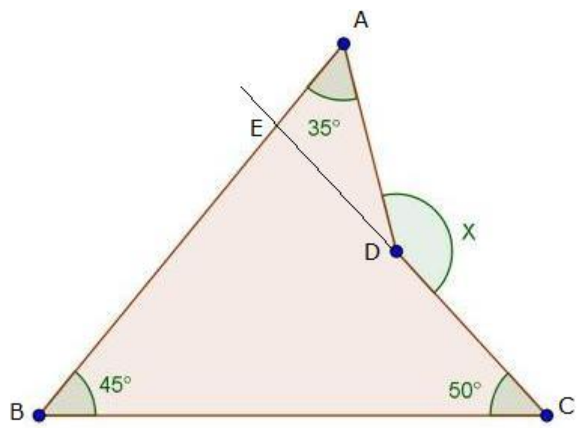
(iv) CD *is produced to meet* AB *at* E.

$\angle BEC = 180^\circ - 45^\circ - 50^\circ$

$= 85^\circ$ (sum of all angles of a $\triangle$)

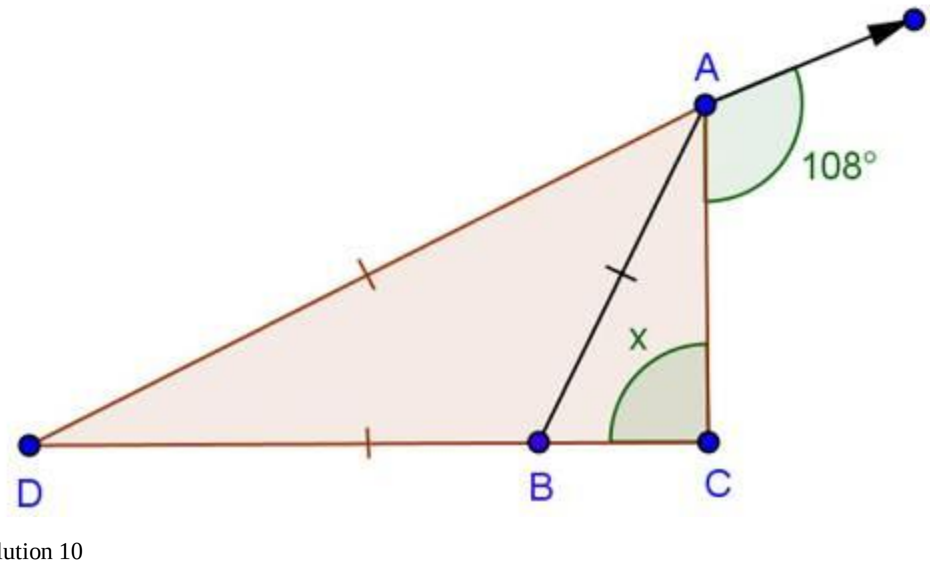
$\angle AEC = 180^\circ - 85^\circ = 95^\circ$ (linear pair)

$\therefore x = 95^\circ + 35^\circ = 130^\circ$ [Exterior angle property]



Question 10

In fig., AB divides $\angle$DAC in the ratio 1 : 3 and AB = DB. Determine the value of x.



Solution 10

Let $\angle BAD = Z, \angle BAC = 3Z$

$\Rightarrow \angle BDA = \angle BAD = Z \ (\because AB = DB)$

Now $\angle BAD + \angle BAC + 108^\circ = 180^\circ$ [linear pair]

$\Rightarrow Z + 3Z + 108^\circ = 180^\circ$

$\Rightarrow \quad 4Z = 72^\circ$

$\Rightarrow \quad Z = 18^\circ$

Now, In $\triangle$ADC

$\angle ADC + \angle ACD = 108^\circ$ [Exterior angle property]

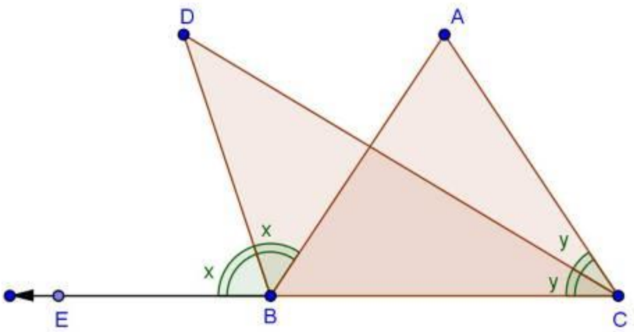
$\Rightarrow x + 18^\circ = 108^\circ$

$\Rightarrow x = 90^\circ$

Question 11

ABC is a triangle. The bisector of the exterior angle at B and the bisector of $\angle C$ intersect each other at D. Prove that $\angle D = \frac{1}{2}\angle A$.

Solution 11



Let $\angle ABE = 2x$ and $\angle ACB = 2y$

$\angle ABC = 180^\circ - 2x$ [linear pair]

$\therefore \ \angle A = 180^\circ - \angle ABC - \angle ACB$ [Angle sum property]

$= 180^\circ - 180^\circ + 2x - 2y$

$= 2(x - y)$ ---(1)

Now, $\angle D = 180^\circ - \angle DBC - \angle DCB$

$\Rightarrow \angle D = 180^\circ - (x + 180^\circ - 2x) - y$

$\Rightarrow \angle D = 180^\circ - x - 180^\circ + 2x - y$

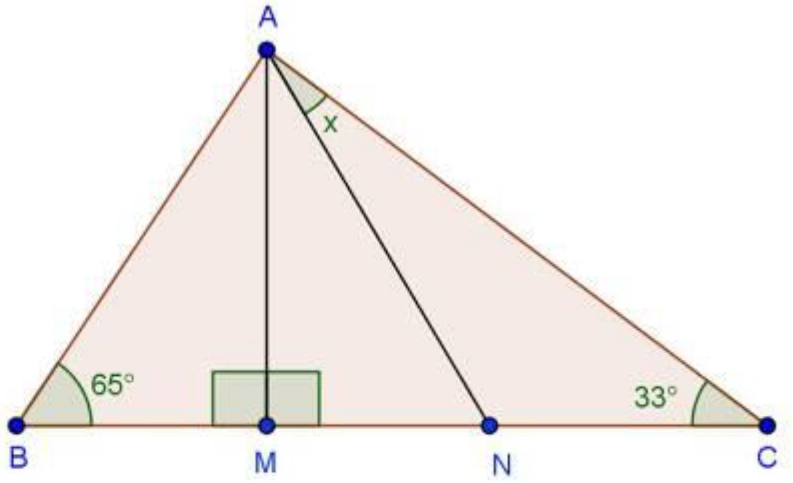
$= (x - y)$

$= \frac{1}{2}\angle A$ ---from (1)

Hence, $\angle D = \frac{1}{2}\angle A$

Question 12

In fig., AM $\perp$ BC and AN is the bisector of $\angle$A. If $\angle$B = 65° and $\angle$C = 33°, find $\angle$MAN.



Solution 12

Let $\angle BAN = \angle NAC = x$ $\quad$ [$\because$ AN bisects $\angle A$]

$\therefore \angle ANM = x + 33^\circ$ $\quad$ [Exterior angle property]

$In \triangle AMB$

$\angle BAM = 90^\circ - 65^\circ = 25^\circ$ $\quad$ [Exterior angle property]

$\therefore \angle MAN = \angle BAN - \angle BAM = (x - 25)^\circ$

Now in $\triangle MAN$,

$(x - 25)^\circ + (x + 33)^\circ + 90^\circ = 180^\circ$ [Angle sum property]

$\Rightarrow 2x + 8^\circ = 90^\circ$

$\Rightarrow \quad 2x = 82^\circ$

$\Rightarrow \quad x = 41^\circ$

$\therefore \angle MAN = x - 25^\circ$

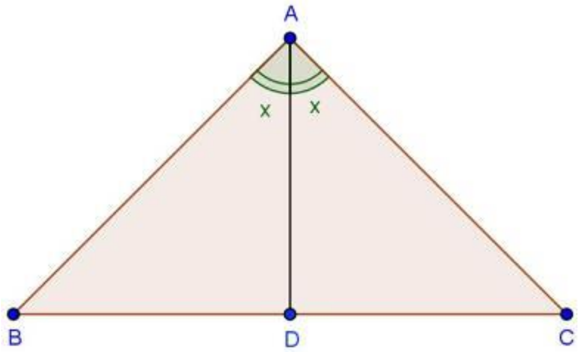
$= 41^\circ - 25^\circ$

$= 16^\circ$

Question 13

In a $\triangle ABC$, AD bisects $\angle A$ and $\angle C > \angle B$. Prove that $\angle ADB > \angle ADC$.

Solution 13



$\because \angle C > \angle B$ (given)

$\Rightarrow \angle C + x > \angle B + x$ (adding both sides x)

$\Rightarrow 180^\circ - \angle ADC > 180^\circ - \angle ADB$

$\Rightarrow -\angle ADC > -\angle ADB$

$\Rightarrow \angle ADB > \angle ADC$

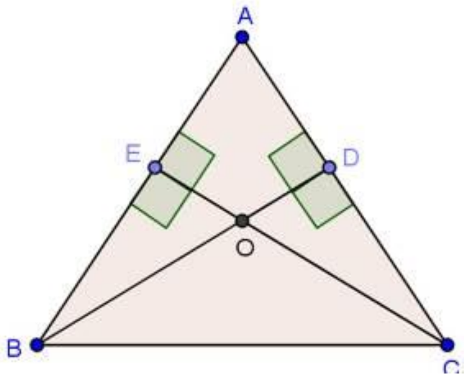
Hence proved.

Question 14

In $\triangle ABC$, $BD \perp AC$ and $CE \perp AB$. If BD and CE intersect at O, Prove that

$\angle BOC = 180^\circ - A$

Solution 14



In quadrilateral $AEOD$

$\angle A + \angle AEO + \angle EOD + \angle ADO = 360^\circ$

$\Rightarrow \angle A + 90^\circ + 90^\circ + \angle EOD = 360^\circ$

$\Rightarrow \quad \angle A + \angle BOC = 180^\circ \quad [\because \angle EOD = \angle BOC$ vertically opposite angles$]$

$\Rightarrow \quad \angle BOC = 180^\circ - \angle A$