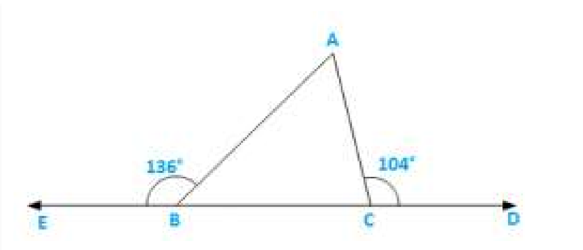
RD SHARMA
Solutions
Class 9 Maths
Chapter 9
Ex *9.2*

Q1) The exterior angles, obtained on producing the base of a triangle both ways are 104^0 and 136^0. Find all the angles of the triangle.

Solution:



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

Now $\angle ABC = 180^0 - 136^0 = 44^0$ [Linera pair]

$\angle ACB = 180^0 - 104^0 = 76^0$ [Linera pair]

Now,

In ΔABC

$\angle A + \angle ABC + \angle ACB = 180^0$ [Sum of all angles of a triangle]

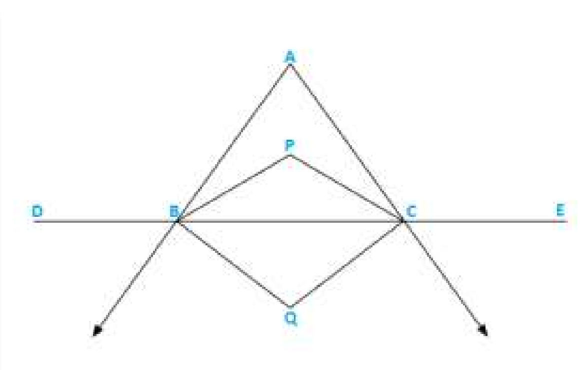
$\Rightarrow \angle A + 44^0 + 76^0 = 180^0$

$\Rightarrow \angle A = 180^0 - 44^0 - 76^0$

$\Rightarrow \angle A = 60^0$

Q2) 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*** $\angle BPC + \angle BQC = 180^0$.

Solution:

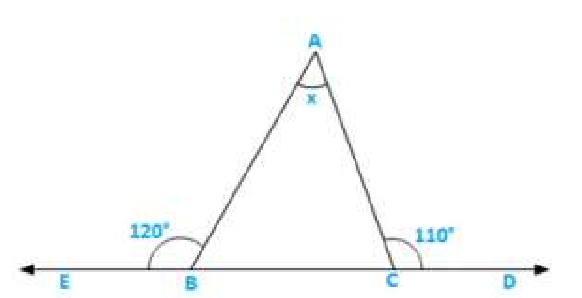


$$\text{Let } \angle ABD = 2x \text{ and } \angle ACE = 2y$$
$$\angle ABC = 180^0 - 2x \quad \text{[Linera pair]}$$
$$\angle ACB = 180^0 - 2y \quad \text{[Linera pair]}$$
$$\angle A + \angle ABC + \angle ACB = 180^0 \quad \text{[Sum of all angles of a triangle]}$$
$$\Rightarrow \angle A + 180^0 - 2x + 180^0 - 2y = 180^0$$
$$\Rightarrow -\angle A + 2x + 2y = 180^0$$
$$\Rightarrow x + y = 90^0 + \tfrac{1}{2}\angle A$$
$$\text{Now in } \Delta BQC$$
$$x + y + \angle BQC = 180^0 \quad \text{[Sum of all angles of a triangle]}$$
$$\Rightarrow 90^0 + \tfrac{1}{2}\angle A + \angle BQC = 180^0$$
$$\Rightarrow \angle BQC = 90^0 - \tfrac{1}{2}\angle A \ldots .(i)$$
$$\text{and we know that } \angle BPC = 90^0 + \tfrac{1}{2}\angle A \ldots .(ii)$$
$$\text{Adding (i) and (ii) we get}$$
$$\angle BPC + \angle BQC = 180^0$$

Hence proved.

Q3) In figure 9.30, the sides BC, CA and AB of a triangle ABC have been produced to D, E and F respectively. If $\angle ACD = 105^0$ and $\angle EAF = 45^0$***, find all the angles of the triangle ABC.***

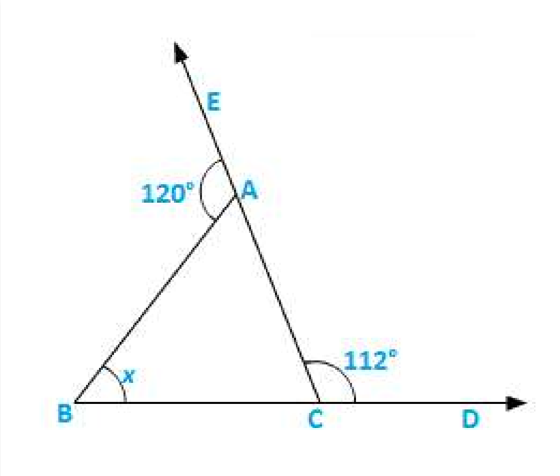
Solution:



$$\angle BAC = \angle EAF = 45^0 \quad \text{[Vertically opposite angles]}$$
$$\angle ABC = 105^0 - 45^0 = 60^0 \quad \text{[Exterior angle property]}$$
$$\angle ACD = 180^0 - 105^0 = 75^0 \quad \text{[Linear pair]}$$

Q4) Compute the value of x in each of the following figures:

(i)



Solution:

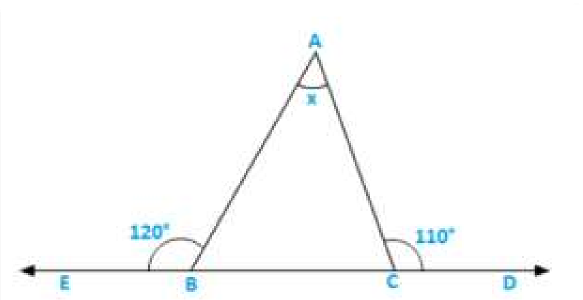
$\angle BAC = 180^0 - 120^0 = 60^0$ [Linear pair]

$\angle ACB = 180^0 - 112^0 = 68^0$ [Linear pair]

$\therefore x = 180^0 - \angle BAC - \angle ACB = 180^0 - 60^0 - 68^0 = 52^0$

[Sum of all angles of a triangle]

(ii)



Solution:

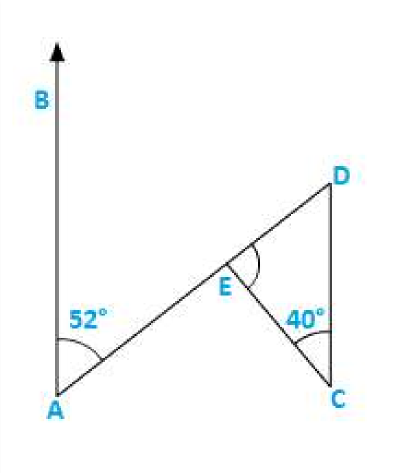
$\angle ABC = 180^0 - 120^0 = 60^0$ [Linear pair]

$\angle ACB = 180^0 - 110^0 = 70^0$ [Linear pair]

$\therefore e\angle BAC = x = 180^0 - \angle ABC - \angle ACB$

$= 180^0 - 60^0 - 70^0 = 50^0$ [Sum of all angles of a triangle]

(iii)



Solution:

$\angle BAE = \angle EDC = 52^0$ [Alternate angles]

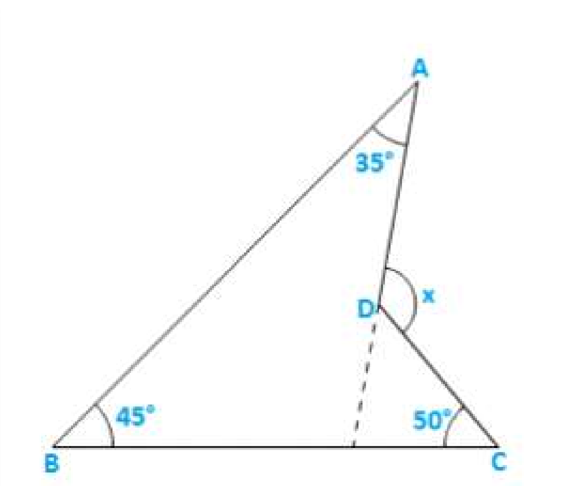
$\therefore \angle DEC = x = 180^0 - 40^0 - \angle EDC$

$= 180^0 - 40^0 - 52^0$

$= 180^0 - 92^0$

$= 88^0$ [Sum of all angles of a triangle]

(iv)



Solution:

CD is produced to meet AB at E.

$\angle BEC = 180^0 - 45^0 - 50^0$

$= 85^0$ [Sum of all angles of a triangle]

$\angle AEC = 180^0 - 85^0 = 95^0$ [Linear pair]

$\therefore x = 95^0 + 35^0 = 130^0$ [Exterior angle property]

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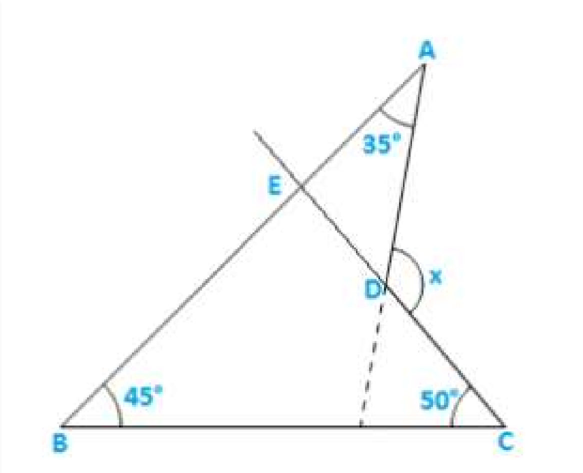
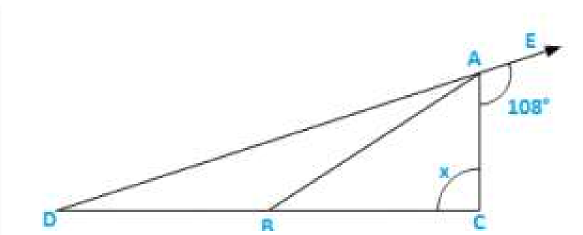


Q5) In figure 9.35, AB divides $\angle DAC$ in the ratio 1 : 3 and AB = DB. Determine the value of x.

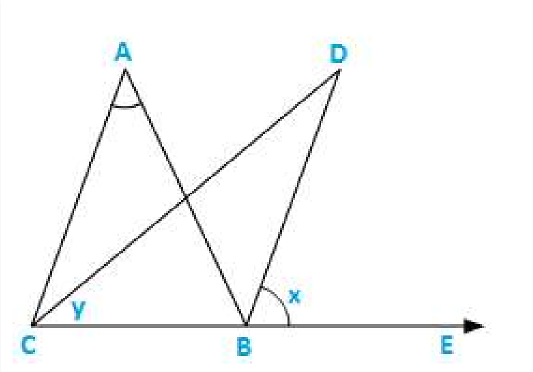


Solution:

$$\text{Let } \angle BAD = Z, \angle BAC = 3Z$$
$$\Rightarrow \angle BDA = \angle BAD = Z \quad (\because AB = DB)$$
$$\text{Now } \angle BAD + \angle BAC + 108^0 = 180^0 \quad \text{[Linear pair]}$$
$$\Rightarrow Z + 3Z + 108^0 = 180^0$$
$$\Rightarrow 4Z = 72^0$$
$$\Rightarrow Z = 18^0$$
$$\text{Now, In } \Delta ADC$$
$$\angle ADC + \angle ACD = 108^0 \quad \text{[Exterior angle property]}$$
$$\Rightarrow x + 18^0 = 180^0$$
$$\Rightarrow x = 90^0$$

Q6) 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:



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

$\angle ABC = 180^0 - 2x$ [Linear pair]

$\therefore \angle A = 180^0 - \angle ABC - \angle ACB$ [Angle sum property]

$= 180^0 - 180^0 + 2x + 2y$

$= 2(x - y)$ .....(i)

Now, $\angle D = 180^0 - \angle DBC - \angle DCB$

$\Rightarrow \angle D = 180^0 - (x + 180^0 - 2x) - y$

$\Rightarrow \angle D = 180^0 - x - 180^0 + 2x - y$

$= (x - y)$

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

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

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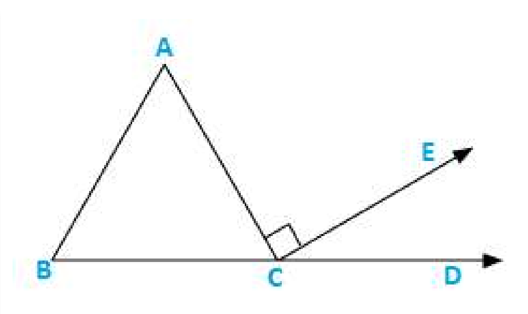
Q7) In figure 9.36, $AC \perp CE$ and $\angle A : \angle B : \angle C = 3 : 2 : 1$, find



Solution:

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

Let the angles be 3x, 2x and x

$\Rightarrow 3x + 2x + x = 180^0$ [Angle sum property]

$\Rightarrow 6x = 180^0$

$\Rightarrow x = 30^0 = \angle ACB$

$\therefore \angle ECD = 180^0 - \angle ACB - 90^0$ [Linear pair]

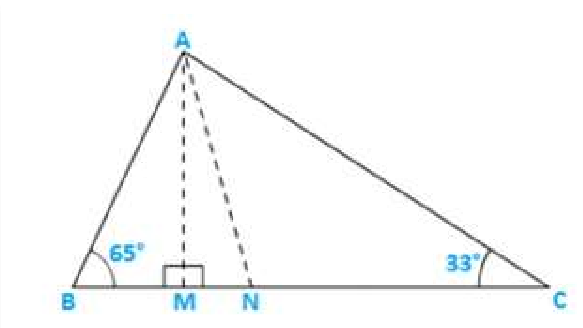
$= 180^0 - 30^0 - 90^0$

$= 60^0$

$\therefore \angle ECD = 60^0$

Q8) In figure 9.37,

AM $\perp$ BC and AN is the bisector of $\angle A$. If $\angle B = 65^0$ and $\angle C = 33^0$, find $\angle MAN$..



Solution:

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

$\therefore \angle ANM = x + 33^0$ [Exterior angle property]

In ΔAMB

$\angle BAM = 90^0 - 65^0 = 25^0$ [Exterior angle property]

$\therefore \angle MAN = \angle BAN - \angle BAM = (x - 25)^0$

Now in ΔMAN,

$(x - 25)^0 + (x + 33)^0 + 90^0 = 180^0$ [Angle sum property]

$\Rightarrow 2x + 8^0 = 90^0$

$\Rightarrow 2x = 82^0$

$\Rightarrow x = 41^0$

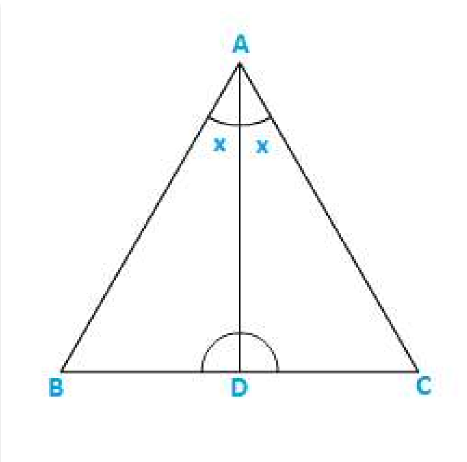
$\therefore MAN = x - 25^0$

$= 41^0 - 25^0$

$= 16^0$

Q9) In a triangle ABC, AD bisects $\angle A$ and $\angle C > \angle B$. Prove that $\angle ADB > \angle ADC$..

Solution:



$\because \angle C > \angle B$ [Given]

$\Rightarrow \angle C + x > \angle B + x$ [Adding x on both sides]

⇒ 180° – ∠ ADC>180^{0} – ∠ ADB

⇒ -∠ ADC> – ∠ ADB

⇒ ∠ ADB > ∠ ADC

Hence proved.

Q10) In triangle ABC,
$BD \perp AC$ and $CE \perp AB$. If BD and CE intersect at O, prove that $\angle BOC = 180^0 - \angle A$

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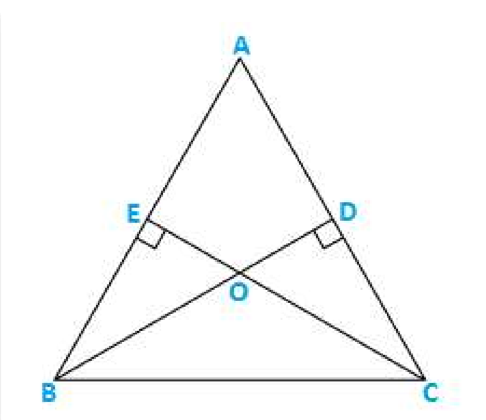
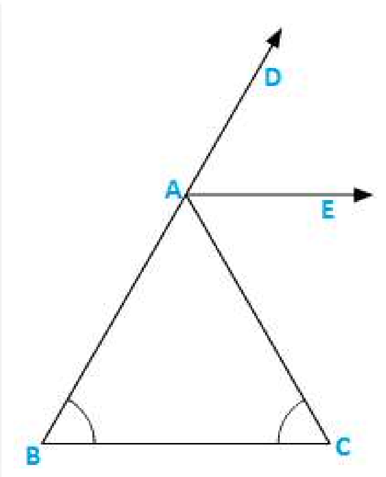
Solution:



In quadrilateral AEOD

$$\angle A + \angle AEO + \angle EOD + \angle ADO = 360^0$$
$$\Rightarrow \angle A + 90^0 + 90^0 + \angle EOD = 360^0$$
$$\Rightarrow \angle A + \angle BOC = 180^0 \quad [\because \angle EOD = \angle BOC \text{ vertically opposite angles}]$$
$$\Rightarrow \angle BOC = 180^0 - \angle A$$

Q11) In figure 9.38, AE bisects $\angle CAD$ and $\angle B = \angle C$. Prove that $AE \parallel BC$.



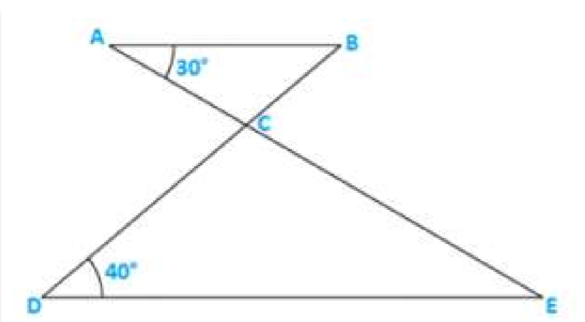
Solution:

$$\text{Let } \angle B = \angle C = x$$
$$\text{Then,}$$
$$\angle CAD = \angle B + \angle C = 2x \qquad \text{(exterior angle)}$$
$$\Rightarrow \frac{1}{2}\angle CAD = x$$
$$\Rightarrow \angle EAC = x$$
$$\Rightarrow \angle EAC = \angle C$$

These are alternate interior angles for the lines AE and BC

$\therefore AE \parallel BC$

Q12) In figure 9.39, $AB \parallel DE$. Find $\angle ACD$.



Solution:

Since $AB \parallel DE$

$\therefore \angle ABC = \angle CDE = 40^0$ [Alternate angles]

$\therefore \angle ACB = 180^0 - \angle ABC - \angle BAC$

$= 180^0 - 40^0 - 30^0$

$= 110^0$

$\therefore \angle ACD = 180^0 - 110^0$ [Linear pair]

$= 70^0$

Q13) . 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:

(i) T

(ii) F

(iii) F

(iv) F

(v) T

(vi) F

(vii) T

(viii) T

(ix) F

(x) T

(xi) T

Q14) Fill in the blanks to make the following statements true:

(i) Sum of the angles of a triangle is _______ .

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

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

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

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

Solution:

(i) 180^0

(ii) Interior

(iii) Greater

(iv) One

(v) One