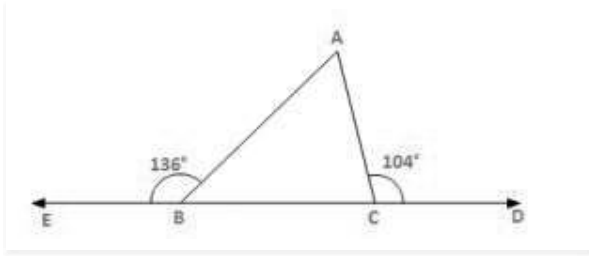


Q1) The exterior angles, obtained on producing the base of a triangle both ways are 104° and 136° . Find all the angles of the triangle.

Solution:



$$\angle ACD = \angle ABC + \angle BAC \quad [\text{Exterior angle property}]$$

$$\text{Now } \angle ABC = 180^\circ - 136^\circ = 44^\circ \quad [\text{Linear pair}]$$

$$\angle ACB = 180^\circ - 104^\circ = 76^\circ \quad [\text{Linear pair}]$$

Now,

In $\triangle ABC$

$$\angle A + \angle ABC + \angle ACB = 180^\circ \quad [\text{Sum of all angles of a triangle}]$$

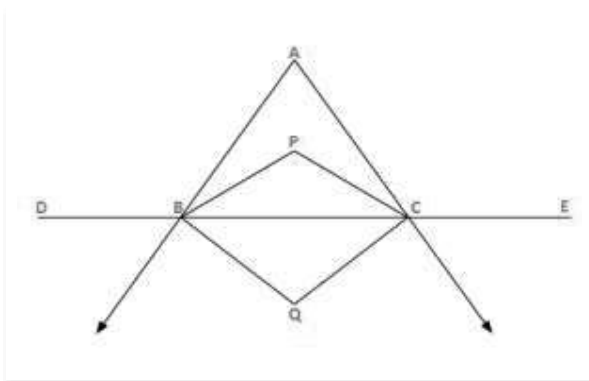
$$\Rightarrow \angle A + 44^\circ + 76^\circ = 180^\circ$$

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

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

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 $\angle BPC + \angle BQC = 180^\circ$.

Solution:



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

$$\angle ABC = 180^\circ - 2x \quad [\text{Linear pair}]$$

$$\angle ACB = 180^\circ - 2y \quad [\text{Linear pair}]$$

$$\angle A + \angle ABC + \angle ACB = 180^\circ \quad [\text{Sum of all angles of a triangle}]$$

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

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

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

Now in $\triangle BQC$

$$x + y + \angle BQC = 180^\circ \quad [\text{Sum of all angles of a triangle}]$$

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

$$\Rightarrow \angle BQC = 90^\circ - \frac{1}{2}\angle A \dots (i)$$

$$\text{and we know that } \angle BPC = 90^\circ + \frac{1}{2}\angle A \dots (ii)$$

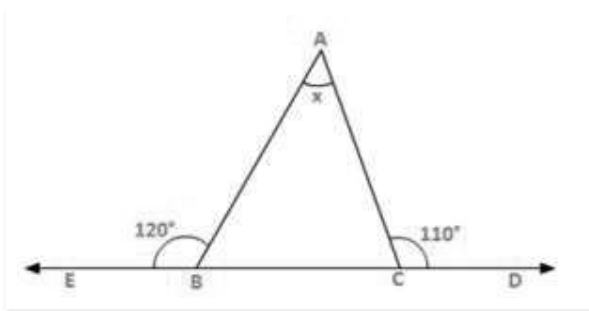
Adding (i) and (ii) we get

$$\angle BPC + \angle BQC = 180^\circ$$

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 $\angle ACD = 105^\circ$ and $\angle EAF = 45^\circ$, find all the angles of the triangle ABC.

Solution:



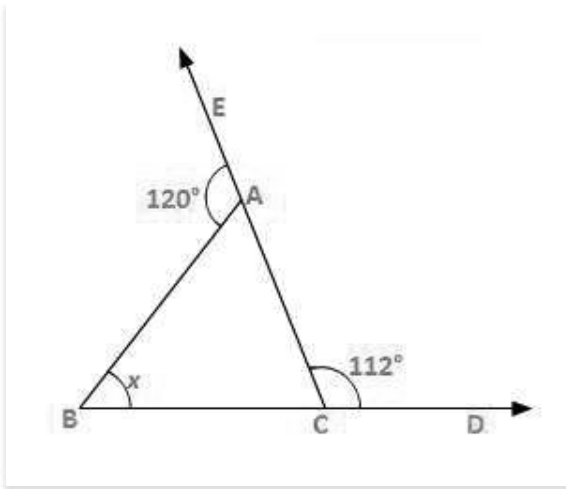
$$\angle BAC = \angle EAF = 45^\circ \quad [\text{Vertically opposite angles}]$$

$$\angle ABC = 105^\circ - 45^\circ = 60^\circ \quad [\text{Exterior angle property}]$$

$$\angle ACD = 180^\circ - 105^\circ = 75^\circ \quad [\text{Linear pair}]$$

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

(i)



Solution:

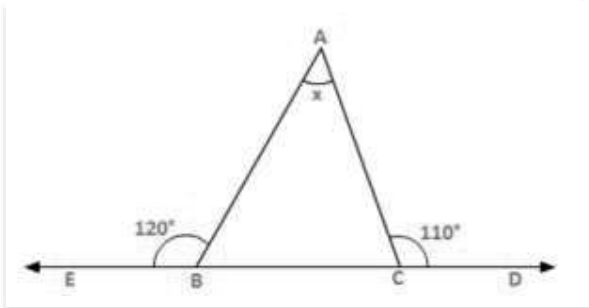
$$\angle BAC = 180^0 - 120^0 = 60^0 \quad [\text{Linear pair}]$$

$$\angle ACB = 180^0 - 112^0 = 68^0 \quad [\text{Linear pair}]$$

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

[Sum of all angles of a triangle]

(ii)



Solution:

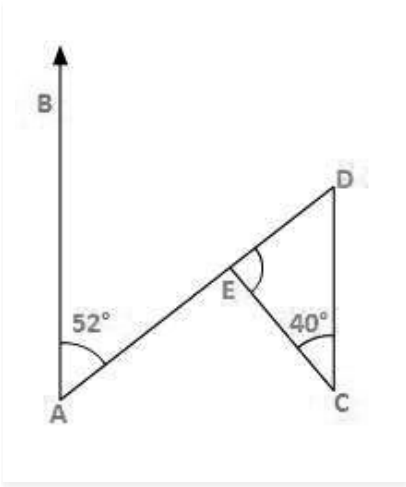
$$\angle ABC = 180^0 - 120^0 = 60^0 \quad [\text{Linear pair}]$$

$$\angle ACB = 180^0 - 110^0 = 70^0 \quad [\text{Linear pair}]$$

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

$$= 180^0 - 60^0 - 70^0 = 50^0 \quad [\text{Sum of all angles of a triangle}]$$

(iii)



Solution:

$$\angle BAE = \angle EDC = 52^{\circ} \quad [\text{Alternate angles}]$$

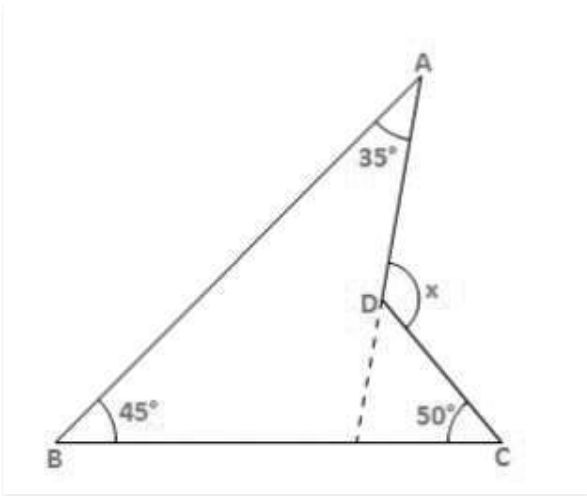
$$\therefore \angle DEC = x = 180^{\circ} - 40^{\circ} - \angle EDC$$

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

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

$$= 88^{\circ} \quad [\text{Sum of all angles of a triangle}]$$

(iv)



Solution:

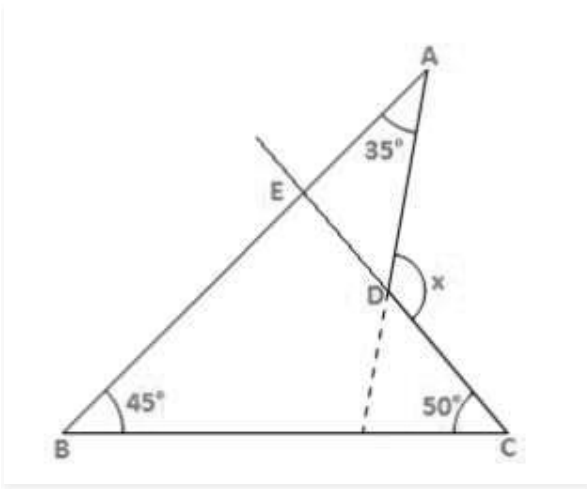
CD is produced to meet AB at E.

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

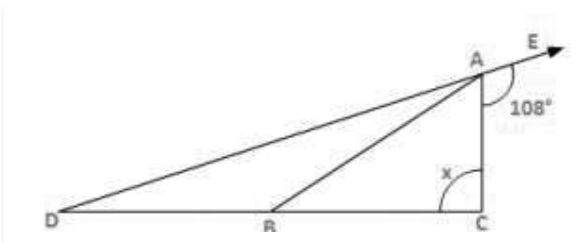
$$= 85^{\circ} \quad [\text{Sum of all angles of a triangle}]$$

$$\angle AEC = 180^{\circ} - 85^{\circ} = 95^{\circ} \quad [\text{Linear pair}]$$

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



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



Solution:

$$\text{Let } \angle BAD = Z, \angle BAC = 3Z$$

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

$$\text{Now } \angle BAD + \angle BAC + 108^\circ = 180^\circ \quad [\text{Linear pair}]$$

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

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

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

Now, In $\triangle ADC$

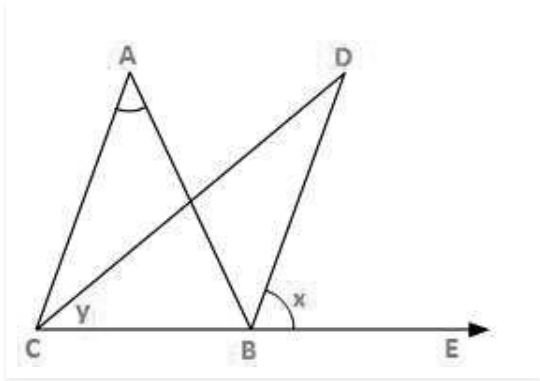
$$\angle ADC + \angle ACD = 108^\circ \quad [\text{Exterior angle property}]$$

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

$$\Rightarrow x = 90^\circ$$

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 $\angle ACB = 2y$

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

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

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

$$= 2(x + y) \quad \dots\dots(i)$$

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

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

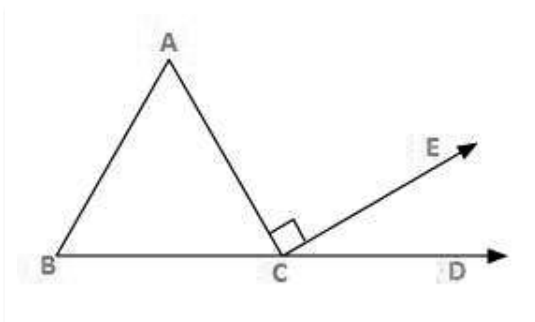
$$\Rightarrow \angle D = 180^\circ - x - 180^\circ + 2x - y$$

$$= (x - y)$$

$$= \frac{1}{2} \angle A \quad \dots\dots \text{from}(i)$$

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

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

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

$$\Rightarrow 6x = 180^0$$

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

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

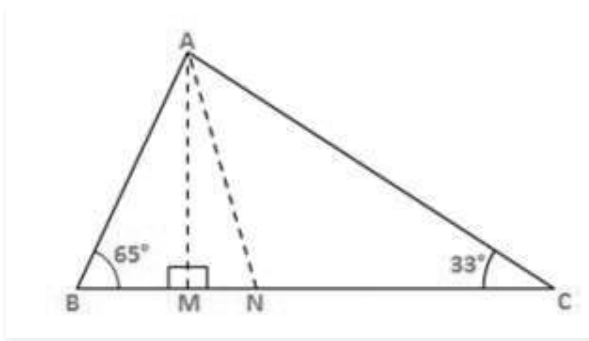
$$= 180^0 - 30^0 - 90^0$$

$$= 60^0$$

$$\therefore \angle ECD = 60^0$$

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:

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

$$\therefore \angle ANM = x + 33^0 \quad [\text{Exterior angle property}]$$

In $\triangle AMB$

$$\angle BAM = 90^0 - 65^0 = 25^0 \quad [\text{Exterior angle property}]$$

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

Now in $\triangle MAN$,

$$(x - 25)^0 + (x + 33)^0 + 90^0 = 180^0 \quad [\text{Angle sum property}]$$

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

$$\Rightarrow 2x = 82^0$$

$$\Rightarrow x = 41^0$$

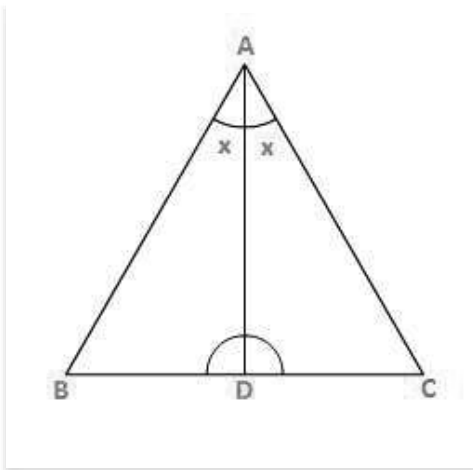
$$\therefore \angle MAN = x - 25^0$$

$$= 41^0 - 25^0$$

$$= 16^0$$

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

Solution:



$$\because \angle C > \angle B \quad [\text{Given}]$$

$$\Rightarrow \angle C + x > \angle B + x \quad [\text{Adding } x \text{ on both sides}]$$

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

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

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

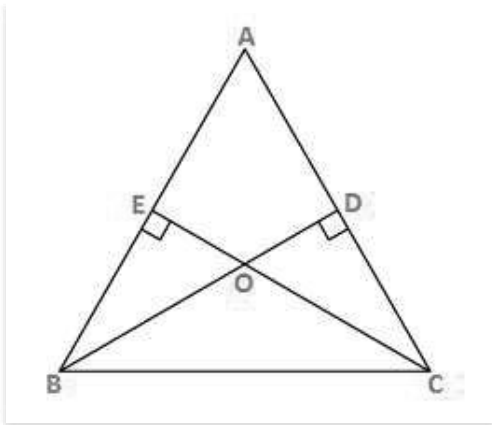
Hence proved.

Q10) In triangle ABC,

BD $\perp$ AC and CE $\perp$ AB. If BD and CE intersect at O, prove that $\angle BOC = 180^\circ - \angle A$

.

Solution:



In quadrilateral AEOD

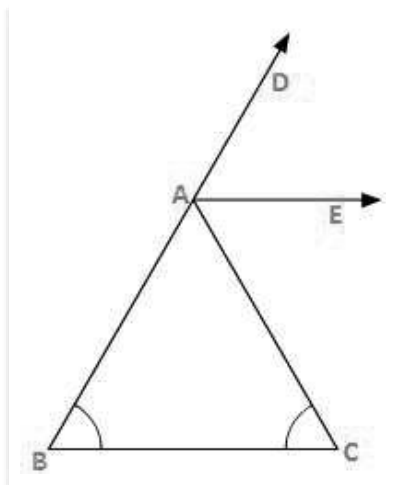
$$\angle A + \angle AEO + \angle EOD + \angle ADO = 360^\circ$$

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

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

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

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



Solution:

Let $\angle B = \angle C = x$

Then,

$\angle CAD = \angle B + \angle C = 2x$ (exterior angle)

$\Rightarrow \frac{1}{2} \angle CAD = x$

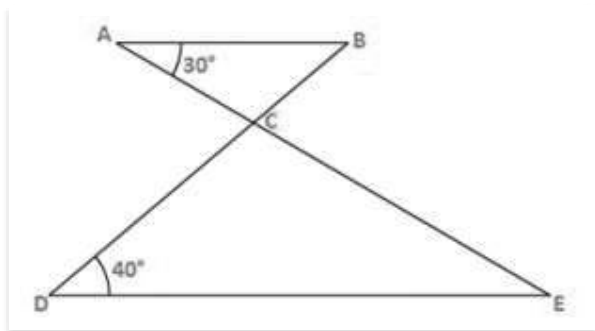
$\Rightarrow \angle EAC = x$

$\Rightarrow \angle EAC = \angle C$

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 $AB \parallel DE$

$$\begin{aligned}
&\therefore \angle ABC = \angle CDE = 40^0 \quad [\text{Alternate angles}] \\
&\therefore \angle ACB = 180^0 - \angle ABC - \angle BAC \\
&= 180^0 - 40^0 - 30^0 \\
&= 110^0 \\
&\therefore \angle ACD = 180^0 - 110^0 \quad [\text{Linear pair}] \\
&= 70^0
\end{aligned}$$

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°

(ii) Interior

(iii) Greater

(iv) One

(v) One