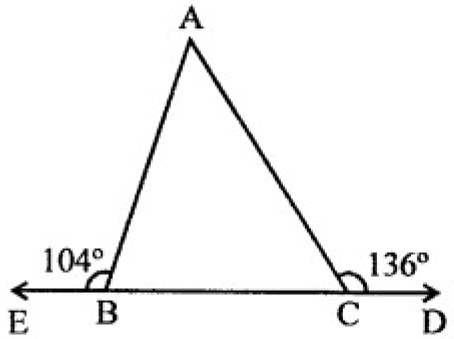
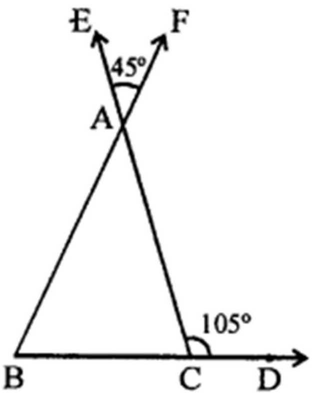
# RD Sharma Solutions Class 9 Chapter 11 Coordinate Geometry Ex 11.2

Question 1.
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:
In ΔABC, base BC is produced both ways to D and E respectivley forming ∠ABE = 104° and ∠ACD = 136°



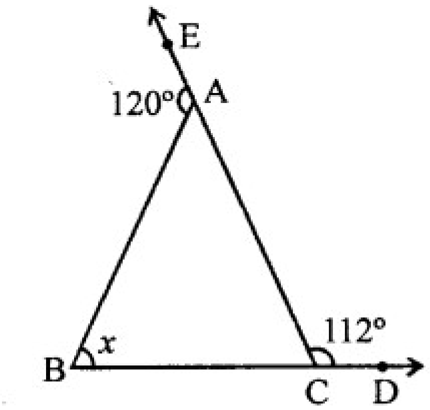

$\because$ ∠ABC + ∠ABE = 180° (Linear pair)
$\Rightarrow$ ∠ABC + 104° = 180°
$\Rightarrow$ ∠ABC = 180° – 104°
$\therefore$ ∠ABC = 76°
Similarly, ∠ACB + ∠ACD = 180°
$\Rightarrow$ ∠ACB + 136° = 180°
$\Rightarrow$ ∠ACB = 180° – 136° = 44°
But ∠ABC + ∠ACB + ∠BAC = 180° (Angles of a triangle)
$\Rightarrow$ 76° + 44° + ∠BAC = 180°
$\Rightarrow$ 120° + ∠BAC = 180°
$\Rightarrow$ ∠BAC = 180° – 120° = 60°
Hence angles of the triangle are 60°, 76°, 44°

Question 2.
In the figure, the sides BC, CA and AB of a ΔABC have been produced to D, E and F respectively. If ∠ACD = 105° and ∠EAF = 45°, find all the angles of the ΔABC.

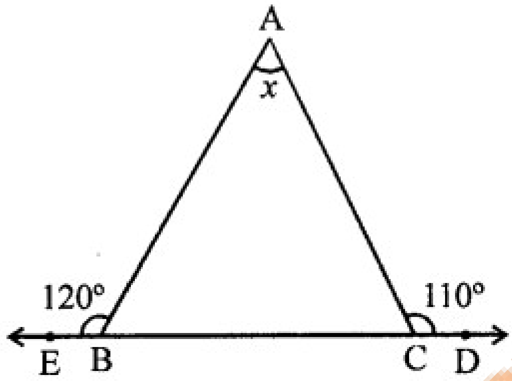



Solution:
In ΔABC, sides BC, CA and BA are produced to D, E and F respectively.
∠ACD = 105° and ∠EAF = 45°
∠ACD + ∠ACB = 180° (Linear pair)
⇒ 105° + ∠ACB = 180°
⇒ ∠ACB = 180°- 105° = 75°
∠BAC = ∠EAF (Vertically opposite angles)
= 45°
But ∠BAC + ∠ABC + ∠ACB = 180°
⇒ 45° + ∠ABC + 75° = 180°
⇒ 120° +∠ABC = 180°
⇒ ∠ABC = 180°- 120°
∴ ∠ABC = 60°
Hence ∠ABC = 60°, ∠BCA = 75°
and ∠BAC = 45°

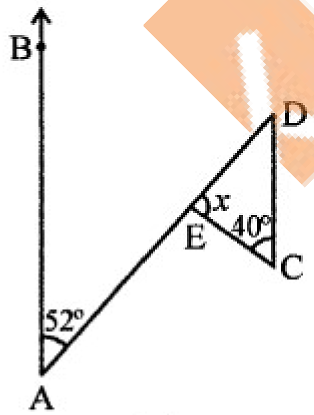
Question 3.
Compute the value of x in each of the following figures:



(i)



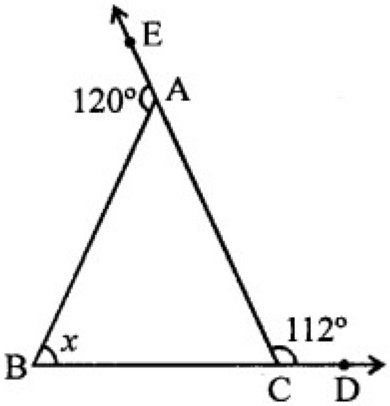
(ii)



(iii)



Solution:
(i) In ΔABC, sides BC and CA are produced to D and E respectively




$\angle ACD = 112°$ and $\angle BAE = 120°$

$\angle ACB + \angle ACD = 180°$ (Linear pair)

$\Rightarrow \angle ACB + 112° = 180°$

$\Rightarrow \angle ACB = 180° - 112° = 68°$

Similarly,

$\angle BAE + \angle BAC = 180°$ (Linear pair)

$\Rightarrow 120° + \angle BAC = 180°$

$\Rightarrow \angle BAC = 180° - 120° = 60°$

But $\angle BAC + \angle ABC + \angle BCA = 180°$

(Angles of a triangle)

$\Rightarrow 60° + x + 68° = 180°$

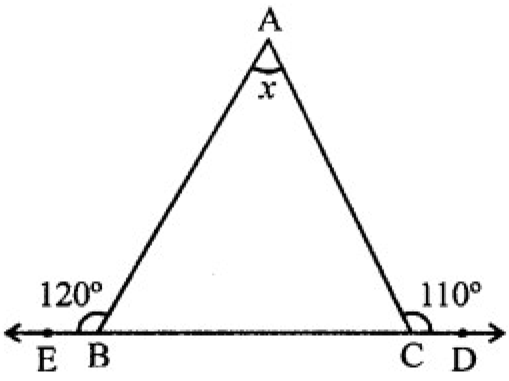
$\Rightarrow 128° + x = 180° \Rightarrow x = 180° - 128° = 52°$

$\therefore x = 52°$

(ii) In ΔABC, side BC is produced to either side to D and E respectively

∠ABE = 120° and ∠ACD =110°

∵ ∠ABE + ∠ABC = 180° (Linear pair)




$\Rightarrow 120° + \angle ABC = 180°$

$\Rightarrow \angle ABC = 180° - 120° = 60°$

Similarly,

$\angle ACB + \angle ACD = 180°$ (Linear pair)

$\Rightarrow \angle ACB + 110° = 180°$

$\Rightarrow \angle ACB = 180° - 110° = 70°$

But $\angle BAC + \angle ABC + \angle ACB = 180°$

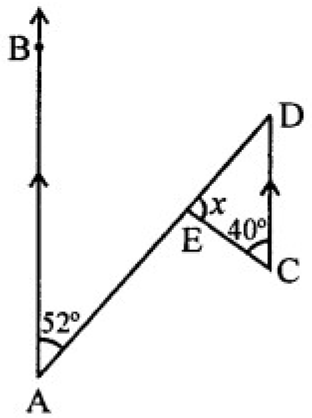
(Angles of a triangle)

$\Rightarrow x + 60° + 70° = 180°$

$\Rightarrow x + 130° = 180° \Rightarrow x = 180° - 130°$

$\therefore x = 50°$

(iii) In the figure, BA || DC




$\angle BAD = 52°$ and $\angle DCE = 40°$

$\because$ BA || DC and AD is the transversal

$\therefore \angle ABD = \angle BDC$ (Alternate angles)

$\therefore \angle ADC = 52°$ or $\angle EDC = 52°$

Now in $\Delta DCE$,

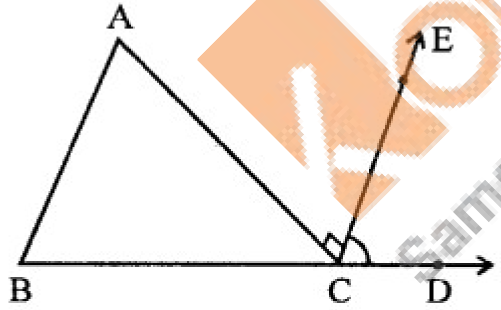
$\angle EDC + \angle ECD + \angle DEC = 180°$ (Angles of a triangle)

$\Rightarrow 52° + 40° + x = 180°$

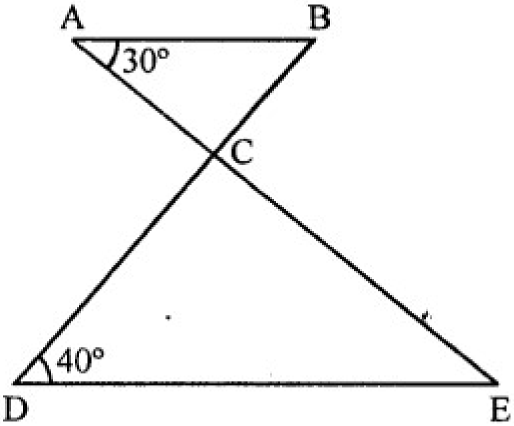
$\Rightarrow 92° + x = 180° \Rightarrow x = 180° - 92°$

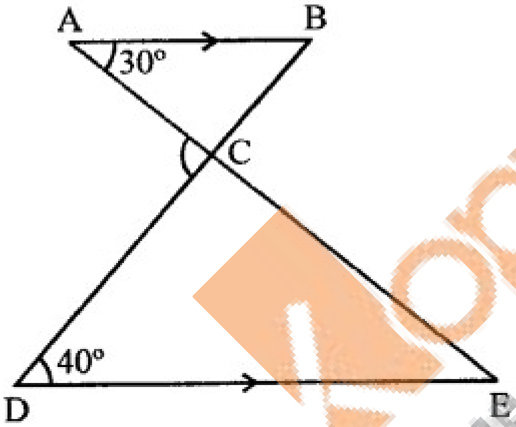
$\therefore x = 88°$

Question 4.
In the figure, $AC \perp CE$ and $\angle A : \angle B : \angle C = 3:2:1$, find the value of $\angle ECD$.




Solution:
In $\Delta ABC$, $\angle A : \angle B : \angle C = 3 : 2 : 1$
BC is produced to D and $CE \perp AC$
$\because \angle A + \angle B + \angle C = 180°$ (Sum of angles of a triangles)
Let $\angle A = 3x$, then $\angle B = 2x$ and $\angle C = x$
$\therefore 3x + 2x + x = 180° \Rightarrow 6x = 180°$
$\Rightarrow x = \frac{180°}{6} = 30°$
$\therefore \angle A = 3x = 3 \times 30° = 90°$
$\angle B = 2x = 2 \times 30° = 60°$
$\angle C = x = 30°$
In $\Delta ABC$,
Ext. $\angle ACD = \angle A + \angle B$

⇒ 90° + ∠ECD = 90° + 60° = 150°
∴ ∠ECD = 150°-90° = 60°
Question 5.
In the figure, AB || DE, find ∠ACD.


Solution:
In the figure, AB || DE
AE and BD intersect each other at C ∠BAC = 30° and ∠CDE = 40°
∵ AB || DE
∴ ∠ABC = ∠CDE (Alternate angles)


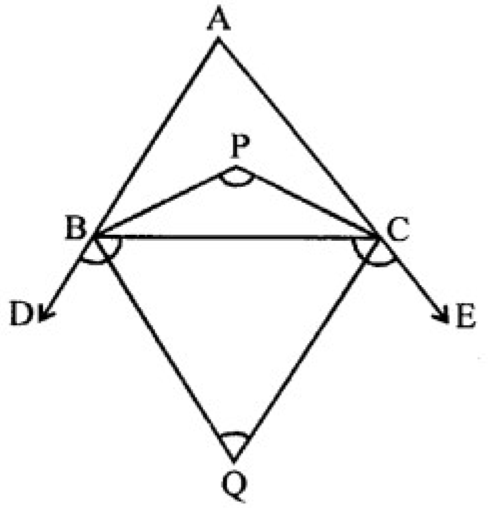

⇒ ∠ABC = 40°
In ΔABC, BC is produced
Ext. ∠ACD = Int. ∠A + ∠B
= 30° + 40° = 70°

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.

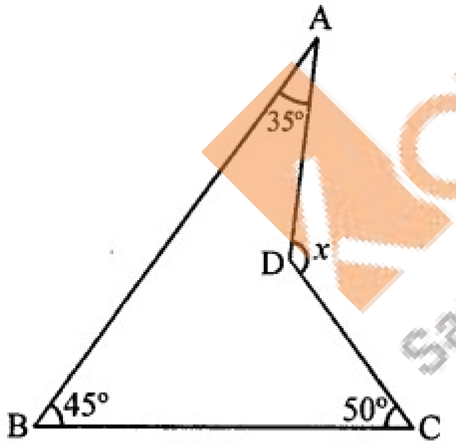
(x) An exterior angle of a triangle is equal to the sum of the two interior opposite angles.
(xi) An exterior angle of a triangle is greater than the opposite interior angles.
Solution:
(i) True.
(ii) False. A right triangle has only one right angle.
(iii) False. In this, the sum of three angles will be less than 180° which is not true.
(iv) False. In this, the sum of three angles will be more than 180° which is not true.
(v) True. As sum of three angles will be 180° which is true.
(vi) False. A triangle has only one obtuse angle.
(vii) True.
(viii)True.
(ix) False. Exterior angle of a triangle is always greater than its each interior opposite angles.
(x) True.
(xi) True.

Question 7.
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) Sum of the angles of a triangle is 180°.
(ii) An exterior angle of a triangle is equal to the two interior opposite angles.
(iii) An exterior angle of a triangle is always greater than either of the interior opposite angles.
(iv) A triangle cannot have more than one right angles.
(v) A triangles cannot have more than one obtuse angles.

Question 8.
In a ΔABC, the internal bisectors of ∠B and ∠C meet at P and the external bisectors of ∠B and ∠C meet at Q. Prove that ∠BPC + ∠BQC = 180°.
Solution:
Given : In ΔABC, sides AB and AC are produced to D and E respectively. Bisectors of interior ∠B and ∠C meet at P and bisectors of exterior angles B and C meet at Q.

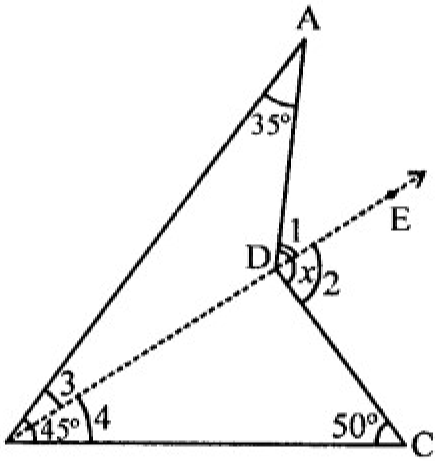



To prove : ∠BPC + ∠BQC = 180°
Proof : ∵ PB and PC are the internal bisectors of ∠B and ∠C
∠BPC = 90°+ 12 ∠A ...(i)
Similarly, QB and QC are the bisectors of exterior angles B and C
∴ ∠BQC = 90° + 12 ∠A ...(ii)
Adding (i) and (ii),
∠BPC + ∠BQC = 90° + 12 ∠A + 90° − 12 ∠A
= 90° + 90° = 180°
Hence ∠BPC + ∠BQC = 180°
Question 9.
In the figure, compute the value of x.




Solution:
In the figure,

∠ABC = 45°, ∠BAD = 35° and ∠BCD = 50° Join BD and produce it E




In ΔABD,

Ext. ∠1 = ∠A + ∠3 ...(i)

and in ΔCBD,

Ext. ∠2 = ∠C + ∠4 ...(ii)

Adding, we get

∠1 + ∠2 = ∠A + ∠3 + ∠C + ∠4

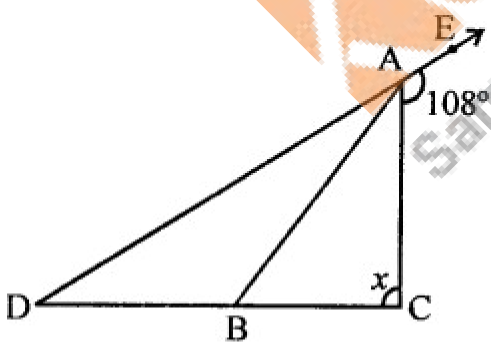
⇒ $x$ = ∠A + ∠3 + ∠4 + ∠C

⇒ $x$ = ∠A + ∠B + ∠C

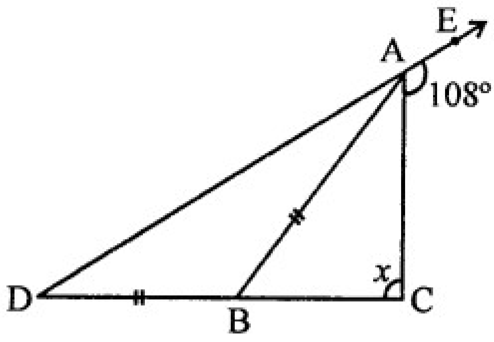
⇒ $x$ = 35° + 45° + 50° = 130°

∴ $x$ = 130°

Question 10.
In the figure, AB divides ∠D AC in the ratio 1 : 3 and AB = DB. Determine the value of x.




Solution:
In the figure AB = DB




AB divides ∠DAC in the ratio 1 : 3 and ∠CAE = 108°

But ∠CAE + ∠DAC = 180° (Linear pair)

⇒ 108° + ∠DAC = 180°

⇒ ∠DAC = 180° – 108° = 72°

∵ AB divides it in the ratio 1 : 3

$\therefore \angle DAB = \frac{72° \times 1}{1+3} = \frac{72° \times 1}{4} = 18°$

and $\angle CAB = \frac{72°}{4} \times 3 = 54°$

∵ AB = BD

∴ ∠DAB = ∠ADB = 18°

Now in ΔADC,

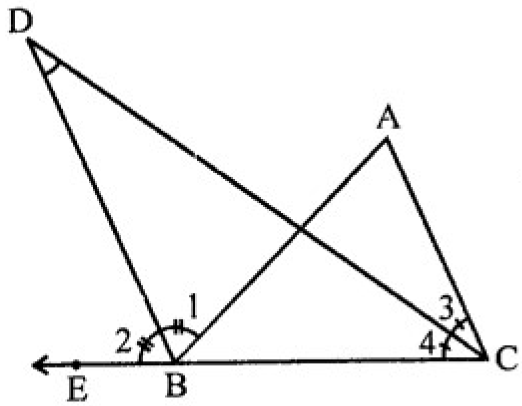
Ext. ∠CAE = ∠BDA + ∠ACD

⇒ 108° = 18° + $x$

⇒ $x$ = 108° – 18° = 90°

∴ $x$ = 90°

Question 11.
ABC is a triangle. The bisector of the exterior angle at B and the bisector of ∠C intersect each other at D. Prove that ∠D = 12 ∠A.
Solution:
Given : In ∠ABC, CB is produced to E bisectors of ext. ∠ABE and into ∠ACB meet at D.




**To prove :** $\angle D = \frac{1}{2} A$

**Proof :** In $\Delta BDC$,
Ext. $\angle ABE = \angle A + \angle C$

$\frac{1}{2}\angle ABE = \frac{1}{2}\angle A + \frac{1}{2}\angle C$

$\angle 1 = \frac{1}{2}\angle A + \angle 4$ ...(*i*)

($\because$ CD is bisector of $\angle C$)

In $\Delta BDC$,
Ext. $\angle 2 = \angle D + \angle 4$
$\Rightarrow \angle D = \angle 2 - \angle 4$
$= \angle 1 - \angle 4$ ($\because$ BD is bisector of $\angle ABE$)

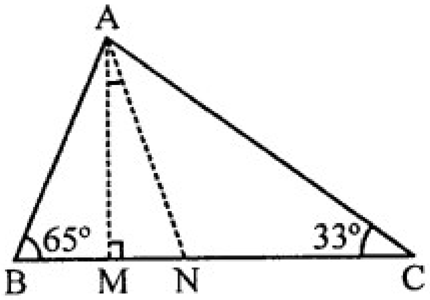
$= \left(\frac{1}{2}\angle A + \angle 4\right) - \angle 4$ [From (*i*)]

$= \frac{1}{2}\angle A + \angle 4 - \angle 4$

$= \frac{1}{2}\angle A$

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

Question 12.
In the figure, AM ⊥ BC and AN is the bisector of ∠A. If ∠B = 65° and ∠C = 33°, find ∠MAN.




Solution:

In $\Delta ABC$, $\angle B = 65°$, $\angle C = 33°$

$AM \perp BC$ and AN is bisector of $\angle A$

$\because AM \perp BC$

$\therefore \angle AMC = 90°$

$\Rightarrow \angle AMN = 90°$

In $\Delta ABC$,

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

$\Rightarrow \angle A + 65° + 33° = 180°$

$\Rightarrow \angle A + 98° = 180°$

$\Rightarrow \angle A = 180° - 98° = 82°$

$\because$ AN is the bisector of $\angle A$

$\therefore \angle NAC = \angle NAB = \frac{1}{2}\angle A$

$= \frac{1}{2} \times 82° = 41°$

In $\Delta AMN$,

Ext. $\angle ANM = \angle C + \angle NAC$

$= 33° + 41 = 74°$

In $\Delta MAN$,

$\angle MAN + \angle AMN + \angle ANM = 180°$ (Angles of a triangle)

$\angle MAN + 90° + 74° = 180°$

$\Rightarrow \angle MAN + 164° = 180°$

$\Rightarrow \angle MAN = 180° - 164° = 16°$

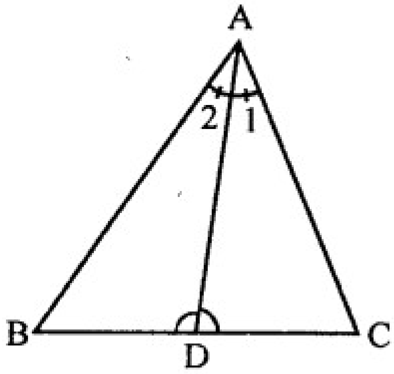
Hence $\angle MAN = 16°$

Question 13.

In a AABC, AD bisects ∠A and ∠C > ∠B. Prove that ∠ADB > ∠ADC.

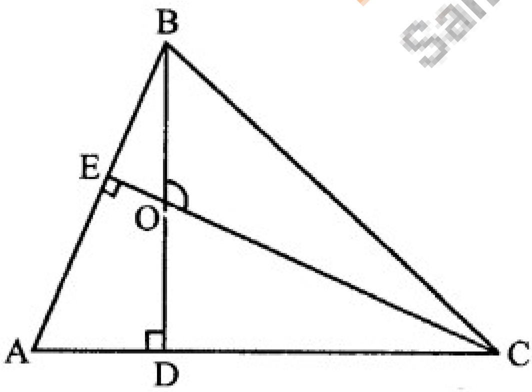
Solution:

Given : In ΔABC,
∠C > ∠B and AD is the bisector of ∠A




To prove : ∠ADB > ∠ADC
Proof: In ΔABC, AD is the bisector of ∠A
∴ ∠1 = ∠2
In ΔADC,
Ext. ∠ADB = ∠l+ ∠C
⇒ ∠C = ∠ADB – ∠1 …(i)
Similarly, in ΔABD,
Ext. ∠ADC = ∠2 + ∠B
⇒ ∠B = ∠ADC – ∠2 …(ii)
From (i) and (ii)
∵ ∠C > ∠B (Given)
∴ (∠ADB – ∠1) > (∠ADC – ∠2)
But ∠1 = ∠2
∴ ∠ADB > ∠ADC

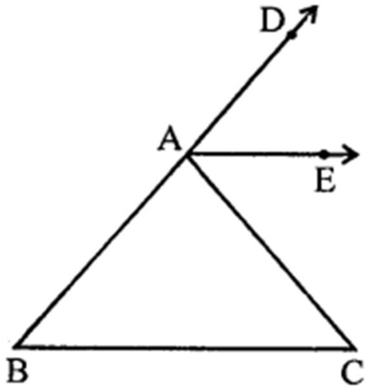
Question 14.
In ΔABC, BD ⊥ AC and CE ⊥ AB. If BD and CE intersect at O, prove that ∠BOC = 180°- ∠A.
Solution:
Given : In ΔABC, BD ⊥ AC and CE⊥ AB BD and CE intersect each other at O



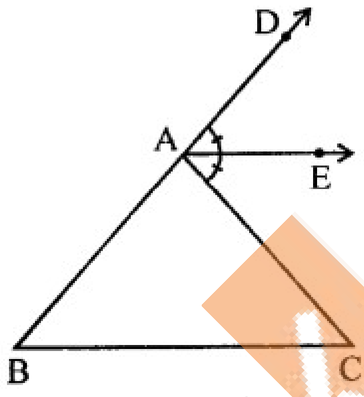

To prove : ∠BOC = 180° – ∠A
Proof: In quadrilateral ADOE
∠A + ∠D + ∠DOE + ∠E = 360° (Sum of angles of quadrilateral)
⇒ ∠A + 90° + ∠DOE + 90° = 360°
∠A + ∠DOE = 360° – 90° – 90° = 180°

But ∠BOC = ∠DOE (Vertically opposite angles)
⇒ ∠A + ∠BOC = 180°
∴ ∠BOC = 180° – ∠A

Question 15.
In the figure, AE bisects ∠CAD and ∠B = ∠C. Prove that AE || BC.




Solution:
Given : In AABC, BA is produced and AE is the bisector of ∠CAD
∠B = ∠C




To prove : AE || BC
Proof: In ΔABC, BA is produced
∴ Ext. ∠CAD = ∠B + ∠C
⇒ 2∠EAC = ∠C + ∠C (∵ AE is the bisector of ∠CAE) (∵ ∠B = ∠C)
⇒ 2∠EAC = 2∠C
⇒ ∠EAC = ∠C
But there are alternate angles
∴ AE || BC