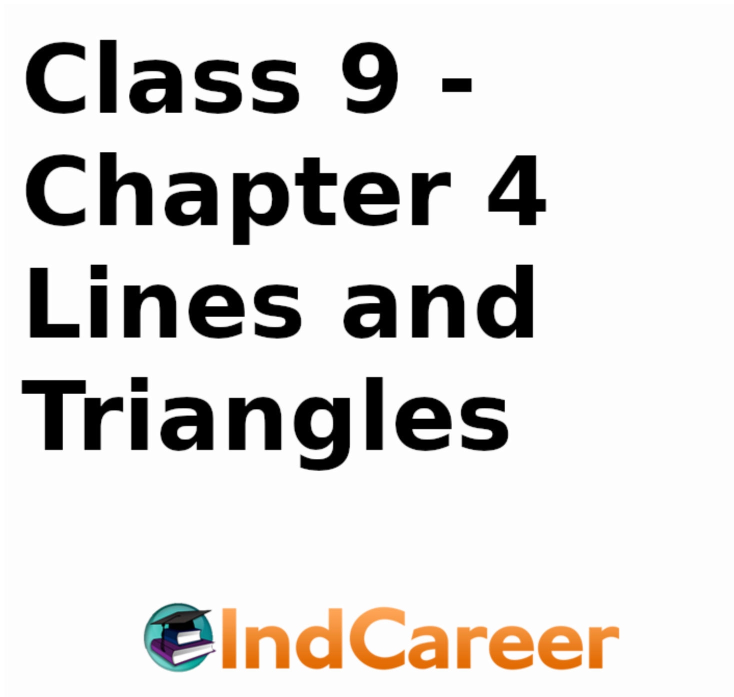
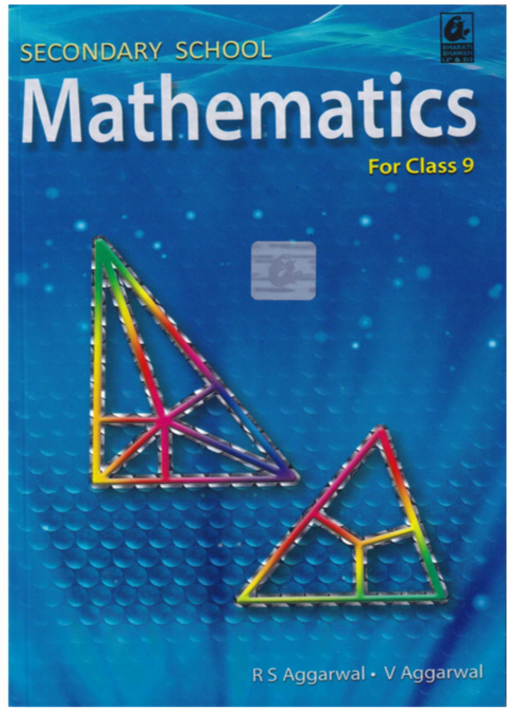
RS Aggarwal Solutions for Class 9 Maths Chapter 4–Lines and Triangles





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RS Aggarwal Solutions for Class 9 Maths Chapter 4–Lines and Triangles

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RS Aggarwal Solutions for Class 9 Maths Chapter 4–Lines and Triangles

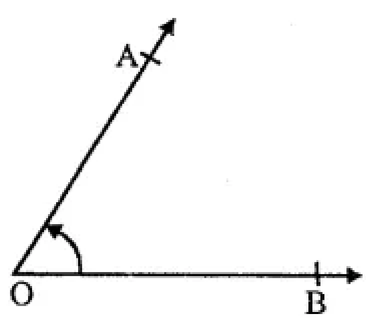
RS Aggarwal 9th Maths Chapter 4, Class 9 Maths Chapter 4 solutions

Ex 4A

Question 1.

Solution:

(i)Angle : When two rays OA and OB meet at a point o, then ∠AOB is called an angle.



(ii) Interior of angle : The interior an angle is a set of all points in its plane which lie on the same side of OA as B and also on the same side of OB as A.

(iii) Obtuse angle : An angle greater than 90° but less than 180° is called an obtuse angle.

(iv) Reflex angle : An angle more than 180° but less than 360° is called a reflex angle.

(v) Complementary angles : Two angles are said to be complementary angles if their sum is 90°.

(vi) Supplementary angles : Two angles are said to be supplementary angles if their sum is 180°.

Question 2.

Solution:

∠A = 36°27'46"

∠B = 28° 43'39"

Adding, ∠A + ∠B = 64° 70′ 85″

We know that 60″ = 1′ and 60′ = 1°

∠A+ ∠B = 65° 11′ 25″ Ans.

Question 3.

Solution:

36° – 24° 28′ 30″

= 35° 59'60" – 25° 28'30"

$$\left\{ \begin{array}{r} \because 1^\circ = 60' \\ 1' = 60'' \end{array} \right\}$$

$$\begin{array}{r} 35^\circ\ 59'\ 60' \\ \underline{25^\circ\ 28'\ 30''} \\ \underline{10^\circ\ 31'\ 30''} \end{array}$$

= 10° 31′ 30″ Ans.

Question 4.

Solution:

We know that two angles are complementary of their sum is 90°. Each of these two angles is complement to the other, therefore.

(i) Complement of 58° = 90° – 58° = 32°

(ii) Complement of 16° = 90° – 16° = 74°

(iii) Complement of 23 of a right angle i.e.

of 23 x 90° or 60° = 90° – 60° = 30°

= 23 of right angle,

(iv) Complement of 46° 30′

= 90° – 46° 30′

= 43° 30′

(v) Complement of 52° 43′ 20°= 90° – 52° 43′ 20″

= 37° 16′ 40″

(vi) Complement of 68° 35′ 45″

= 90° – 68° 35′ 45″

= 21° 24′ 15″ Ans.

Question 5.

Solution:

We know that two angles are said to be supplement to each other of their sum is 180° therefore

(i) Supplement of 68° = 180° – 68° =112°

(ii) Supplement of 138° = 180° – 138° = 42°

(iii) Supplement of 35 of a right angle or 35 x 90° or 54°

= 180° – 54° = 126°

(iv) Supplement of 75° 36′ = 180° – 75° 36′ = 104° 24′

(v) Supplement of 124° 20′ 40″

= 180° – 124° 20′ 40″

= 55° 39′ 20″

(vi) Supplement of 108° 48′ 32″ = 180° – 108″ 48′ 32″ = 71° 11′ 28″ Ans.

Question 6.

Solution:

(i) Let the measure of required angle = x ,

their its complement = 90° – x

According to the condition,

x = 90° – x => 2x = 90°

=>x = 90o2 = 45°

Required angle = 45°

(ii) Let the measure of required angle = x then its supplement = 180° – x

According to the condition,

x = 180° – x => 2x = 180° = 90°

=>x = 180o2 = 90°

Hence required angle = 90° Ans.

Question 7.

Solution:

Let required angle = x

then its complement = 90° – x

According to the condition,

x – (90° – x) = 36°

=> x – 90° + x = 36°

=> 2x = 36° + 90° = 126°

= 126o2 = 63°

Required angle = 63° Ans.

Question 8.

Solution:

Let the required angle = x

then its supplement = 180° – x

According to the condition,

(180° – x) – x = 25°

=> 180° – x – x = 25°

=> – 2x = 25° – 180°

=> – 2x = – 155°

=> x = –155o–2

= 77.5°

Hence required angle = 77.5° Ans.

Question 9.

Solution:

Let required angle = x

Then its complement = 90° – x

According to the condition,

x = 4 (90° – x) => x = 360° – 4x

=> x + 4x = 360° => 5x = 360°

x = 360o5 = 72°

Required angle = 72° Ans.

Question 10.

Solution:

Let required angle = x

Then its supplement = 180° – x

According to the condition,

x = 5 (180° – x)

=> x = 900° – 5x

=> x + 5x = 900°

=> 6x = 900°

=> x = 900o6 = 150°

Hence, required angle = 150° Ans

Question 11.

Solution:

Let required angle = x

then its supplement = 180° – x

and complement = 90° – x

According to the condition,

180° – x = 4 (90°- x)

=> 180° – x = 360° – 4x

=> – x + 4x — 360° – 180°

=> 3x= 180°

=> x = 180o3 = 60°

Required angle = 60° Ans.

Question 12.

Solution:

Let required angle = x

Then, its complement = 90° – x

and its supplement = 180° – x

According to the condition,

90° – x = 13 (180° – x)

=> 90° – x = 60° – 13 x

=> 90° – 60° = x – 13 x

=> 23 x = 30° =>x = 30oX32 => x = 45° Ans.

Question 13.

Solution:

Let one angle = x

Then, its supplement = 180° – x

According to the condition,

x : (180° – x) = 3:2

=> x180o−x=32

=>2x = 3(180°- x)

=> 2x = 540° – 3x

=> 2x + 3x = 540°

=> 5x = 540° => x = 540o5 = 108°

Angle = 108° and its supplement = 180° – 108° = 72°

Hence, angles are 108° and 72° Ans.

Question 14.

Solution:

Let angle = x

Then, its complementary angle = 90° – x

According to the condition,

x : (90° – x) = 4 : 5

=> x90o−x=45

=> 5x = 4 (90° – x)

=> 5x = 360° – 4x

=> 5x + 4x = 360°

=> 9x = 360°

=> x = 360o9=40o

and its complement = 90° – 40° = 50°

Hence, angles are 40° and 50° Ans.

Question 15.

Solution:

Let the required angle = x

.'. its complement = 90° – x

and supplement = 180° – x

According to the condition,

$7(90° – x) = 3(180° – x) – 10°$

$=> 630° – 7x = 3 (180° – x) – 10°$

$=> 630° – 7x = 540° – 3x – 10°$

$=> – 7x + 3x = 540° – 10° – 630°$

$– 4x = – 100°$

x = −100o−4=25o

Hence required angle = 25° Ans.

Question 1.

Solution:

AOB is a straight line

∠AOC + ∠BOC = 180° (Linear pair)

$=> 62° + x= 180°$

$=> x = 180° – 62°$

$=> x = 118°$

Hence, x = 118° Ans.

Question 2.

Solution:

AOB is straight line

∠AOC + ∠COD + ∠DOB – 180°

$=> (3x – 5)° + 55° + (x + 20)° = 180°$

$=> 3x – 5° + 55° + x + 20° = 180°$

$=> 4x – 5° + 75° = 180°$

=> 4x + 70° = 180°

=> 4x = 180° – 70°

=> 4x = 110°

=> x=110o4=27.5o

Hence x = 27.5°

and ∠AOC = 3x – 5° = 3 x 27.5° – 5°

= 82.5° – 5° = 77.5°

∠BOD = x + 20° = 27.5° + 20°

= 47.5° Ans.

Question 3.

Solution:

AOB is a straight line

∠AOC + ∠COD + ∠DOB = 180°

{angles on the same side of line AB}

=> (3x + 7)° + (2x – 19)° + x = 180°

=> 3x + 7° + 2x – 19° + x = 180°

=> 6x – 12° – 180°

=> 6x = 180° + 12° = 192°

=> x=192o6=32o

Here x = 32°

∠AOC = 3x + 7° = 3 x 32° + 7°

= 96° + 7°= 103°

∠COD = 2x – 19° = 2 x 32° – 19°

= 64 – 19° = 45°

and ∠BOD = x = 32° Ans.

Question 4.

Solution:

In the given figure,

x + y + z = 180°

But x : y : z = 5:4:6

Let ∠XOP = x° – 5a

∠POQ =y° = 4a

and ∠QOY = z = 6a

then 5a + 4a + 6a = x + y + z = 180°

=> 15a = 180°

=> a = 180o15=12o

=> x = 5a = 5 x 12° = 60°

y = 4a = 4 x 12° = 48°

and z = 6x = 6 x 12° = 72° Ans.

Question 5.

Solution:

AOB will be a straight line

If ∠AOC + ∠COB = 180°

If (3x + 20)° + (4x – 36)° = 180°

If 3x + 20 + 4x – 36 = 180°

If 7x – 16 = 180°

If 7x = 180° + 16 = 196°

If x=196o7=28o

Hence, if x = 28°, then AOB will be a straight line.

Question 6.

Solution:

AB and CD intersect each other at O

AOC = ∠BOD and ∠BOC = ∠AOD (vertically opposite angles)

But ∠AOC = 50°

∠BOD = ∠AOC = 50°

But ∠AOC + ∠BOC = 180° (Linear pair)

=> 50° + ∠BOC = 180°

=> ∠BOC = 180° – 50° = 130°

∠AOD = ∠BOC = 130°

Hence,∠AOD = 30°,∠BOD = 50° and ∠BOC = 130° Ans.

Question 7.

Solution:

In the figure,

AB, CD and EF are coplanar lines intersecting at O.

∠AOF = ∠BOE

∠DOF = ∠COE and ∠BOD = ∠AOC (Vertically opposite angles)

x = y,

z = 50°

t = 90°

But AOF + ∠DOF + ∠BOD = 180° (Angles on the same side of a st. line)

=> x + 50° + 90° = 180°

=> x° + 140° + 180°

=> x = 180° – 140° = 40°

Hence, x = 40°, y = x = 40°, z = 50° and t = 90° Ans.

Question 8.

Solution:

Three coplanar lines AB, CD and EF intersect at a point O

∠AOD = ∠BOC

∠DOF = ∠COE

and ∠AOE = ∠BOF

(Vertically opposite angles)

But ∠AOD = 2x

∠BOC = 2x

and ∠BOF = 3x

∠AOE = 3x

and ∠COE = 5x

∠DOF = 5x

But ∠AOD + ∠DOF + ∠BOF + ∠BOC + ∠COE + ∠AOE = 360° (Angles at a point)

=> 2x + 5x + 3x + 2x + 5x + 3x = 360°

=> 20x = 360° => x = 360o20 = 18°

Hence x = 18°

∠AOD = 2x = 2 x 18° = 36°

∠COE = 5x = 5 x 18° = 90°

and ∠AOE = 3x = 3 x 18° = 54° Ans.

Question 9.

Solution:

AOB is a line and CO stands on it forming ∠AOC and ∠BOC

But ∠AOC : ∠BOC = 5:4

Let ∠AOC = 5x and ∠BOC = 4x

But ∠AOC + ∠BOC = 180° (Linear pair)

=> 5x + 4x = 180° => 9x = 180°

=> x = 180o9 = 20°

∠AOC = 5x = 5 x 20° = 100°

and ∠BOC = 4x = 4 x 20° = 80° Ans.

Question 10.

Solution:

Two lines AB and CD intersect each other at O and

∠AOC = 90°

∠AOC = ∠BOD

(Vertically opposite angles)

∠BOD = 90°

But ∠AOC + ∠BOC = 180° (Linear pair)

=> 90° + ∠BOC – 180°

=> ∠BOC = 180° – 90° = 90°

But ∠AOD = ∠BOC

(Vertically opposite angles)

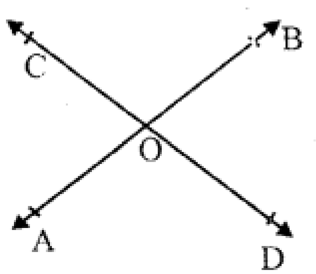
∠AOD = 90°

Hence each of the remaining angle is 90°.

Question 11.

Solution:

Two lines AB and CD intersect each other at O and



∠BOC + ∠AOD = 280°

∠AOD = ∠BOC

(vertically opposite angles)

∠BOC + ∠BOC = 280°

(∠AOD = ∠BOC)

=> 2 ∠BOC = 280°

=> ∠BOC = 280o2 = 140°

But ∠BOC + ∠AOC = 180° (Linear pair)

=> 140° + ∠AOC = 180°

=> ∠AOC = 180° – 140° = 40°

But ∠BOD = ∠AOC

(vertically opposite angles)

∠BOD = 40°

Hence ∠AOC = 40°, ∠BOC = 140°,

∠BOD = 40°

and ∠AOD = 140° Ans.

Question 12.

Solution:

OC is the bisector of ∠AOB. and OD is the ray opposite to OC.

Now ∠AOC = ∠BOC (OC is bisector of ∠AOB)

But ∠BOC + ∠BOD = 180° (Linear pair)

Similarly, ∠AOD + ∠AOC = 180°

=> ∠BOC + ∠BOD = ∠AOD + ∠AOC

But ∠AOC = ∠BOC (Given)

∠BOD = ∠AOD

=> ∠AOD = ∠BOD

Hence proved.

Question 13.

Solution:

AB is the mirror.

PQ is the incident ray, QR is its reflected ray.

=> ∠BQR = ∠PQA

But ∠BQR + ∠PQR + ∠PQA = 180° (Angles on one side of a straight line)

=> ∠PQA + ∠PQA + 112° = 180°

=> 2∠PQA + 112° = 180°

=> 2∠PQA = 180° – 112° = 68°

∠PQA = 68o2 = 34° Ans.

Question 14.

Solution:

Given. Two lines AB and CD intersect each other at O.

OE is the bisector of ∠BOD and EO is produced to F.

To Prove : OF bisects ∠AOC.

Proof : AB and CD intersect each other at O

∠AOC = ∠BOD

(Vertically opposite angles)

OE is the bisector of ∠BOD

∠1 = ∠2

But ∠1 = ∠3

and ∠2 = ∠4 (Vertically opposite angles)

and ∠1 = ∠2 (proved)

∠3 = ∠4

Hence, OF is the bisector of ∠AOC.

Hence proved.

Question 15.

Solution:

Given ∠AOC and ∠BOC are supplementary angles

OE is the bisector of ∠BOC and OF is the bisector of ∠AOC

To Prove : ∠EOF = 90°

Proof : ∠1 = ∠2

∠3 = ∠4

{OE and OF are the bisectors of ∠BOC and ∠AOC respectively}

But ∠AOC + ∠BOC = 180°

(Linear pair)

=> ∠1 + ∠2 + ∠3 + ∠4 = 180°

=> ∠1 + ∠1 + ∠3 + ∠3 = 180°

=> 2∠1 + 2∠3 = 180°

=> 2(∠1 + ∠3) = 180°

=> ∠1 + ∠3 = 180o2 90°

=> ∠EOF = 90°

Hence proved.

Question 1.

Solution:

AB || CD and a line t intersects them at E and F forming angles ∠1, ∠ 2, ∠3, ∠4, ∠5, ∠6, ∠7 and ∠8.

$\angle 1 = 70^\circ$

$\because \quad \angle 1 = \angle 3$ (vertically opposite angle)

$\therefore \quad \angle 3 = 70^\circ$

$\because \quad \angle 1 = \angle 5$ (corresponding angles)

$\therefore \quad \angle 5 = 70^\circ$

$\because \quad \angle 3 = \angle 7$ (corresponding angles)

$\therefore \quad \angle 7 = 70^\circ$

$\because \quad \angle 1 + \angle 2 = 180^\circ$ (linear pair)

$\Rightarrow \quad 70^\circ + \angle 2 = 180^\circ$

$\Rightarrow \quad \angle 2 = 180^\circ - 70^\circ = 110^\circ$

$\because \quad \angle 2 = \angle 4$ (vertically opposite angles)

$\therefore \quad \angle 4 = 110^\circ$

$\because \quad \angle 2 = \angle 6$ (corresponding angles)

$\therefore \quad \angle 6 = 110^\circ$

$\because \quad \angle 4 = \angle 8$ (corresponding angles)

$\therefore \quad \angle 8 = 110^\circ$

Hence $\angle 2 = 110^\circ$, $\angle 3 = 70^\circ$, $\angle 4 = 110^\circ$, $\angle 5 = 70^\circ$, $\angle 6 = 110^\circ$, $\angle 7 = 70^\circ$ and $\angle 8 = 110^\circ$ Ans.

Question 2.

Solution:

AB || CD and a transversal t intersects them at E and F respectively forming angles ∠I, ∠2, ∠3, ∠4, ∠5, ∠ 6, ∠ 7 and ∠ 8

Hence $\angle 2 = 110^\circ$, $\angle 3 = 70^\circ$, $\angle 4 = 110^\circ$, $\angle 5 = 70^\circ$, $\angle 6 = 110^\circ$, $\angle 7 = 70^\circ$ and $\angle 8 = 110^\circ$ Ans.

$\angle 2 : \angle 1 = 5 : 4$

Let $\angle 2 = 5x$ and $\angle 1 = 4x$

But $\angle 2 + \angle 1 = 180^\circ$ (Linear pair)

$\Rightarrow 5x + 4x = 180^\circ$

$\Rightarrow 9x = 180^\circ \Rightarrow x = \frac{180^\circ}{9} = 20^\circ$

$\therefore \angle 2 = 5x = 5 \times 20^\circ = 100^\circ$

and $\angle 1 = 4x = 4 \times 20^\circ = 80^\circ$

But $\angle 1 = \angle 3$ (vertically opposite angles)

$\therefore \angle 3 = 80^\circ$

Similarly $\because \angle 2 = \angle 4$

(vertically opposite angles)

$\therefore \angle 4 = 100^\circ$

$\because \angle 1 = \angle 5$ (Corresponding angles)

$\therefore \angle 5 = 80^\circ$

$\because \angle 4 = \angle 6$ (Alternate angles)

$\therefore \angle 6 = 100^\circ$

$\because \angle 3 = \angle 7$ (Corresponding angles)

$\therefore \angle 7 = 80^\circ$

$\because \angle 4 = \angle 8$ (Corresponding angles)

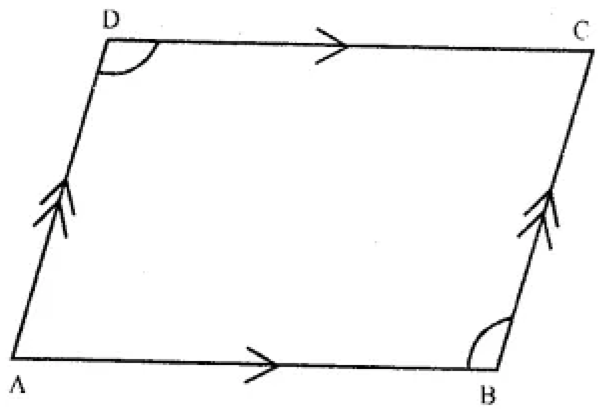
$\therefore \angle 8 = 100^\circ$

Hence $\angle 3 = 80^\circ$, $\angle 4 = 100^\circ$, $\angle 5 = 80^\circ$, $\angle 6 = 100^\circ$, $\angle 7 = 80^\circ$ and $\angle 8 = 100^\circ$

Ans.

Question 3.

Solution:



Given. In quadrilateral ABCD, AB || DC and AD || BC

To Prove : ∠ADC = ∠ABC

Proof : AB || DC and AD intersects their

∠DAB + ∠ADC = 180°

(sum of co-interior angles)

Similarly ∴ AD || BC

∠DAB + ∠ABC = 180° …(ii)

from (i) and (ii),

∠ DAB + ∠ ADC = ∠DAB + ∠ABC

∴∠ADC = ∠ABC. Hence proved.

Question 4.

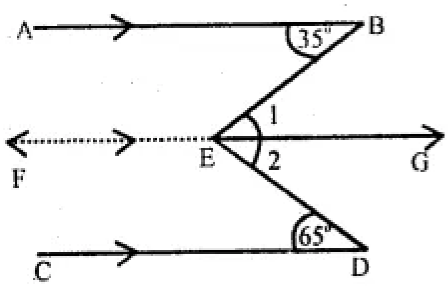
Solution:

(i) In the figure, AB || CD

∠ABE = 35° and ∠EDC = 65°

Draw FEG || AB or CD

∴ AS || FG (const.)



$\therefore \quad \angle 1 = \angle ABE$ (Alternate angles)

$\angle 1 = 35^\circ$

Again, CD || FG (Const.)

$\therefore \quad \angle 2 = \angle EDC$ (Alternate angles)

$= 65^\circ$

Adding, we get :

$\angle 1 + \angle 2 = 35^\circ + 65^\circ$

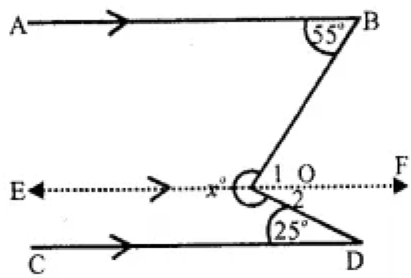
$\Rightarrow \quad x = 100^\circ$

Hence, $x = 100^\circ$ Ans.

(*ii*) AB ∥ CD

$\angle ABO = 55^\circ$

and $\angle ODC = 25^\circ$



From O, draw a line EOF ∥ AB on CD.

∵ AB ∥ EOF (const.)

∴ $\angle 1 = \angle ABO$ (alternate angles)

$= 55^\circ$

Similarly EOF ∥ CD (const.)

∴ $\angle 2 = \angle ODC$(alternate angles)

$= 25^\circ$

$\therefore \quad \angle 1 + \angle 2 = 55^\circ + 25^\circ$

$\Rightarrow \quad \angle BOD = 80^\circ$

But $\angle BOD$ + reflex. $\angle BOD = 360^\circ$

$\Rightarrow \quad 80^\circ + x = 360^\circ$

$\Rightarrow \quad x = 360^\circ - 80^\circ$

$\Rightarrow \quad x = 280^\circ$

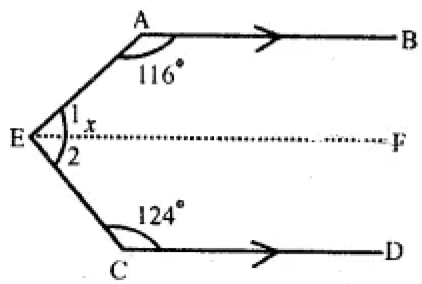
Hence $x = 280^\circ$ Ans.

(*iii*) In the figure,

AB || CD

$\angle BAE = 116^\circ$ and $\angle ECD = 124^\circ$

From E, draw EF || AB or CD.



$\because$ AB || EF (const.)

$\therefore$ $\angle BAE + \angle AEF = 180^\circ$

$\Rightarrow$ $116^\circ + \angle 1 = 180^\circ$

(Sum of co-interior angles)

$\Rightarrow$ $\angle 1 = 180^\circ - 116^\circ = 64^\circ$

Similarly, EF || CD (const.)

$\therefore$ $\angle 2 + \angle ECD = 180^\circ$

(Sum of co-interior angles)

$\Rightarrow$ $\angle 2 + 124^\circ = 180^\circ$

$\Rightarrow$ $\angle 2 = 180^\circ - 124^\circ = 56^\circ$

Now $\angle 1 + \angle 2 = 64^\circ + 56^\circ$

$\Rightarrow$ $x = 120^\circ$

Hence $x = 120^\circ$ Ans.

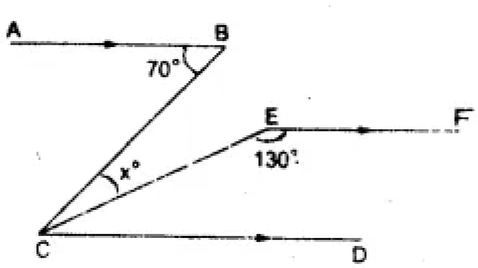
Question 5.

Solution:

In the figure, AB || CD || EF,

$\angle$ ABC = 70° and $\angle$ CEF = 130°

∴EF || CD (given)



∴$\angle$ CEF +$\angle$1 – 180°

(sum of Co-interior angles)

=> 130° + ∠ 1 = 180°

=> ∠ 1 = 180° – 130° = 50°

Again, AB || CD (given)

∴ ∠ ABC = ∠ BCD (Alternate angles)

=> 70° = ∠ BCD = x + ∠ 1

=> x + 50° – 70°

=> x = 70° – 50° = 20°

Hence x = 20° Ans.

Question 6.

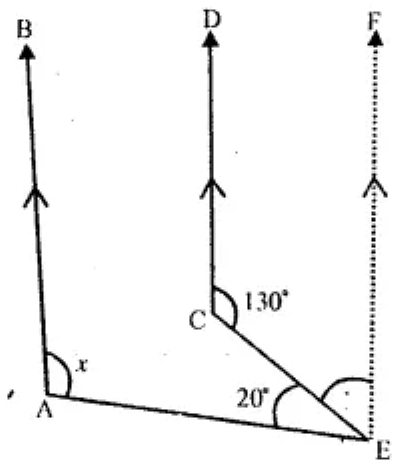
Solution:

In the figure, AB || CD.

∠DCE = 130°

and ∠ CEA – 20°

From E, draw EF || AB or CD.



Now ∵ CD || EF (const.)

∴ $\angle DCE + \angle 1 = 80^\circ$

(Sum of co-interior angles)

$\Rightarrow 130^\circ + \angle 1 = 180^\circ$

$\Rightarrow \angle 1 = 180^\circ - 130^\circ = 50^\circ$

Again ∵ AB || EF

∴ $\angle BAE + \angle AEF = 180^\circ$

(Sum of co-interior angles)

$\Rightarrow x + 20^\circ + \angle 1 = 180^\circ$

$\Rightarrow x + 20^\circ + 50^\circ = 180^\circ$

$\Rightarrow x + 70^\circ = 180^\circ$

$\Rightarrow x = 180^\circ - 70^\circ$

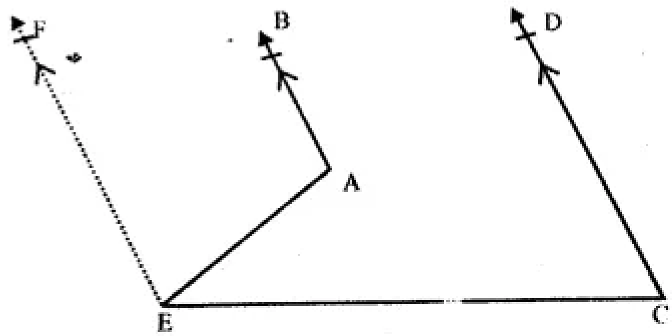
$\Rightarrow x = 110^\circ$

Hence $x = 110^\circ$ Ans.

Question 7.

Solution:

Given. In the given figure, AB || CD.



To Prove : $\angle BAE - \angle DCE = \angle AEC$

Construction : From E, draw EF || AB or CD

Proof : $\because$ EF || AB (const.)

$\therefore \quad \angle BAE + \angle AEF = 180^\circ$
(Sum of co-interior angles) ...(*i*)

Similarly $\because$ EF || CD (const.)

$\therefore \quad \angle DCE + \angle FEC = 180^\circ$ ...(*ii*)

From (*i*) and (*ii*)

$\angle BAE + \angle AEF = \angle DCE + \angle FEC$

$\Rightarrow \quad \angle BAE - \angle DCE = \angle FEC - AEF$

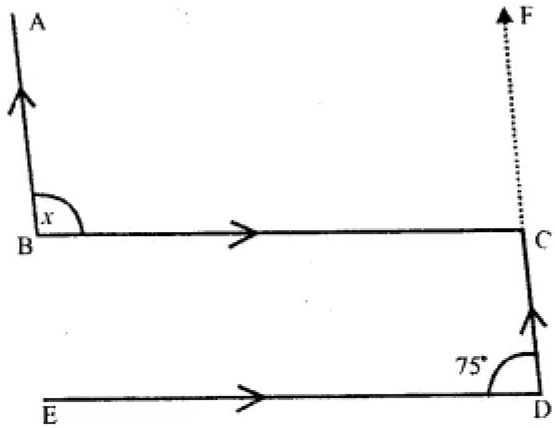
$\Rightarrow \quad \angle BAE - \angle DCE = \angle AEC$

Hence proved.

Question 8.

Solution:

In the figure, AB || CD



and BC || ED, $\angle EDC = 75^\circ$

Produce DC to F

$\because$ BC || ED

$\therefore$ $\angle EDC = \angle BCF$ (corresponding angles)

$\therefore$ $\angle BCF = 75^\circ$

$\because$ AB || FCD

$\therefore$ $\angle ABC + \angle BCF = 180^\circ$ (Sum of co-interior angles)

$\Rightarrow$ $x + 75^\circ = 180^\circ$

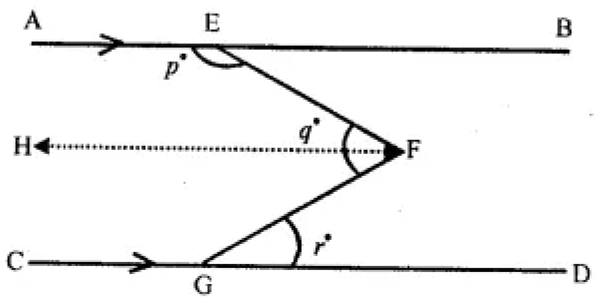
$\Rightarrow$ $x = 180^\circ - 75^\circ = 105^\circ$

Hence, $x = 105^\circ$ Ans.

Question 9.

Solution:

In the figure, AB || CD, ∠AEF = p



$\angle EFG = q$ and $\angle FGD = r$

To prove. $p + q - r = 180^\circ$

Const. From F, draw FH || AB or CD.

Proof :

$\because$ CD || HF (const.)

$\therefore \angle HFG = \angle FGD$

(Alternate angles)

$\Rightarrow \angle HFG = r$

$\therefore \angle EFH = q - r$

Again, AB || HF

$\therefore \angle AEF + \angle EFH = 180^\circ$

(Sum of co-interior angles)

$\Rightarrow p + (q - r) = 180^\circ$

$\Rightarrow p + q - r = 180^\circ$ Hence proved.

Question 10.

Solution:

In the figure, AB || PQ.

A transversal LM cuts them at E and F

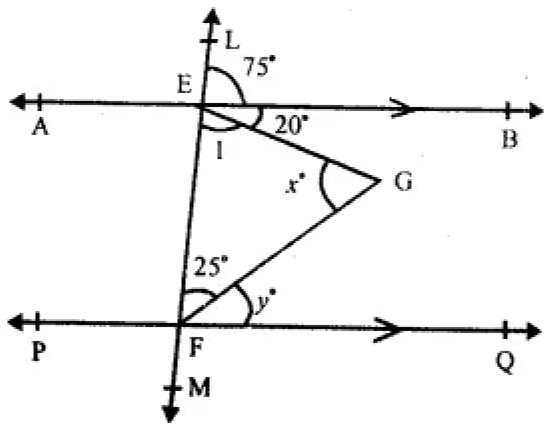
∠ LEB = 75°

∠BEG = 20°

∠ EFG = 25°

∠ EGF = x° and ∠ GFD = y°

∴ ∠ LEB + ∠ BEF = 180° (Linear pair)



$\Rightarrow \quad 75^o + \angle BEF = 180^o$

$\Rightarrow 75^o + 20^o + \angle 1 = 180^o$

$\Rightarrow 95^o + \angle 1 = 180^o$

$\Rightarrow \quad \angle 1 = 180^o - 95^o = 85^o$

$\because \quad AB \parallel CD.$

$\therefore \quad \angle BEF + \angle EFD = 180^o$

(Sum of co-interior angles)

$\Rightarrow \quad 20^\circ + \angle 1 + 25^\circ + y = 180^\circ$

$\Rightarrow \quad 20^\circ + 85^\circ + 25^\circ + y = 180^\circ$

$\Rightarrow \quad 130^\circ + y = 180^\circ$

$\Rightarrow \quad y = 180^\circ - 130^\circ = 50^\circ.$

$\therefore \quad y = 50^\circ$

In Δ EFG,

$\angle 1 + 25^\circ + x = 180^\circ$

(Sum of angles of a triangle)

$\Rightarrow \quad 85^\circ + 25^\circ + x = 180^\circ$

$\Rightarrow \quad 110^\circ + x = 180^\circ$

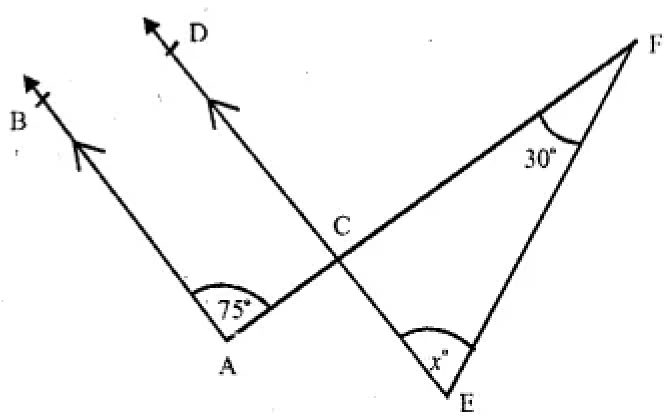
$\Rightarrow \quad x = 180^\circ - 110^\circ = 70^\circ$

Hence, $x = 70^\circ$, $y = 50^\circ$

Question 11.

Solution:

In the figure



AB || CD

$\angle BAC = 75^\circ$ and $\angle CFE = 30^\circ$

$\because$ AB || CD

$\therefore$ $\angle BAC + \angle ACD = 180^\circ$

(Sum of co-interior angles)

$\Rightarrow$ $75^\circ + \angle ACD = 180^\circ$

$\Rightarrow$ $\angle ACD = 180^\circ - 75^\circ = 105^\circ$

But $\angle ECF = \angle ACD$

$= 105^\circ$ (Vertically opposite angles)

Now in Δ CEF

$\angle ECF + \angle CFE + \angle CEF = 180^\circ$

(Angles of a triangle)

$\Rightarrow$ $105^\circ + 30^\circ + x = 180^\circ$

$\Rightarrow$ $130^\circ + x = 180^\circ$

$\Rightarrow$ $x = 180^\circ - 135^\circ$ $\Rightarrow$ $x = 45^\circ$

Hence $x = 45^\circ$ Ans.

Question 12.

Solution:

In the figure, AB || CD

∠PEF = 85°, ∠QHC = 115°

∴ ∠ GHF = ∠ QHC

(Vertically opposite angles)

∠ GHF = 115°

∴AB || CD

∴∠ PEF = ∠ EGH

(Corresponding angles)

∴∠EGH = 85°

But ∠ QGH + ∠ EGH = 180°, (Linear pair)

=> ∠QGH + 85° = 180°

=> QGH = 180° – 85° = 95°

In Δ GHQ,

Ext. ∠GHF = ∠QGH + ∠GQH

=> 115° = 95° + x

=> x = 115° – 95°

Hence, x = 20° Ans.

Question 13.

Solution:

In the figure, AB || CD

∠BAD = 75°, ∠ BCD = 35°

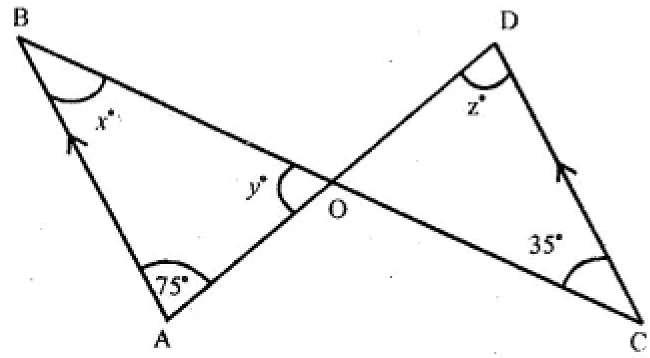
∴AB || CD

∴∠ABC = ∠BCD (Alternate angles)

=> x = 35°

and ∠ BAD = ∠ ADC (Alternate angles)

=> 75° = z



Now, in Δ AOB

$\angle ABO + \angle BAO + \angle AOB = 180^\circ$
(Angles of a triangle)

$\Rightarrow \quad x + 75^\circ + y = 180^\circ$

$\Rightarrow \quad 35^\circ + 75^\circ + y = 180^\circ$

$\Rightarrow \quad 110^\circ + y = 180^\circ$

$\therefore \quad y = 180^\circ - 110^\circ = 70^\circ$

Hence $x = 35^\circ$, $y = 70^\circ$ and $z = 75^\circ$ Ans.

Question 14.

Solution:

In the figure, AB || CD

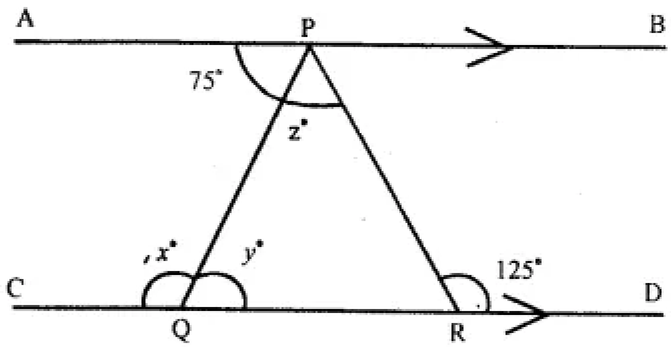
∠APQ = 75°, ∠ PRD = 125°

∴AB || CD.

∠ APQ = ∠ PQR (Alternate angles)

∴75° = y°

=> y° = 75°



But $\angle PQC + \angle PQR = 180^\circ$ (Linear pair)

$\Rightarrow \angle x^\circ + y^\circ = 180^\circ$

$\Rightarrow x^\circ + 75^\circ = 180^\circ$

$\Rightarrow x^\circ = 180^\circ - 75^\circ = 105^\circ$

Again $\because AB \parallel CD$

$\therefore \angle APR = \angle PRD$ (Alternate angles)

$\Rightarrow 75^\circ + z^\circ = 125^\circ$

$\Rightarrow z^\circ = 125^\circ - 75^\circ = 50^\circ$

Hence $x^\circ = 105^\circ$, $y = 75^\circ$ and $z = 50^\circ$

Question 15.

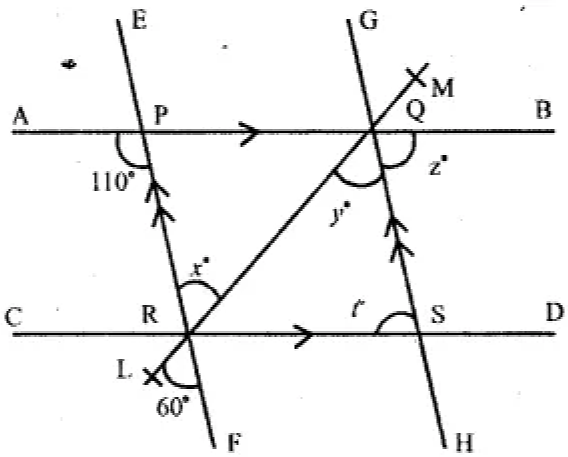
Solution:

In the figure, AB || CD and EF || GH

∠APR = 110°, ∠LRF = 60°

∴ ∠PRQ = ∠LRF

(vertically opposite angles)



$\Rightarrow \quad x^\circ = 60^\circ$

$\because \quad EF \parallel GH$

$\therefore \quad \angle PRQ = \angle RQS$ (Alternate angles)

$\Rightarrow \quad x^\circ = y^\circ = 60^\circ$

But $\angle APQ + \angle RPQ = 180^\circ$ (Linear pair)

$\Rightarrow \quad 110^\circ + \angle RPQ = 180^\circ$

$\Rightarrow \quad \angle RPQ = 180^\circ - 110^\circ = 70^\circ$

$\because \quad EF \parallel GH$

$\therefore \quad \angle RPF = \angle BQS$

$\Rightarrow \quad 70^\circ = z^\circ$

$\because \quad AB \parallel CD.$

$\therefore \quad z = t$ (Alternate angles)

$\therefore \quad t = 70^\circ$

Hence $x = 60^\circ$, $y = 60^\circ$, $z = 70^\circ$, $t = 70^\circ$

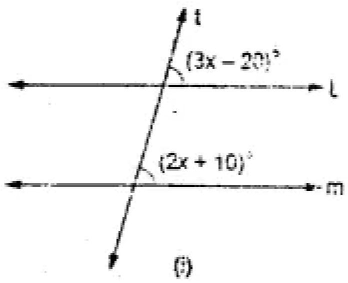
Question 16.

Solution:

(i) l is parallel to m

if $3x – 20° = 2x + 10°$

(Alternate angles are equal)



if $3x - 2x = 10^\circ + 20^\circ$

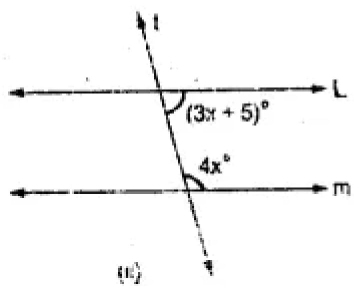
if $x = 30^\circ$

Hence for $x = 30^\circ$, the lines l and m are parallel to each other.

(*ii*) Lines l and m are parallel

if $(3x + 5)^\circ + 4x^\circ = 180^\circ$

(Sum of co-interior angles is 180°)



if $3x + 5^\circ + 4x = 180^\circ$

if $7x = 180^\circ - 5^\circ = 175^\circ$

if $x = \dfrac{175}{7} = 25^\circ$

Hence, for $x = 25^\circ$, the lines l and m are parallel to each other.

Question 17.

Solution:

Given. Two lines AB and CD are perpendiculars on EF

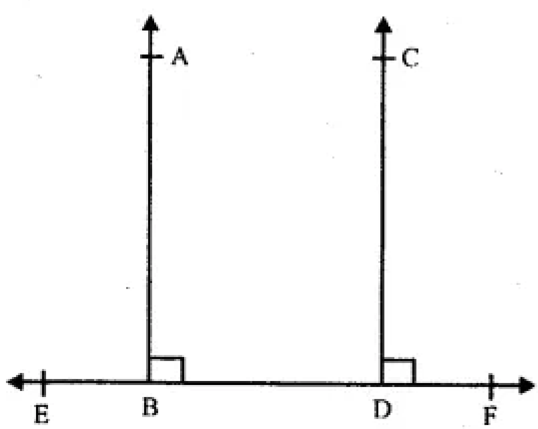
To Prove : AB ⊥ CD.

Proof : ∵ AB ⊥ EF

then $\angle ABD = 90^\circ$ ...(*i*)

Similarly, CD ⊥ EF

∴ $\angle CDF = 90^\circ$ ...(*ii*)



From (*i*) and (*ii*),

$\angle ABD = \angle CDF$ (each = 90°)

But these are corresponding angles

∴ AB || CD

Hence proved.

Question 1.

Solution:

https://www.indcareer.com/schools/rs-aggarwal-solutions-for-class-9-maths-chapter-4-lines-and-triangles/

In ∆ABC,

∠B = 76° and ∠C = 48°

But ∠A + ∠B + ∠C = 180°

(Sum of angles of a triangle)

=> ∠A + 76° + 48° = 180°

=> ∠ A + 124° = 180°

=> ∠A= 180° – 124° = 56°

Question 2.

Solution:

Angles of a triangle are in the ratio = 2:3:4

Let first angle = 2x

then second angle = 3x

and third angle = 4x

2x + 3x + 4x = 180°

(Sum of angles of a triangle)

=> 9x = 180°

=> x = 180o9 = 20°

First angle = 2x = 2 x 20° = 40°

Second angle = 3x = 3 x 20° = 60°

and third angle = 4x = 4 x 20° = 80° Ans.

Question 3.

Solution:

In ∆ABC,

3∠A = 4∠B = 6∠C = x (Suppose)

$$\therefore \quad \angle A = \frac{1}{3}x,\ \angle B = \frac{1}{4}x \text{ and } \angle C = \frac{1}{6}x$$

But $\angle A + \angle B + \angle C = 180^\circ$

(Sum of angles of a triangle)

$$\Rightarrow \frac{1}{3}x + \frac{1}{4}x + \frac{1}{6}x = 180^\circ$$

$$\Rightarrow \frac{4x+3x+2x}{12} = 180^\circ$$

$$\Rightarrow \frac{9x}{12} = 180^\circ$$

$$\Rightarrow x = \frac{180^\circ \times 12}{9} = 240^\circ$$

$$\Rightarrow \angle A = \frac{1}{3}x = \frac{1}{3} \times 240^\circ = 80^\circ$$

$$\angle B = \frac{1}{4}x = \frac{1}{4} \times 240^\circ = 60^\circ$$

$$\text{and } \angle C = \frac{1}{6}x = \frac{1}{6} \times 240^\circ = 40^\circ \text{ Ans.}$$

Question 4.

Solution:

In ∆ABC,

∠ A + ∠B = 108° …(i)

∠B + ∠C – 130° …(ii)

But ∠A + ∠B + ∠C = 180° …(iii)

(sum of angles of a triangle)

Subtracting (i) from (iii),

∠C = 180° – 108° = 72°

Subtracting (ii) from (iii),

∠A = 180°- 130° = 50°

But ∠ A + ∠B = 108° (from i)

50° + ∠B = 108°

=> ∠B = 108° – 50° = 58°

Hence ∠A = 50°, ∠B = 58° and ∠C = 72° Ans.

Question 5.

Solution:

In ∆ABC,

∠A+∠B = 125° …(i)

∠A + ∠C = 113° …(ii)

But ∠A + ∠B + ∠C = 180° …(iii)

(sum of angles of a triangles) Subtracting, (i), from (iii),

∠C = 180°- 125° = 55°

Subtracting (ii) from (iii),

∠B = 180°- 113° – 67°

∠A + ∠B = 125°

∠ A + 67° = 125°

=> ∠ A = 125° – 67°

∠A = 58°

Hence ∠A = 58°, ∠B = 67° and ∠ C = 55° Ans.

Question 6.

Solution:

In ∆ PQR,

∠ P – ∠ Q = 42°

=> ∠P = 42°+∠Q …(i)

∠Q – ∠R = 21°

∠Q – 21°=∠R …(ii)

But ∠P + ∠Q + ∠R = 180°

(Sum of angles of a triangles)

42° + ∠Q + ∠Q + ∠Q – 21°= 180°

=> 21° + 3∠Q = 180°

=> 3∠Q = 180°- 21° = 159°

from ∠Q = 159o3 = 53°

(i)∠P = 42° + ∠Q = 42° + 53° = 95°

and from (ii) ∠R = ∠Q – 21°

= 53° – 25° = 32°

Hence ∠P = 95°, ∠Q = 53° and ∠R = 32° Ans.

Question 7.

Solution:

Let ∠ A, ∠ B and ∠ C are the three angles of A ABC.

and ∠A + ∠B = 116° …(i)

$\angle A - \angle B = 24^\circ$ ...(ii)

Adding we get :

$2\angle A = 140^\circ$

$\Rightarrow \angle A = \frac{140^\circ}{2} = 70^\circ$

Subtracting, we get

$2\angle B = 92^\circ$

$\Rightarrow \angle B = \frac{92^\circ}{2} = 46^\circ$

But $\angle A + \angle B + \angle C = 180^\circ$

(sum of angles of a triangle)

$\Rightarrow 70^\circ + 46^\circ + \angle C = 180^\circ$

$\Rightarrow 116^\circ + \angle C = 180^\circ$

$\Rightarrow \angle C = 180^\circ - 116^\circ = 64^\circ$

Hence angles of the triangle are,

$70^\circ, 46^\circ$ and 64° Ans.

Question 8.

Solution:

Let ∠ A, ∠ B and ∠ C are the three angles of the ∆ ABC

Let ∠ A = ∠ B = x

then ∠C = x + 48°

But ∠A + ∠B + ∠C = 180°

(Sum of angles of a triangle)

x + x + x + 18° = 180°

=> 3x + 18° = 180°

=> 3x = 180° – 18° = 162°

x = 162o3 = 54°

∠A = 54°, ∠B = 54° and ∠C = 54° + 18° = 72°

Hence angles are 54°, 54 and 72° Ans.

Question 9.

Solution:

Let the smallest angle of a triangle = x°

their second angle = 2x°

and third angle = 3x°

But sum of angle of a triangle = 180°

x + 2x + 3x = 180°

=> 6x = 180°

=> x – 180o6 = 30°

Hence smallest angle = 30°

Second angle = 2 x 30° = 60°

and third angle = 3 x 30° = 90° Ans.

Question 10.

Solution:

In a right angled triangle.

one angle is = 90°

Sum of other two acute angles = 90°

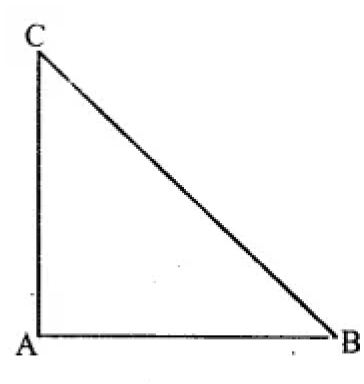
But one acute angle = 53°

Second acute angle = 90° – 53° = 37°

Hence angle of the triangle with be 90°, 53°, 37° Ans.

Question 11.

Solution:



Given : In ∆ ABC,

∠ A = ∠B + ∠C

To Prove : ∆ABC is a right-angled

Proof : We know that in ∆ABC,

∠A + ∠B + ∠C = 180°

(angles of a triangle)

But ∠ A = ∠ B + C given

∠A + (∠B + ∠C) = 180°

=> ∠A + ∠A = 180°

=> 2∠A = 180°

=> ∠ A = 180o2 = 90°

∠ A = 90°

Hence ∆ ABC is a right-angled Hence proved.

Question 12.

Solution:

Given. In ∆ ABC, ∠A = 90°

AL ⊥ BC.

To Prove : ∠BAL = ∠ACB

Proof : In ∆ ABC, AL ⊥ BC

In right angled ∆ALC,

∠ ACB + ∠ CAL = 90° …(i)

(∴ ∠L = 90°)

But ∠ A = 90° ‘

=> ∠ BAL + ∠ CAL = 90° …(ii)

From (i) and (ii),

∠BAL + ∠ CAL= ∠ ACB+ ∠CAL

=> ∠ BAL = ∠ ACB Hence proved.

Question 13.

Solution:

Given. In ∆ABC,

Each angle is less than the sum of the other two angles

∠A< ∠B + ∠C

∠B < ∠C + ∠A

and ∠C< ∠A + ∠C

Proof : ∠ A < ∠B + ∠C

Adding ∠ A both sides,

∠A + ∠A < ∠A + ∠B + ∠C => 2 ∠ A < 180°

(∴ ∠A+∠B+∠C=180°)

∠A < 180o2 => ∠A< 90

Similarly, we can prove that,

∠B < 90° and ∠C < 90°

∴ each angle is less than 90°

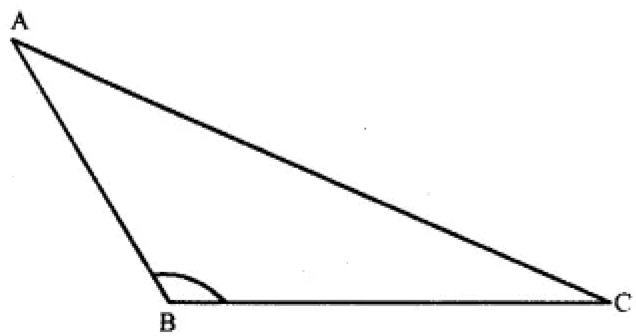
Hence, triangle is an acute angled triangle. Hence proved.

Question 14.

Solution:

Given. In ∆ABC,

∠B > ∠A + ∠C



Adding $\angle B$ both sides,

$\angle B + \angle B > \angle A + \angle B + \angle C$

$\Rightarrow 2\angle B > 180^\circ$

$(\because \angle A + \angle B + \angle C = 180^\circ)$

$\Rightarrow \angle B > \frac{180^\circ}{2} \Rightarrow \angle B > 90^\circ$

Hence Δ ABC is obtuse angled.

Hence proved.

Question 15.

Solution:

In ∆ABC

∠ ABC = 43° and Ext. ∠ ACD = 128°

$\because \quad \angle ACD + \angle ACB = 180^\circ$

(Linear pair)

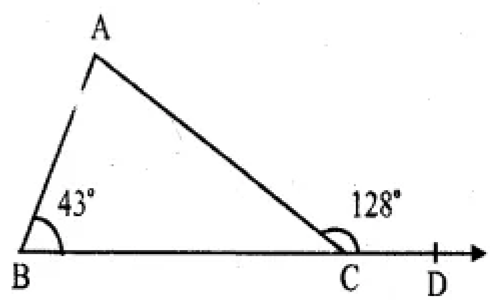
$\Rightarrow \quad 128^\circ + \angle ACB = 180^\circ$

$\Rightarrow \quad \angle ACB = 180^\circ - 128^\circ = 52^\circ$

But in Δ ABC,

$\angle BAC + \angle ABC + \angle ACB = 180^\circ$

(sum of angles of a triangle)



$\Rightarrow \quad \angle BAC + 43^\circ + 52^\circ = 180^\circ$

$\Rightarrow \quad \angle BAC + 95^\circ = 180^\circ$

$\Rightarrow \quad \angle BAC = 180^\circ - 95^\circ$

$\Rightarrow \quad \angle BAC = 85^\circ$

Hence, $\angle BAC = 85^\circ$ and $\angle ACB = 52^\circ$

Ans.

Question 16.

Solution:

$\angle$ ABC + $\angle$ ABD = 180°

(Linear pair)

$\Rightarrow \angle ABC + 106^\circ = 180^\circ$

$\Rightarrow \angle ABC = 180^\circ - 106^\circ = 74^\circ$

Again $\angle ACE + \angle ACB = 180^\circ$

(Linear pair)

$\Rightarrow 118^\circ + \angle ACB = 180^\circ$

$\Rightarrow \angle ACB = 180^\circ - 118^\circ = 62^\circ$

But $\angle ABC + \angle ACB + \angle BAC = 180^\circ$

(sum of angles of a triangle)

$\Rightarrow 74^\circ + 62^\circ + \angle BAC = 180^\circ$

$\Rightarrow 136^\circ + \angle BAC = 180^\circ$

$\Rightarrow \angle BAC = 180^\circ - 136^\circ$

$\Rightarrow \angle BAC = 44^\circ$

Hence, $\angle A = 44^\circ$, $\angle B = 74^\circ$ and $\angle C = 62^\circ$ Ans.

Question 17.

Solution:

(i)In the figure, $\angle BAE = 110^\circ$ and $\angle ACD = 120^\circ$.

$\because \quad \angle ACD + \angle ACB = 180^\circ$ (Linear pair)

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

$\Rightarrow \quad \angle ACB = 180^\circ - 120^\circ = 60^\circ$

In Δ ABC,

Ext. $\angle BAE = \angle ABC + \angle ACB$

$\Rightarrow \quad 110^\circ = x + 60^\circ$

$\Rightarrow \quad x = 110^\circ - 60^\circ$

$x = 50^\circ$ Ans.

(*ii*) In the figure,

$\angle A = 30^\circ, \angle B = 40^\circ$ and $\angle D = 50^\circ$

In Δ ABC,

$\angle A + \angle B + \angle C = 180^\circ$

(sum of angles of a triangle)

$\Rightarrow 30^\circ + 40^\circ + \angle C = 180^\circ$

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

$\Rightarrow \angle C = 180^\circ - 70^\circ$

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

But $\angle ACB + \angle ACD = 180^\circ$ (Linear pair)

$\Rightarrow 110^\circ + \angle ACD = 180^\circ$

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

Now in Δ ECD,

Ext. $\angle AED = \angle ACD + \angle CDE$

$\Rightarrow x^\circ = 70^\circ + 50^\circ = 120^\circ$

Hence $x^\circ = 120^\circ$ Ans.

(*iii*) In the given figure,

$\angle EAF = 60^\circ$, $\angle ACD = 115^\circ$

$\because \angle EAF = \angle BAC$

(Vertically opposite angles)

$\therefore \quad \angle BAC = 60^\circ$

In ΔABC.

Ext. $\angle ACD = \angle BAC + \angle ABC$

$\Rightarrow \quad 115^\circ = 60^\circ + x^\circ$

$\Rightarrow \quad x^\circ = 115^\circ - 60^\circ = 55^\circ$

Hence $x^\circ = 55^\circ$ Ans.

(*iv*) In the figure,

$\angle BAE = 60^\circ, \angle ECD = 45^\circ$

and $AB \parallel CD$.

$\because \quad AB \parallel CD$

$\therefore \quad \angle BAD = \angle EDC$ (Alternate angles)

$\therefore \quad \angle EDC = 60^\circ$

($\because \angle BAD$ or $\angle BAE = 60^\circ$)

Now in ΔECD,

$\angle DEC + \angle ECD + \angle EDC = 180^\circ$

(Sum of angles of a triangle)

$\Rightarrow \quad x^\circ + 45^\circ + 60^\circ = 180^\circ$

$\Rightarrow \quad x^\circ + 105^\circ = 180^\circ$

$\Rightarrow \quad x^\circ = 180^\circ - 105^\circ = 75^\circ$

Hence $x = 75^\circ$ Ans.

(v) In Δ ABC,

$\angle A = 40^\circ, \ \angle C = 90^\circ$

$\angle BED = 100^\circ$

Now in Δ ABC,

$\angle A + \angle B + \angle C = 180^\circ$

(sum of angles of a triangle)

$\Rightarrow \quad 40^\circ + \angle B + 90^\circ = 180^\circ$

$\Rightarrow \quad \angle B + 130^\circ = 180^\circ$

$\Rightarrow \quad \angle B = 180^\circ - 130^\circ = 50^\circ$

Similarly in Δ BED

$\angle B + \angle BED + \angle D = 180^\circ$

$\Rightarrow\ 50^\circ + 100^\circ + x^\circ = 180^\circ$

$\Rightarrow\ 150^\circ + x^\circ = 180^\circ$

$\Rightarrow\ x = 180^\circ - 150^\circ = 30^\circ$

(*vi*) In the figure,

$\angle A = 75^\circ,\ \angle B = 65^\circ,$

$\angle C = 110^\circ$

Now in Δ ABE

$\angle A + \angle B + \angle AEB = 180^\circ$

(sum of angles of a triangle)

$\Rightarrow\ 75^\circ + 65^\circ + \angle AEB = 80^\circ$

$\Rightarrow\ 140^\circ + \angle AEB = 180^\circ$

$\Rightarrow\ \angle AED = 180^\circ - 140^\circ = 40^\circ$

But $\angle DEC = \angle AEQ$

(vertically opposite angles)

$\therefore\ \angle DEC = 40^\circ$

Now in Δ DEC,

$\angle DEC + \angle D + \angle C = 180^\circ$

(sum of angles of a triangle)

$\Rightarrow\ 40^\circ + x^\circ + 110^\circ = 180^\circ$

$\Rightarrow\ 150^\circ + x^\circ = 180^\circ$

$\Rightarrow\ x^\circ = 180^\circ - 150^\circ = 30^\circ$

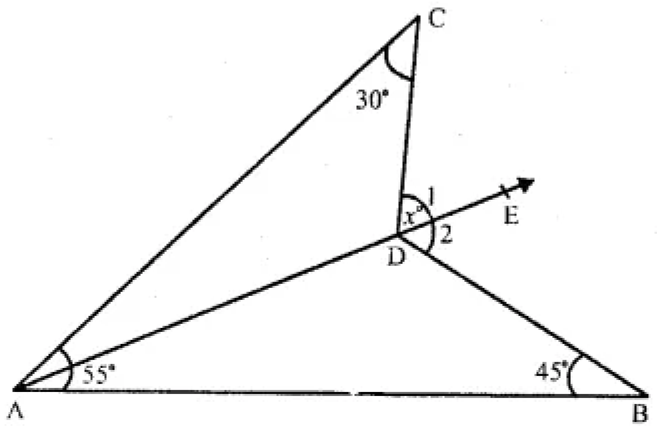
Hence $x = 30^\circ$ Ans.

Question 18.

Solution:

In the figure,

∠A = 55°, ∠B = 45°, ∠C = 30° Join AD and produce it to E



Now in Δ ACD, AD is produced

$\therefore$ Ext. $\angle 1 = \angle C + \angle 3$ ...(*i*)

and in Δ ADB, side AD is produced

$\therefore$ Ext. $\angle 2 = \angle B + \angle 4$ ...(ii)

Adding (*i*) and (*ii*)

$$\angle 1 + \angle 2 = \angle C + \angle 3 + \angle 4 + \angle B$$

$\Rightarrow \angle BDC = \angle B + \angle A + \angle C$

$\Rightarrow x^{\circ} = 30^{\circ} + 55^{\circ} + 45^{\circ} = 130^{\circ}$

Hence $x^{\circ} = 130^{\circ}$

Question 19.

Solution:

In the figure,

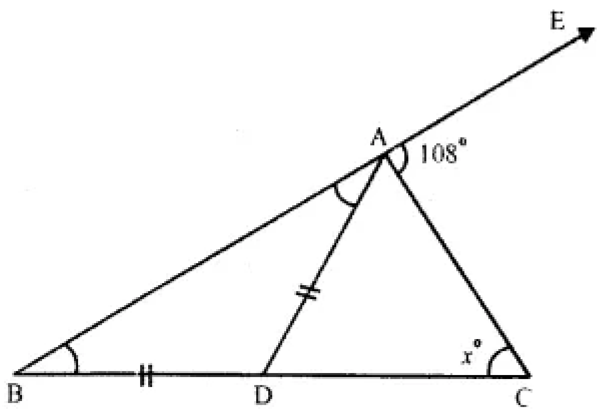
∠EAC = 108°,

AD divides ∠ BAC in the ratio 1 : 3

and AD = DB

∠EAC + ∠ BAC = 180°

(Linear pair)



$\Rightarrow \quad 108^\circ + \angle BAC = 180^\circ$

$\Rightarrow \quad \angle BAC = 180^\circ - 108^\circ = 72^\circ$

$\because$ AD, divides $\angle BAC$ in the ratio = 1 : 3

$\therefore \quad \angle BAD = \frac{1 \times 72^\circ}{1+3} = \frac{1 \times 72^\circ}{4} = 18^\circ$

and $\angle DAC = \frac{3 \times 72^\circ}{1+3} = \frac{3 \times 72^\circ}{4} = 54^\circ$

$\because \quad AD = BD$ (given)

$\therefore \quad \angle BAD = \angle ABD = 18^\circ$

Now in Δ ABC,

$\angle BAC + ACB + \angle ABC = 180^\circ$

(Angles of a triangle)

$\Rightarrow \quad 72^\circ + x^\circ + 18^\circ = 180^\circ$

$\Rightarrow \quad x^\circ + 90^\circ = 180^\circ$

$\Rightarrow \quad x = 180^\circ - 90^\circ$

$\Rightarrow \quad x = 90^\circ$ Ans.

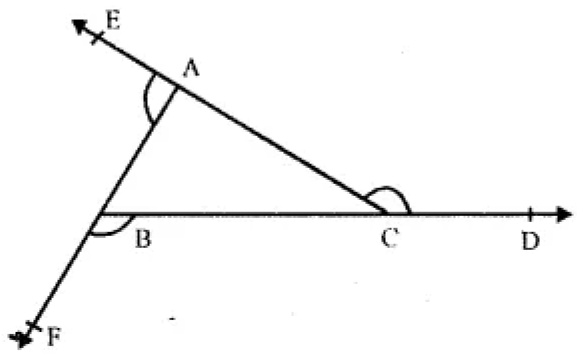
Question 20.

Solution:

Sides BC, CA and AB

are produced in order forming exterior

angles ∠ ACD,



∠BAE and ∠CBF respectively

To Prove : ∠ACD + ∠BAE + ∠CBF = 4 right angles.

Proof : In Δ ABC,

∠A + ∠B + ∠C = 180^o or $2rt$ angle.

But ∠ACD + ∠C = 180^o

or $2rt$ angles ...(*i*) (Linear pair)

Similarly $\angle BAE + \angle A = 2rt.$ angles ...(*ii*)

and $\angle CBF + \angle B = 2\ rt.$ angles ...(*iii*)

Adding (*i*), (*ii*) and (*iii*), we get :

$\angle ACD + \angle C + \angle BAE + \angle A + \angle CBF + \angle B = 2rt$ angles + $2rt.$ angles + $2rt$ angles

$\Rightarrow \angle ACD + \angle BAE + \angle CBF + \angle A + \angle B + \angle C = 6\ rt.$ angles

$\Rightarrow \angle ACD + \angle BAE + \angle CBF + 2rt.$ angles $= 6\ rt.$ angles ($\because \angle A + \angle B + \angle C = 2\ rt.$ angles)

$\Rightarrow \angle ACD + \angle BAE + \angle CBF = 6\ rt.$ angles $- 2rt.$ angles

$\Rightarrow \angle ACD + \angle BAE + \angle CBF = 4rt.$ angles.

Hence proved.

Question 21.

Solution:

Given : Two Δ s DFB and ACF intersect each other as shown in the figure.

To Prove : $\angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 360°$

Proof : In Δ DFB,

$\angle D + \angle F + \angle B = 180°$

(sum of angles of a triangle)

Similarly,in Δ ACE

$\angle A + \angle C + \angle E = 180°$ …(ii)

Adding (i) and (ii), we get :

∠D + ∠F + ∠B+ ∠A+ ∠C + ∠E = 180° + 180°

=> ∠A+∠B+∠C+∠D+∠E + ∠ F = 360°

Hence proved.

Question 22.

Solution:

In the figure,

ABC is a triangle

and OB and OC are the angle

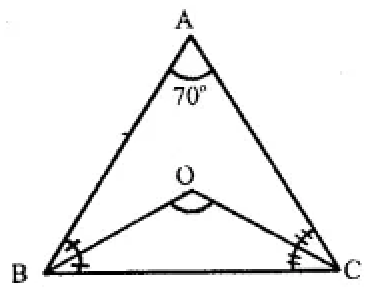
bisectors of ∠ B and ∠ C meeting each other at O.

∠ A = 70°

In ∆ ABC,

∠A + ∠B + ∠C = 180°

(sum of angles of a triangle)



$\Rightarrow\ 70^\circ + \angle B + \angle C = 180^\circ$

$\Rightarrow\ \angle B + \angle C = 180^\circ - 70^\circ = 110^\circ$

or $\frac{1}{2}\angle B + \frac{1}{2}\angle C = \frac{110^\circ}{2} = 55^\circ$ ...(*i*)

Now in Δ OBC,

$\angle BOC + \angle OBC + \angle OCB = 180^\circ$
(angle of a triangle)

But $\angle OBC = \frac{1}{2}\angle B$

($\because$ OB is the bisector of $\angle B$)

and $\angle OCB = \frac{1}{2}\angle C$

(∵ OC is the bisector of $\angle C$)

$\therefore \quad \angle BOC + \frac{1}{2}\angle B + \frac{1}{2}\angle C = 180^\circ$

$\Rightarrow \quad \angle BOC + 55^\circ = 180^\circ \qquad$ [from (i)]

$\Rightarrow \quad \angle BOC = 180^\circ - 55^\circ = 125^\circ$

$\therefore \quad \angle BOC = 125^\circ$ Ans.

Or

We know that in a Δ ABC, if OB and OC are bisectors of $\angle B$ and $\angle C$ respectively meeting at O.

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

$= 90^\circ + \frac{1}{2} \times 70^\circ$

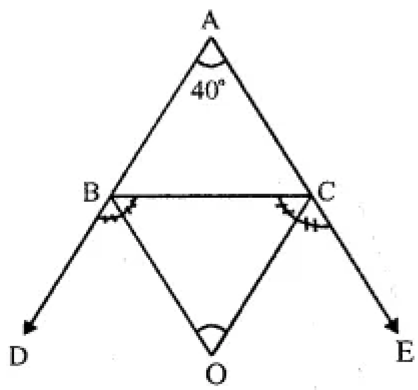
$= 90^\circ + 35^\circ = 125^\circ$ Ans.

Question 23.

Solution:

In ΔABC, $\angle$ A = 40°

Sides AB and AC are produced forming exterior angles $\angle$ CBD and $\angle$ BCE



OB and OC are the bisectors of ∠CBD and ∠BCF respectively meeting each other at O

Now in Δ ABC, ∠A = 40°

∴ ∠B + ∠C = 180° – 40° = 140°

and sum of their exterior angles = 180° + 180° – 140°

= 360° – 140° = 220°

⇒ ∠CBD + ∠BCE = 220°

OB and OC are their bisectors

$\therefore \frac{1}{2} \angle CBD + \frac{1}{2} \angle BCE$

$= 220^\circ \times \frac{1}{2}$

$= 110^\circ$

$\Rightarrow \angle CBO + \angle BCO = 110^\circ$

Now in ΔOBC,

$\angle CBO + \angle BCO + \angle BOC = 180^\circ$
(sum of angles of a triangle)

$\Rightarrow 110^\circ + \angle BOC = 180^\circ$

$\Rightarrow \angle BOC = 180^\circ - 110^\circ = 70^\circ$ Ans.

Or

We know that in a triangle ABC, if OB and OC are the bisectors of Ext. $\angle B$ and Ext $\angle C$ respectively meeting at O.

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

$\Rightarrow \angle BOC = 90^\circ - \frac{1}{2}(40^\circ)$

$(\because \angle A = 40^\circ)$

$= 90^\circ - 20^\circ = 70^\circ$ Ans.

Question 24.

Solution:

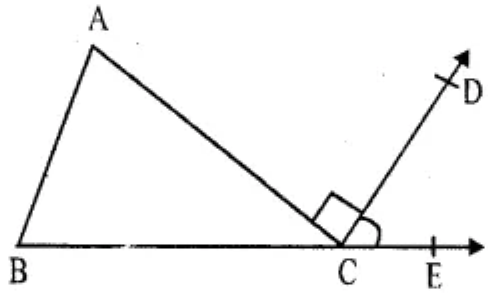
In the figure, ΔABC is triangle and ∠A : ∠B : ∠C = 3 : 2 : 1

AC ⊥ CD.

∠ A + ∠B + ∠C = 180°

(sum of angles of a triangle)

But ∠A : ∠B : ∠C = 3 : 2 : 1



Let ∠A = 3x, then ∠B = 2x and ∠C = x

$\therefore \quad 3x + 2x + x = 180^\circ$

$\Rightarrow \quad 6x = 180^\circ$

$\Rightarrow \quad x = \frac{180^\circ}{6} = 30^\circ$

$\therefore \quad \angle A = 3x = 3 \times 30^\circ = 90^\circ$

$\angle B = 2x = 2 \times 30^\circ = 60^\circ$

and $\angle C = x = 30^\circ$

Again, In Δ ABC, BC is produced to E

$\therefore$ Ext. $\angle ACE = \angle A + \angle B$

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

$\Rightarrow 90^\circ + \angle ECD = 90^\circ + 60^\circ = 150^\circ$

$\Rightarrow \angle ECD = 150^\circ - 90^\circ = 60^\circ$

Hence $\angle ECD = 60^\circ$ Ans.

Question 25.

Solution:

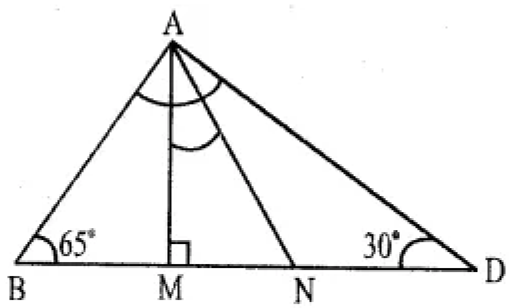
In Δ ABC

AN is the bisector of ∠ A

∠NAB =12 ∠A.

Now in right angled ∆ AMB,

∠B + ∠MAB = 90° (∠M = 90°)



$\Rightarrow \quad \angle MAB = 90^\circ - \angle B$

$\therefore \quad \angle MAN = \angle NAB - \angle MAB$

$= \frac{1}{2} \angle A - (90^\circ - \angle B) = \frac{1}{2} \angle A - 90^\circ$
$+ \angle B$

$= \frac{1}{2} \angle A - \left(\frac{1}{2}\angle A + \frac{1}{2}\angle B + \frac{1}{2}\angle C\right) + \angle B$

$(\because \frac{1}{2} \angle A + \frac{1}{2} \angle B + \frac{1}{2} \angle C = 90^\circ)$

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

$= \frac{1}{2} \angle B - \frac{1}{2}\angle C = \frac{1}{2}(\angle B - \angle C)$

But $\angle B = 65^\circ$ and $\angle C = 30^\circ$

$\therefore \quad \angle MAN = \frac{1}{2} (65^\circ - 30^\circ) = \frac{1}{2} \times 35^\circ$

$= (17.5)^\circ$ Ans.

Question 26.

Solution:

(i) False: As a triangle has only one right angle

(ii) True: If two angles will be obtuse, then the third angle will not exist.

(iii) False: As an acute-angled triangle all the three angles are acute.

(iv) False: As if each angle will be less than 60°, then their sum will be less than 60° x 3 = 180°, which is not true.

(v) True: As the sum of three angles will be 60° x 3 = 180°, which is true.

(vi) True: A triangle can be possible if the sum of its angles is 180°

But the given triangle having angles 10° + 80° + 100° = 190° is not possible.

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