Chapter : 4. ANGLES, LINES AND TRIANGLES

Exercise : 4A

Question: 1

(i) Angle – A shape formed by two lines or rays diverging from a common vertex.

Types of angle: (a) Acute angle (less than 90°)

(b) Right angle (exactly 90°)

(c) Obtuse angle (between 90° and 180°)

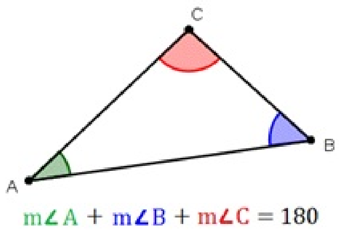
(d) Straight angle (exactly 180°)

(e) Reflex angle (between 180° and 360°)

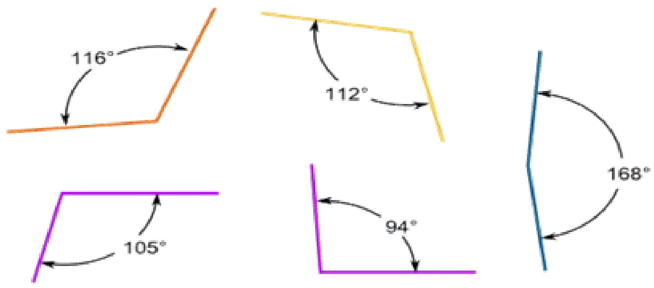
(f) Full angle (exactly 360°)

(ii) Interior of an angle – The area between the rays that make up an angle and extending away from the vertex to infinity.

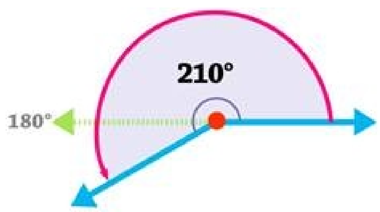
The interior angles of a triangle always add up to 180°.



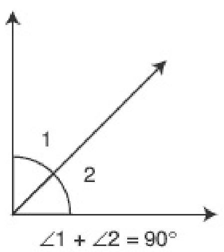
(iii) Obtuse angle – It is an angle that measures between 90 to 180 degrees.



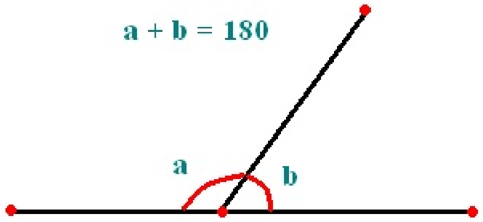
(iv) Reflex angle – It is an angle that measures between 180 to 360 degrees.



(v) Complementary angles – Two angles are called complementary angles if the sum of two angles is 90°.



(vi) Supplementary angles – Angles are said to be supplementary if the sum of two angles is 180°.



Question: 2

65°11’25’

$\angle A$ + $\angle B$ = 36°27’46’’ + 28°43’39’’

= 64°70’85’’

∵ 60’ = 1° ⇒ 70’ = 1°10’

60’’ = 1’ ⇒ 85’’ = 1’ 25’’

∵ $\angle A$ + $\angle B$ = 65°11’25’’

Question: 3

11°31’30’’

36° - 24°28’30’’ = 35°59’60’’ - 24°28’30’’

= 11°31’30’’

Question: 4

(i) 32°

Complement of angle = 90° – θ

Complement of 58° = 90° - 58°

= 32°

(ii) 74°

Complement of angle = 90° – θ

Complement of 58° = 90° - 16°

= 74°

(iii) 30°

Right angle = 90°

$\frac{2}{3}$ of a right angle = $\frac{2}{3}$ × 90°

= 60°

Complement of 60° = 90° - 60°

= 30°

(iv) 43°30’

Complement of angle = 90° – θ

Complement of 46°30’ = 90° - 46°30’

= 89°60’ - 46°30’

(v) 37°16’40’’

Complement of angle = 90° – θ

Complement of 52°43’20’’ = 90° - 52°43’20’’

= 89°59’60’’ - 52°43’20’’

= 37°16’40’’

(vi) 21°24’15’’

Complement of angle = 90° – θ

Complement of 68°35’45’’ = 90° - 68°35’45’’

= 89°59’60’’ - 68°35’45’’

= 68°35’45’’

Question: 5

(i) 117°

Supplement of angle = 180° – θ

Supplement of 58° = 180° - 63°

= 117°

(ii) 42°

Supplement of angle = 180° – θ

Supplement of 58° = 180° - 138°

= 42°

(iii) 126°

Right angle = 90°

$\frac{3}{5}$ of a right angle = $\frac{3}{5}$ × 90°

= 54°

Supplement of 54° = 180° - 54°

= 126°

(iv) 104°24’

Supplement of angle = 180° – θ

Supplement of 75°36’ = 180° - 75°36’

= 179°60’ - 75°36’

= 104°24’

(v) 55°39’20’’

Supplement of angle = 180° – θ

Supplement of 124°20’40’ = 180° - 124°20’40’’

= 179°59’60” - 124°20’40’’

= 55°39’20’’

(vi) 71°11’28’’

Supplement of angle = 180° – θ

Supplement of 108°48’32’’ = 180° - 108°48’32’’

= 179°59’60” - 108°48’32’’

= 71°11’28’’

Question: 6

(i) 45°

Let, measure of an angle = X

Complement of X = 90° – X

Hence,

⇒ X = 90° – X

⇒ 2X = 90°

⇒ X = 45°

Therefore measure of an angle = 45°

(ii) 90°

Let, measure of an angle = X

Supplement of X = 180° – X

Hence,

⇒ X = 180° – X

⇒ 2X = 180°

⇒ X = 90°

Therefore measure of an angle = 90°

Question: 7

63°

Let, measure of an angle = X

Complement of X = 90° – X

According to question,

⇒ X = (90° – X) + 36°

⇒ X + X = 90° + 36°

⇒ 2X = 126°

⇒ X = 63°

Therefore measure of an angle = 63°

Question: 8

(77.5)°

Let, measure of an angle = X

Supplement of X = 180° – X

According to question,

⇒ X = (180° – X) - 25°

⇒ X + X = 180° - 25°

⇒ 2X = 155°

⇒ X = (77.5)°

Therefore measure of an angle = (77.5)°

Question: 9

72°

Let the angle = X

Complement of X = 90° – X

According to question,

⇒ $X = 4(90° – X)$

⇒ $X = 360° - 4X$

⇒ $X + 4X = 360°$

⇒ $5X = 360°$

⇒ $X = 72°$

Therefore angle = 72°

Question: 10

150°

Let the angle = X

Supplement of $X = 180° – X$

According to question,

⇒ $X = 5(180° – X)$

⇒ $X = 900° - 4X$

⇒ $X + 5X = 900°$

⇒ $6X = 900°$

⇒ $X = 150°$

Therefore angle = 150°

Question: 11

60°

Let the angle = X

Complement of $X = 90° – X$

Supplement of $X = 180° – X$

According to question,

⇒ $180° – X = 4(90° – X)$

⇒ $180° – X = 360° – 4X$

⇒ $– X + 4X = 360° – 180°$

⇒ $3X = 180°$

⇒ $X = 60°$

Therefore angle = 60°

Question: 12

180°

Let the angle = X

Complement of $X = 90° – X$

Supplement of $X = 180° – X$

According to question,

⇒ $90° – X = 4(180° – X)$

⇒ $180° – X = 720° – 4X$

⇒ $– X + 4X = 720° – 180°$

⇒ $3X = 540°$

⇒ $X = 180°$

Therefore angle = 180°

Question: 13

108°, 72°

Let angle = X

Supplementary of X = 180° – X

According to question,

$X : 180° – X = 3 : 2$

⇒ $X / (180° – X) = 3 / 2$

⇒ $2X = 3(180° – X)$

⇒ $2X = 540° – 3X$

⇒ $2X + 3X = 540°$

⇒ $5X = 540°$

⇒ $X = 108°$

Therefore angle = 108°

And its supplement = 180° – 108° = 72°

Question: 14

40°, 50°

Let angle = X

Complementary of X = 90° – X

According to question,

$X : 90° – X = 4 : 5$

⇒ $X / (90° – X) = 4 / 5$

⇒ $5X = 4(90° – X)$

⇒ $5X = 360° – 4X$

⇒ $5X + 4X = 360°$

⇒ $9X = 360°$

⇒ $X = 40°$

Therefore angle = 40°

And its supplement = 90° – 40° = 50°

Question: 15

25°

Let the measure of an angle = X

Complement of X = 90° – X

Supplement of X = 180° – X

According to question,

⇒ $7(90° – X) = 3(180° – X) - 10°$

⇒ $630° – 7X = 540° – 3X - 10°$

⇒ – 7X + 3X = 540° – 10° – 630°

⇒ - 4X = 100°

⇒ X = 25°

Therefore measure of an angle = 25°

Exercise : 4B

Question: 1

⇒ ∠AOC + ∠BOC = 180°

⇒ 62° + x = 180°

⇒ x = 180° – 62°

= 118°

Question: 2

X=27.5, $\angle AOC$ =77.5° $\angle BOD$ =47.5°

AOB is a straight line

Therefore, $\angle AOC$ + ∠COD + $\angle BOD$ = 180°

⇒ (3x - 5)° + 55° + (x + 20)° = 180°

⇒ 3x - 5° + 55° + x + 20° = 180°

⇒ 4x = 180° - 70°

⇒ 4x = 110°

⇒ x = 27.5°

$\angle AOC$ = (3x - 5)°

= 3×27.5 – 5 = 77.5°

$\angle BOD$ = (x + 20)°

= 27.5 + 20 = 47.5°

Question: 3

X=32, $\angle AOC$ =103°, ∠COD =45° $\angle BOD$ =32°

AOB is a straight line

Therefore, $\angle AOC$ + ∠COD + $\angle BOD$ = 180°

⇒ (3x + 7)° + (2x - 19)° + x° = 180°

⇒ 3x + 7° + 2x - 19° + x° = 180°

⇒ 6x = 180° + 12°

⇒ 6x = 192°

⇒ x = 32°

$\angle AOC$ = (3x + 7)°

= 3×32° + 7 = 103°

∠COD = (2x - 19)°

= 2×32° – 19 = 45°

$\angle BOD$ = x

= 32°

Question: 4

X=60, Y=48, Z=72

AOB is a straight line

Therefore, $\angle XOP + \angle POQ + \angle YOQ = 180°$

Given, x: y: z =5: 4: 6

Let $\angle XOP = x° = 5a$, $\angle POQ = y° = 4a$, $\angle YOQ = z° = 6a$

$\Rightarrow 5a + 4a + 6a = 180°$

$\Rightarrow 15a = 180°$

$\Rightarrow a = 12°$

Therefore,

$x = 5a = 5\times12° = 60°$

$y = 4a = 4\times12° = 48°$

$z = 6a = 6\times12° = 72°$

Question: 5

X=28°

AOB is a straight line

Therefore, $\angle AOB = 180°$

$\Rightarrow (3x +20)° + (4x -36)° = 180°$

$\Rightarrow 3x + 20° + 4x - 36° = 180°$

$\Rightarrow 7x - 16° = 180°$

$\Rightarrow 7x = 196°$

$\Rightarrow x = 28°$

Question: 6

$\angle AOD$ =130°, $\angle BOD$ =50°, $\angle BOC$ =130°

Given AB and CD intersect a O

Therefore, $\angle AOC = \angle BOD$ ______________________ (i)

And $\angle BOC = \angle AOD$ ______________________ (ii)

$\angle AOC$ =50°

Therefore, $\angle BOD$ =50° from equation (i)

AOB is a straight line,

$\Rightarrow \angle AOC + \angle BOC = 180°$

$\Rightarrow 50° + \angle BOC = 180°$

$\Rightarrow \angle BOC = 180° - 50°$

$\Rightarrow \angle BOC = 130°$

$\angle AOD = \angle BOC = 130°$ from equation (ii)

Question: 7

X=4, Y=4, Z=50, t=90

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

Therefore, $\angle AOF = \angle BOE$ _________________________ (i)

∠BOD = ∠AOC ________________________ (ii)

∠DOF = ∠COE ________________________ (iii)

x = y from equation (i)

t = 90 from equation (ii)

z = 50 from equation (iii)

∠AOF + ∠DOF + ∠BOD = 180° (from AOB straight line)

⇒ x + 50° + 90° = 180°

⇒ x = 180° - 140°

⇒ x = 40°

x = y = 40° from equation (i)

Question: 8

)

∠AOD + ∠DOF + ∠BOF + ∠BOC + ∠COE + ∠AOE = 360°

⇒ 2x + 5x + 3x + 2x + 5x + 3x = 360°

⇒ 20x = 360°

⇒ x = 18°

∠AOD = 2x = 2× 18° = 36°

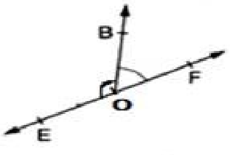
∠COE = 3x = 3× 18° = 54°

∠AOE = 4x = 4× 18° = 72°

Question: 9

100°, 80°

Explanation:



EOF is a straight line and its adjacent angles are ∠EOB and ∠FOB.

Let ∠EOB = 5a, and ∠FOB = 4a

∠EOB + ∠FOB = 180° (EOF is a straight line)

⇒5a + 4a = 180°

⇒9a = 180°

⇒ a = 20°

Therefore, ∠EOB = 5a

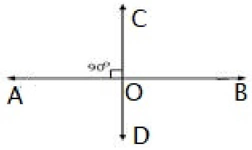
= 5 × 20° = 100°

And ∠FOB = 4a

= 4 × 20° = 80°

Question: 10

Proof



Given lines AB and CD intersect each other at point O and ∠AOC = 90°

∠AOC = ∠BOD (Opposite angles)

Therefore, ∠BOD = 90°

⇒ ∠BOD + ∠AOC = 180°

⇒ ∠BOC + 90° = 180°

⇒ ∠BOC = 90°

Now, ∠AOD = ∠BOC (Opposite angles)

Therefore,

∠AOD = 90°

Proved each of the remaining angles measures 90°.

Question: 11

$\angle BOC$=140°, $\angle AOC$=40°, $\angle AOD$ = 140°, ∠BOD = 40°

Given lines AB and Cd intersect at a point O and $\angle BOC$ + $\angle AOD$ =280°

$\angle BOC$ = $\angle AOD$ (Opposite angle)

⇒ $\angle BOC$ + $\angle AOD$ = 280°

⇒ $\angle BOC$ + $\angle BOC$ = 280°

⇒ 2$\angle BOC$ = 280°

⇒ $\angle BOC$ = 140°

$\angle BOC$ = $\angle AOD$ = 140°

Now,

$\angle AOC$ + $\angle BOC$ = 180° (Because AOB is a straight line)

⇒ $\angle AOC$ + 140° = 180°

⇒ $\angle AOC$ = 40°

$\angle AOC$ = ∠BOD = 40°

Question: 12

Proof

Given OC is the bisector of $\angle AOB$

Therefore, ∠AOC = ∠COB ______________________ (i)

DOC is a straight line,

$\angle BOD + \angle COB$ = 180° _______________ (ii)

Similarly, $\angle AOC + \angle AOD$ = 180° ________________ (iii)

From equations (i) and (ii)

⇒ $\angle BOD + \angle COB = \angle AOC + \angle AOD$

⇒ $\angle BOD + \angle AOC = \angle AOC + \angle AOD$ (from equation (i))

⇒ $\angle BOD = \angle AOD$ Proved

Question: 13

34°

Angle of incidence =angle of reflection.

Therefore, $\angle PQA = \angle BQR$ ________________________ (i)

$\Rightarrow \angle BQR + \angle PQR + \angle PQA = 180°$[Because AQB is a straight line]

$\Rightarrow \angle BQR + 112° + \angle PQA = 180°$

$\Rightarrow \angle BQR + \angle PQA = 180° - 112°$

$\Rightarrow \angle PQA + \angle PQA = 68°$ [from equation (i)]

$\Rightarrow 2\ \angle PQA = 68°$

$\Rightarrow \angle PQA = 34°$

Question: 14

Given, lines AB and CD intersect each other at point O.

OE is the bisector of $\angle$ BOD.

TO prove: OF bisects $\angle$AOC.

Proof:

AB and CD intersect each other at point O.

Therefore, $\angle$ AOC = $\angle$ BOD

$\angle 1 = \angle 2$ [OE is the bisector of $\angle$BOD] ___________________ (i)

$\angle 1 = \angle 3$ and $\angle 2 = \angle 4$ [Opposite angles] _____________ (ii)

From equations (i) and (ii)

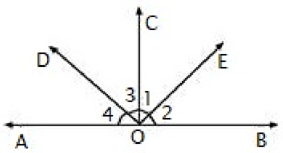
$\angle 3 = \angle 4$

Hence, OF is the bisector of $\angle$AOC.

Question: 15

Prove that

Solution:



Given, $\angle$AOC and $\angle$BOC are supplementary angles

OE is the bisector of $\angle$BOC and

OD is the bisector of $\angle$AOC

Therefore, $\angle 1 = \angle 2$ and $\angle 3 = \angle 4$ __________________ (i)

$\angle BOC + \angle AOC = 180°$ [Because AOB is a straight line]

$\Rightarrow \angle 1 + \angle 2 + \angle 3 + \angle 4 = 180°$

$\Rightarrow \angle 1 + \angle 1 + \angle 3 + \angle 3 = 180°$ [From equation (i)]

$\Rightarrow 2\ \angle 1 + 2\ \angle 3 = 180°$

$\Rightarrow 2(\angle 1 + \angle 3) = 180°$

$\Rightarrow \angle 1 + \angle 3 = 90°$

Hence, $\angle EOD = 90°$ proved.

Exercise : 4C

Question: 1

$\angle 2 = 110°$, $\angle 3 = 70°$, $\angle 4 = 110°$, $\angle 5 = 70°$, $\angle 6 = 110°$, $\angle 7 = 70°$, $\angle 8 = 110°$

Given AB ||CD are cut by a transversal t at E and F respectively.

And $\angle 1 = 70°$

$\angle 1 = \angle 3 = 70°$ [Opposite angles]

$\angle 5 = \angle 1 = 70°$ [Corresponding angles]

$\angle 3 = \angle 7 = 70°$ [Corresponding angles]

$\angle 1 + \angle 2 = 180°$ [Because AB is a straight line]

$\Rightarrow 70° + \angle 2 = 180°$

$\Rightarrow \angle 2 = 110°$

$\angle 4 = \angle 2 = 110°$ [Opposite angles]

$\angle 6 = \angle 2 = 110°$ [Corresponding angles]

$\angle 8 = \angle 4 = 110°$ [Corresponding angles]

Question: 2

$\angle 1 = 100°$, $\angle 2 = 80°$, $\angle 3 = 100°$ $\angle 4 = 80°$, $\angle 5 = 100°$, $\angle 6 = 80°$, $\angle 7 = 100°$, $\angle 8 = 80°$

Given AB ||CD are cut by a transversal t at E and F respectively.

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

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

$\angle 1 + \angle 2 = 180°$ [Because AB is a straight line]

$\Rightarrow 5a + 4a = 180°$

$\Rightarrow 9a = 180°$

$\Rightarrow a = 20°$

Therefore, $\angle 1 = 5a$

$\angle 1 = 5 \times 20° = 100°$

$\angle 2 = 4a$

$\angle 2 = 4 \times 20° = 80°$

$\angle 3 = \angle 1 = 100°$ [Opposite angles]

$\angle 4 = \angle 2 = 80°$ [Opposite angles]

$\angle 5 = \angle 1 = 100°$ [Crossponding angles]

$\angle 6 = \angle 4 = 80°$ [Crossponding angles]

$\angle 7 = \angle 5 = 100°$ [Opposite angles]

$\angle 8 = \angle 6 = 80°$ [Opposite angles]

Question: 3

Given AB||DC and AD||BC

Therefore, $\angle ADC + \angle DCB = 180°$ _____________ (i)

$\angle DCB + \angle ABC = 180°$ _____________ (ii)

From equations (i) and (ii)

$\angle ADC + \angle DCB = \angle DCB + \angle ABC$

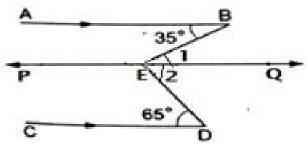
$\angle ADC = \angle ABC$ Proved.

Question: 4

(i) x = 100

Given AB||CD, ∠ABE = 35° and ∠EDC = 65°

Draw a line PEQ||AB or CD



∠1 = ∠ABE = 35°[AB||PQ and alternate angle] _______________ (i)

∠2 = ∠EDC = 65°[CD||PQ and alternate angle] _______________ (ii)

From equations (i) and (ii)

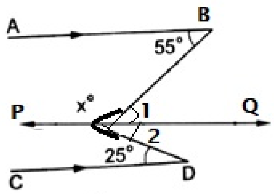
∠1 + ∠2 = 100°

⇒ x = 100°

(ii) x=280

Given AB||CD, ∠ABE = 35° and ∠EDC = 65°

Draw a line POQ||AB or CD



(ii)

∠1 = ∠ABO = 55°[AB||PQ and alternate angle] _______________ (i)

∠2 = ∠CDO = 25°[CD||PQ and alternate angle] _______________ (ii)

From equations (i) and (ii)

∠1 + ∠2 = 80°

Now,

∠BOD + ∠DOB = 360°

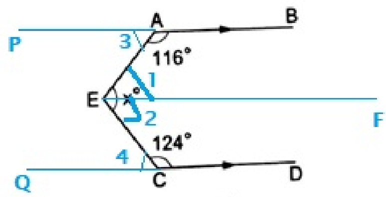
⇒ 80° + x° = 360°

⇒ x = 280°

(iii) x=120

Given AB||CD, ∠BAE = 116° and ∠DCE = 124°

Draw a line EF||AB or CD



(iii)

∠BAE + ∠PAE = 180° [Because PAB is a straight line]

⇒ 116° + ∠3 = 180°

$\Rightarrow \angle 3 = 180° - 116°$

$\Rightarrow \angle 3 = 64°$

Therefore,

$\angle 1 = \angle 3 = 64°$ [Alternate angles] ____________________ (i)

Similarly, $\angle 4 = 180° - 124°$

$\angle 4 = 56°$

Therefore,

$\angle 2 = \angle 4 = 56°$ [Alternate angles] ____________________ (ii)

From equations (i) and (ii)

$\Rightarrow \angle 1 + \angle 2 = 64° + 56°$

$\Rightarrow x = 120°$

Question: 5

X=20

Given AB||CD||EF, $\angle ABC = 70°$ and $\angle CEF = 130°$

AB||CD

Therefore,

$\angle ABC = \angle BCD = 70°$ [Alternate angles] ________________ (i)

EF||CD

Therefore,

$\angle DCE + \angle CEF = 180°$

$\Rightarrow \angle DCE + 130° = 180°$

$\Rightarrow \angle DCE = 50°$

Now,

$\angle BCE + \angle DCE = \angle BCD$

$\Rightarrow x + 50° = 70°$

$\Rightarrow x = 20°$

Question: 6

CD||EF

Therefore, $\angle DCE + \angle CEF = 180°$

$\Rightarrow 130° + \angle 1 = 180°$

$\Rightarrow \angle 1 = 180° - 130°$

$\Rightarrow \angle 1 = 50°$

AB||EF

Therefore, $\angle BAE + \angle AEF = 180°$

$\Rightarrow x + \angle 1 + 20° = 180°$

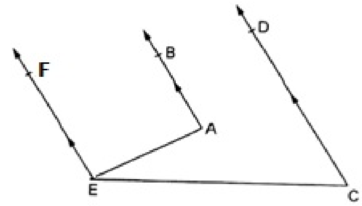
$\Rightarrow x + 50° + 20° = 180°$

$\Rightarrow x = 180° - 70°$

$\Rightarrow \boldsymbol{x = 110°}$

Question: 7

Draw a line EF||AB||CD.



$\angle BAE + \angle AEF = 180°$ [Because AB||EF and AE is the transversal] _________________ (i)

$\angle DCE + \angle CEF = 180°$ [Because DC||EF and CE is the transversal] _________________ (ii)

From equations (i) and (ii)

⇒ $\angle BAE + \angle AEF = \angle DCE + \angle CEF$

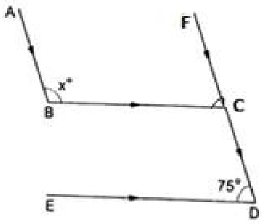
⇒ $\angle BAE - \angle DCE = \angle CEF - \angle AEF$

⇒ $\angle BAE - \angle DCE = \angle AEC$ Proved.

Question: 8

X=105

Given AB||CD and BC||ED.



AB||CD

Therefore, ∠BCF = ∠EDC = 75° [Crossponding angles]

∠ABC + ∠BCF = 180° [Because AB||DCF]

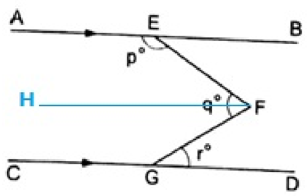
⇒ x + 75° = 180°

⇒ x = 105°

Question: 9

Given AB||CD, ∠AEF = P°, ∠EFG = q°, ∠FGD = r°

Draw a line FH||AB||CD



∠HFG = ∠FGD = r° [Because HF||CD and alternate angles] ___________ (i)

∠EFH = ∠EFG - ∠HFG

⇒ ∠EFH = q – r _____________________ (i)

∠AEF + ∠EFH = 180° [Because AB||HF]

⇒ ∠AEF + ∠EFH = 180°

⇒ p + (q – r) = 180°

⇒ p + q – r = 180°Proved.

Question: 10

x=70, y=50

Given AB||PQ

$\angle GEF + 20° + 75° = 180°$[Because EF is a straight line]

$\Rightarrow \angle GEF = 180° - 95°$

$\Rightarrow \angle GEF = 85°$________________ (i)

In triangle EFG,

$\Rightarrow X + 25° + 85° = 180°$ [$\angle GEF = 85°$]

$\Rightarrow X = 60°$

Now,

$\Rightarrow \angle BEF + \angle EFQ = 180°$[Interior angles on same side of transversal]

$\Rightarrow (20° + 85°) + (25° + Y) = 180°$

$\Rightarrow Y = 180° - 130°$

$\Rightarrow Y = 50°$

Question: 11

Solution:

x=20

Given AB||CD

Therefore,

$\angle QGH = \angle GEF$ [Crossponding angles]

$\angle QGH = 95°$ ___________________ (i)

In CD straight line,

$\Rightarrow \angle CHQ + \angle GHQ = 180°$

$\Rightarrow 115° + \angle GHQ = 180°$

$\Rightarrow \angle GHQ = 65°$

In triangle GHQ,

$\Rightarrow \angle QGH + \angle GHQ + \angle GQH = 180°$

$\Rightarrow 95° + 65° + x = 180°$

$\Rightarrow x = 20°$

Question: 13

Z=75, x=35, y=70

Given AB||CD

Therefore,

$X = 35°$[Alternate angles]

In triangle AOB,

$\Rightarrow x + 75° + y = 180°$

$\Rightarrow 35° + 75° + y = 180°$

$\Rightarrow y = 70°$

$\Rightarrow \angle COD = y = 70°$[Opposite angles]

In triangle COD,

$\Rightarrow z + 35° + \angle COD = 180°$

$\Rightarrow z + 35° + 70° = 180°$

$\Rightarrow z = 75°$

Question: 14

x=105, y=75, z=50

Given AB||CD

Therefore,

$\Rightarrow \angle AEF = \angle EFG = 75°$[Alternate angles]

$\Rightarrow y = 75°$

For CD straight line,

$\Rightarrow x + y = 180°$

$\Rightarrow x + 75° = 180°$

$\Rightarrow x = 105°$

Again,

$\Rightarrow \angle EGF + 125° = 180°$

$\Rightarrow \angle EGF = 155°$

In triangle EFG,

$\Rightarrow y + z + \angle EGF = 180°$

$\Rightarrow 75°+ z + 155°= 180°$

$\Rightarrow z + 130°= 180°$

$\Rightarrow z = 50°$

Question: 15

X=60, y=60, z=70, t=70

Given AB||CD and EF||GH

x = 60° [Opposite angles]

y = x = 60°[Alternate angles]

$\angle PQS = \angle APR = 110°$[Crossponding angles]

$\angle PQS = \angle PQR + y = 110°$_____________ (i)

For AB straight line,

$\Rightarrow y + z + \angle PQR = 180°$

$\Rightarrow z + 110° = 180°$[From equation (i)]

$\Rightarrow z = 70°$

AB||CD

Therefore,

t = z = 70°[Because alternate angles]

Question: 16

(i) x=30

Given l||m

Therefore,

$3x – 20° = 2x + 10°$ [Crossponding angles]

$\Rightarrow 3x – 2x = 10° + 20°$

$\Rightarrow x = 30°$

(ii) x=25

Given l||m

Therefore,

$(3x + 5)° + 4x° = 180°$

$\Rightarrow 7x + 5° = 180°$

$\Rightarrow 7x = 175°$

$\Rightarrow x = 25°$

Question: 17

AB⊥PQ,

Therefore, ∠ABD = 90° _____________ (i)

CD⊥PQ,

Therefore, ∠CDQ = 90° _____________ (ii)

From equations (i0 and (ii)

∠ABD = ∠CDQ = 90°

Hence, AB||CD because Cross ponding angles are equal.

Exercise : 4D

Question: 1

$\angle A$ =56°

In ΔABC,

∠A + ∠B + ∠C = 180° [Sum of angles]

$\Rightarrow \angle A + 76° + 48° = 180°$

$\Rightarrow \angle A + 124° = 180°$

$\Rightarrow \angle A = 56°$

Question: 2

40°, 60°, 80°

Let the angles of triangle are 2a, 3a and 4a.

Therefore,

$2a + 3a + 4a = 180°$[Sum of angles]

$\Rightarrow 9a = 180°$

$\Rightarrow a = 20°$

Angles of triangle are,

$2a = 2 \times 20° = 40°$

$3a = 3 \times 20° = 60°$

$4a = 4 \times 20° = 80°$

Question: 3

$\angle A$ =80°, $\angle B$ =60°, $\angle C$ =40°

Let $3\angle A = 4\angle B = 6\angle C$ = a

Therefore,

$\angle A = a/3$, $\angle B = a/4$, $\angle C = a/6$ ____________________ (i)

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

$\Rightarrow a/3 + a/4 + a/6 = 180°$

$\Rightarrow 9a/12 = 180°$

$\Rightarrow a = 240°$

$\Rightarrow \angle A = a/3 = 240° /3 = 80°$

$\Rightarrow \angle B = a/4 = 240° /4 = 60°$

$\Rightarrow \angle C = a/6 = 240° /6 = 40°$

Question: 4

$\angle A = 50°$, $\angle B = 58°$, $\angle C = 72°$

Given,

$\angle A + \angle B = 108°$ ___________________ (i)

$\angle B + \angle C = 130°$ ___________________ (ii)

We know that sum of angles of triangle = 180°

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

$\angle A + 130° = 180°$ [From equation (ii)]

$\Rightarrow \angle A = 50°$

Value of $\angle A = 50°$ put in equation (i),

$\angle A + \angle B = 108°$

$\Rightarrow 50° + \angle B = 108°$

$\Rightarrow \angle B = 58°$

Value of $\angle B = 58°$ put in equation (ii),

$\angle B + \angle C = 130°$

$\Rightarrow 58° + \angle C = 130°$

$\Rightarrow \angle C = 72°$

Question: 5

$\angle A = 67°$, $\angle B = 41°$, $\angle C = 89°$

Given,

$\angle A + \angle B = 125°$ ___________________ (i)

$\angle B + \angle C = 113°$ ___________________ (ii)

We know that sum of angles of triangle = 180°

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

$\angle A + 113° = 180°$ [From equation (ii)]

$\Rightarrow \angle A = 67°$

Value of $\angle A = 50°$ put in equation (i),

$\angle A + \angle B = 125°$

$\Rightarrow 67° + \angle B = 108°$

$\Rightarrow \angle B = 41°$

Value of ∠B = 41° put in equation (ii),

$\angle B + \angle C = 130°$

$\Rightarrow 41° + \angle C = 130°$

$\Rightarrow \angle C = 89°$

Question: 6

$\angle P = 95°, \angle Q = 53°, \angle R = 32°$

Given,

$\angle P - \angle Q = 42°$ __________________ (i)

$\angle Q - \angle R = 21°$ __________________ (ii)

$\angle P = 42° + \angle Q$ [From equation (i)] _________________ (iii)

$\angle R = \angle Q - 21°$ [From equation (ii)] _________________ (iv)

We know that sum of angles of triangle = 180°

$\angle P + \angle Q + \angle R = 180°$ [Sum of angles]

$\Rightarrow 42° + \angle Q + \angle Q + \angle Q - 21° = 180°$ [From equation (iii) and (iv)]

$\Rightarrow 3\angle Q + 21° = 180°$

$\Rightarrow 3\angle Q = 159°$

$\Rightarrow \angle Q = 53°$

Value of ∠Q = 53° put in equation (iii),

$\angle P = 42° + \angle Q$

$\Rightarrow \angle P = 42° + 53°$

$\Rightarrow \angle P = 95°$

Value of ∠Q = 53° put in equation (iv),

$\angle R = \angle Q - 21°$

$\Rightarrow \angle R = 53° - 21°$

$\Rightarrow \angle R = 32°$

Question: 7

70°, 46°, 64°

Let ∠P, ∠Q and ∠R are three angles of triangle PQR.

Now,

$\angle P + \angle Q = 116°$ __________________ (i)

$\angle P - \angle Q = 24°$ __________________ (i)

Adding equation (i) and (ii),

$2\angle P = 140°$

$\Rightarrow \angle P = 70°$ ______________________ (iii)

Subtracting equation (i) and (ii),

$2\angle Q = 92°$

$\Rightarrow \angle Q = 46°$ ______________________ (iv)

We know that sum of angles of triangle = 180°

$\angle P + \angle Q + \angle R = 180°$ [Sum of angles]

$\Rightarrow 70° + 46° + \angle R = 180°$ [From equation (iii) and (iv)]

$\Rightarrow \angle R = 64°$

Question: 8

54°, 54°, 72°

Let $\angle P$, $\angle Q$ and $\angle R$ are three angles of triangle PQR,

And $\angle P = \angle Q = a$ ________________ (i)

Then, $\angle R = a + 18°$________________ (ii)

We know that sum of angles of triangle = 180°

$\angle P + \angle Q + \angle R = 180°$ [Sum of angles]

$\Rightarrow a + a + a + 18° = 180°$ [From equation (i) and (ii)]

$\Rightarrow 3a = 162°$

$\Rightarrow a = 54°$

Therefore,

$\angle P = \angle Q = 54°$ [from equation (i)]

$\angle R = 54° + 18°$ [from equation (i)]

$= 72°$

Question: 9

60°, 90°, 30°

Let $\angle P$, $\angle Q$ and $\angle R$ are three angles of triangle PQR,

And $\angle P$ is the smallest angle.

Now,

$\angle Q = 2\ \angle P$ ________________ (i)

$\angle R = 3\ \angle P$ ________________ (ii)

We know that sum of angles of triangle = 180°

$\angle P + \angle Q + \angle R = 180°$ [Sum of angles]

$\Rightarrow \angle P + 2\ \angle P + 3\ \angle P = 180°$ [From equation (i) and (ii)]

$\Rightarrow 6\ \angle P = 180°$

$\Rightarrow \angle P = 30°$

Therefore,

$\Rightarrow \angle Q = 2\ \angle P = 60°$ [from equation (i)]

$\Rightarrow \angle R = 3\ \angle P = 90°$ [from equation (ii)]

Question: 10

53°, 37°, 90°

Let PQR be a right angle triangle.

Right angle at P, then

$\angle P = 90°$ and $\angle Q = 53°$ ________________ (i)

We know that sum of angles of triangle = 180°

$\angle P + \angle Q + \angle R = 180°$ [Sum of angles]

$\Rightarrow 90° + 53° + \angle R = 180°$ [From equation (i)]

$\Rightarrow \angle R = 37°$

Question: 11

Proof

Let PQR be a right angle triangle,

Now,

$\angle P = \angle Q + \angle R$ __________________ (i)

We know that sum of angles of triangle = 180°

$\angle P + \angle Q + \angle R = 180°$ [Sum of angles]

$\Rightarrow \angle P + \angle P = 180°$ [From equation (i)]

$\Rightarrow 2\angle P = 180°$

$\Rightarrow \angle P = 90°$

Hence, PQR is a right angle triangle Proved.

Question: 12

proof

We know that the sum of two acute angles of a right triangle is 90°.

Therefore,

$\angle BAL + \angle ABL = 90°$

$\Rightarrow \angle BAL = 90° - \angle ABL$

$\Rightarrow \angle BAL = 90° - \angle ABC$ ____________________ (i)

$\angle ABC + \angle ACB = 90°$

$\Rightarrow \angle ACB = 90° - \angle ABC$ ____________________ (ii)

From equation (i) and (ii),

$\angle BAL = \angle ACB$ Proved.

Question: 13

Proof

Let ABC be a triangle,

Now,

$\angle A < \angle B + \angle C$ ___________________ (i)

$\angle B < \angle A + \angle C$ ___________________ (ii)

$\angle C < \angle A + \angle B$ ___________________ (iii)

$\Rightarrow 2\angle A < \angle A + \angle B + \angle C$ [From equation (i)]

$\Rightarrow 2\angle A < 180°$ [Sum of angles of triangle]

$\Rightarrow \angle A < 90°$ ________________ (a)

Similarly,

$\Rightarrow \angle B < 90°$__________________ (b)

$\Rightarrow \angle C < 90°$__________________ (c)

From equation (a), (b) and (c), each angle is less than 90°

Therefore triangle is an acute angled Proved.

Question: 14

Proof

Let ABC be a triangle,

Now,

$\angle A > \angle B + \angle C$ ________________ (i)

$\angle B > \angle A + \angle C$ ________________ (ii)

$\angle C > \angle A + \angle B$ ________________ (iii)

$\Rightarrow 2\angle A > \angle A + \angle B + \angle C$ [From equation (i)]

$\Rightarrow 2\angle A > 180°$ [Sum of angles of triangle]

$\Rightarrow \angle A > 90°$ ______________ (a)

Similarly,

$\Rightarrow \angle B > 90°$________________ (b)

$\Rightarrow \angle C > 90°$________________ (c)

From equation (a), (b) and (c), each angle is less than 90°

Therefore triangle is an acute angled Proved.

Question: 15

85°, ∠ACB = 52°

Given, $\angle ACD$ =128° and $\angle ABC$ =43°

In triangle ABC,

∠ACB + ∠ACD = 180° [Because BCD is a straight line]

⇒ ∠ACB + 128° = 180°

⇒ ∠ACB = 52°

∠ABC + ∠ACB + ∠BAC = 180° [Sum of angles of triangle ABC]

⇒ 43° + 52° + ∠BAC = 180°

⇒ ∠BAC = 85°

Question: 16

74°, 62°, 44°

Given, $\angle ABD$=106° and $\angle ACE$ =118°

∠ABD + ∠ABC = 180° [Because DC is a straight line]

⇒ 106° + ∠ABC = 180°

⇒ ∠ABC = 74°______________ (i)

∠ACB + ∠ACE = 180° [Because BE is a straight line]

⇒ ∠ACB + 118° = 180°

⇒ ∠ACB = 62°______________ (ii)

Now, triangle ABC

∠ABC + ∠ACB + ∠BAC = 180° [Sum of angles of triangle]

⇒ 74° + 62° + ∠BAC = 180° [From equation (i) and (ii)]

⇒ ∠BAC = 44°

Question: 17

(i) 50°

Given, $\angle BAE = 110°$ and $\angle ACD = 120°$

$\angle ACB + \angle ACD = 180°$ [Because BD is a straight line]

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

$\Rightarrow \angle ACB = 60°$_______________ (i)

In triangle ABC,

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

$\Rightarrow 110° = x + 60°$

$\Rightarrow x = 50°$

(ii) 120°

In triangle ABC,

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

$\Rightarrow 30° + 40° + \angle C = 180°$

$\Rightarrow \angle C = 110°$

$\angle BCA + \angle DCA = 180°$ [Because BD is a straight line]

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

$\Rightarrow \angle DCA = 70°$_________________ (i)

In triangle ECD,

$\angle AED = \angle ECD + \angle EDC$

$\Rightarrow x = 70° + 50°$

$\Rightarrow x = 120°$

(iii) 55°

Explanation:

$\angle BAC = \angle EAF = 60°$[Opposite angles]

In triangle ABC,

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

$\Rightarrow X° + 60° = 115°$

$\Rightarrow X° = 55°$

(iv) 75°

Given $AB \| CD$

Therefore,

$\angle BAD = \angle EDC = 60°$[Alternate angles]

In triangle CED,

$\angle C + \angle D + \angle E = 180°$[Sum of angles of triangle]

$\Rightarrow 45° + 60° + x = 180°$[$\angle EDC = 60°$]

$\Rightarrow x = 75°$

(v) 30°

Explanation:

In triangle ABC,

$\angle BAC + \angle BCA + \angle ABC = 180°$[Sum of angles of triangle]

$\Rightarrow 40° + 90° + \angle ABC = 180°$

$\Rightarrow \angle ABC = 50°$________________ (i)

In triangle BDE,

$\angle BDE + \angle BED + \angle EBD = 180°$[Sum of angles of triangle]

$\Rightarrow x° + 100° + 50° = 180°$[$\angle EBD = \angle ABC = 50°$]

$\Rightarrow x° = 30°$

(vi) x=30

Explanation:

In triangle ABE,

$\angle BAE + \angle BEA + \angle ABE = 180°$[Sum of angles of triangle]

$\Rightarrow 75° + \angle BEA + 65° = 180°$

$\Rightarrow \angle BEA = 40°$

$\angle BEA = \angle CED = 40°$[Opposite angles]

In triangle CDE,

$\angle CDE + \angle CED + \angle ECD = 180°$[Sum of angles of triangle]

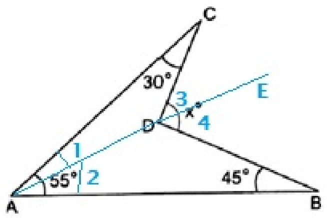
$\Rightarrow x° + 40° + 110° = 180°$

$\Rightarrow x° = 30°$

Question: 18

x=130

Explanation:



In triangle ACD,

$\angle 3 = \angle 1 + \angle C$ __________________ (i)

In triangle ABD,

$\angle 4 = \angle 2 + \angle B$ __________________ (ii)

Adding equation (i) and (ii),

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

$\Rightarrow \angle BDC = (\angle 1 + \angle 2) + \angle C + \angle B$

$\Rightarrow x° = 55° + 30° + 45°$

$\Rightarrow x° = 130°$

Question: 19

X=90

Explanation:

$\angle BAC + \angle CAE = 180°$[Because BE is a straight line]

$\Rightarrow \angle BAC + 108° = 180°$

$\Rightarrow \angle BAC = 72°$

Now,AD = DB

$\Rightarrow \angle DBA = \angle BAD$

$\angle BAD$ = (�)72°= 18°

$\angle DAC$ = (�)72°= 54°

In triangle ABC,

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

$\Rightarrow 72° + 18° + x = 180°$

$\Rightarrow x = 90°$

Question: 20

Proof

In triangle ABC,

$\angle ACD = \angle B + \angle A$ ________________ (i)

$\angle BAE = \angle B + \angle C$ ________________ (ii)

$\angle CBF = \angle C + \angle A$ ________________ (iii)

Adding equation (i), (ii) and (iii),

$\angle ACD + \angle BAE + \angle CEF = 2(\angle A + \angle B + \angle C)$

$\Rightarrow \angle ACD + \angle BAE + \angle CEF = 2(180°)$ [Sum of angles of triangle]

$\Rightarrow \angle ACD + \angle BAE + \angle CEF = 360°$Proved.

Question: 21

Proof

In triangle BDF,

$\angle A + \angle C + \angle E = 180°$[Sum of angles of triangle] _______________ (i)

In triangle BDF,

$\angle B + \angle D + \angle F = 180°$[Sum of angles of triangle] _______________ (ii)

From equation (i) and (ii),

$(\angle A + \angle C + \angle E) + (\angle B + \angle D + \angle F) = (180°+180°)$

$\Rightarrow \angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 360°$Proved.

Question: 22

125°

Given, bisector of $\angle B$ and $\angle C$ meet at O.

If OB and OC are the bisector of $\angle B$ and $\angle C$ meet at point O .

Then,

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

$\Rightarrow \angle BOC = 90° + \frac{1}{2}\ 70°$

$\Rightarrow \angle BOC = 125°$

Question: 23

70°

Given, bisector of $\angle CBD$ and $\angle BCE$ meet at O.

If OB and OC are the bisector of $\angle CBD$ and $\angle BCE$ meet at point O .

Then,

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

$\Rightarrow \angle BOC = 90° - \frac{1}{2}$ 40°

$\Rightarrow \angle BOC = 70°$

Question: 24

60°

Given, $\angle A : \angle B : \angle C$ = 3:2:1 and AC $\perp$ CD

Let, ∠A = 3a

∠B = 2a

∠C = a

In triangle ABC,

∠A + ∠B + ∠C = 180°[Sum of angles of triangle]

⇒ 3a + 2a + a = 180°

⇒ 6a = 180°

⇒ a = 30°

Therefore, ∠C = a = 30°

Now,

∠ACB + ∠ACD + $\angle E$CD = 180°[Sum of angles of triangle]

⇒ 30° + 90° + $\angle E$CD = 180°

⇒ $\angle E$CD = 60°

Question: 25

17.5°

Given, AM $\perp$ BC and “AN” is the bisector of $\angle A$.

Therefore,

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

$\Rightarrow \angle MAN = \frac{1}{2}$ (65° -30°)

$\Rightarrow \angle MAN$ = 17.5°

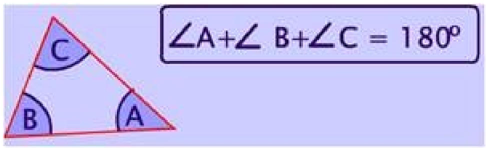
Question: 26

(i) False

Because, sum of angles of triangle equal to 180°.In a triangle maximum one right angle.

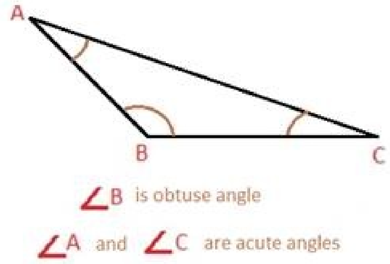
(ii) True

Because, obtuse angle measures in 90° to 180° and we know that the sum of angles of triangle is equal to 180°.



(iii) False

Because, in an obtuse triangle is one with one obtuse angle and two acute angles.



(iv) False

If each angles of triangle is less than 180° then sum of angles of triangle are not equal to 180°.

Any triangle,

$\angle 1 + \angle 2 + \angle 3 = 180°$

(v) True

If value of angles of triangle is same then the each value is equal to 60°.

$\angle 1 + \angle 2 + \angle 3 = 180°$

$\Rightarrow \angle 1 + \angle 1 + \angle 1 = 180° [\angle 1 = \angle 2 = \angle 3]$

$\Rightarrow 3 \angle 1 = 180°$

$\Rightarrow \angle 1 = 60°$

(vi) True

We know that sum of angles of triangle is equal to 180°.

Sum of angles,

$= 10° + 80° + 100°$

$= 190°$

Therefore, angles measure in (10°, 80°, 100°) cannot be a triangle.

Exercise : CCE QUESTIONS

Question: 1

If two angles are

Solution:

If two angles are complements of each other, then each angle is an acute angle

Question: 2

An angle which me

Solution:

An angle which measures more than 180^{o} but less than 360^{o}, is called a reflex angle.

Question: 3

The complement of

Solution:

As we know that sum of two complementary – angles is 90^{o}.

So, $x + y = 90^{o}$

$72°40' + y = 90$

$y = 90^{o} - 72°40'$

$y = 17^{o}20'$

Question: 4

The supplement of

Solution:

As we know that sum of two supplementary – angles is 180^{o}.

So, $x + y = 180^{o}$

$54°30' + y = 180$

$y = 180^{o} - 54°30'$

$y = 125^{o}30'$

Question: 5

The measure of an

Solution:

As we know that sum of two complementary – angles is 90^{o}.

So, $x + y = 90^{o}$

According to question $y = 5x$

$x + 5x = 90$

$6x = 90^{o}$

$x = 15^{o}$

$y = 75^{o}$

Question: 6

Two complementary

Solution:

As we know that sum of two complementary – angles is 90^{o}.

So, $x + y = 90^{o}$

Let x be the common multiple.

According to question angles would be 2x and 3x.

$2x + 3x = 90$

$5x = 90^{o}$

$x = 18^o$

$2x = 36^o$

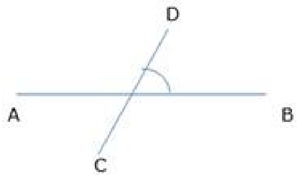
$3x = 54^o$

So, larger angle is 54^o

Question: 7

Two straight line

Solution:



$\angle BOD = 63°$

As we know that sum of adjacent angle on a straight line is 180^o.

$\angle BOD + \angle BOC = 180°$

$\angle BOC = 180° - 63°$

$\angle BOC = 117°$

Question: 8

In the given figu

Solution:

As we know that sum of adjacent angle on a straight line is 180^o.

$\angle AOC + \angle BOD + \angle COD = 180^o$

$\angle COD = 180^o - 95^o$

$\angle COD = 85^o$

Question: 9

In the given figu

Solution:

As we know that sum of adjacent angle on a straight line is 180^o.

According to question,

$\angle AOC = 4x^o$

$\angle BOC = 5x^o$,

$4x + 5x = 180^o$

$9x = 180^o$

$X = 20^o$

$\angle AOC = 4x^o = 80^o$

Question: 10

In the given figu

Solution:

As we know that sum of adjacent angle on a straight line is 180^o.

According to question,

$\angle$ AOC = $(3x + 10)°$

$\angle$ BOC = $(4x – 26)°$

$3x + 10 + 4x – 26 = 180^o$

$7x – 16 = 180^o$

$7x = 196^o$

$X = 28^o$

$\angle$ BOC = $(4x – 26)°$

$\angle$ BOC = $112° – 26°$

$\angle$ BOC = $86°$

Question: 11

In the given figu

Solution:

As we know that sum of all angles on a straight line is 180°

$\angle$ AOC + $\angle$COD + $\angle$BOD = 180°

$$\angle AOC + \angle COD + \angle BOD = 180^o$$

$$40^o + 4x + 3x = 180^o$$

$$7x = 140^o$$

$$x = 20^o$$

So,

$$\angle COD = 4x = 80^o$$

Question: 12

In the given figu

Solution:

As we know that sum of all angles on a straight line is 180^o.

$$\angle AOC + \angle COD + \angle BOD = 180^o$$

$$(3x - 10) + 50^o + (x + 20) = 180^o$$

$$4x + 10 = 130^o$$

$$4x = 120^o$$

$$x = 30^o$$

So,

$$\angle AOC = 3x - 10 = 90^o - 10^o = 80^o$$

Question: 13

Which of the foll

Solution:

Through a given point, we can draw infinite number of lines.

Question: 14

An angle is one –

Solution:

Let x be the common multiple.

According to question,

y= 5x

As we know that sum of two supplementary – angles is 180^o.

So, $x + y = 180^o$

$x + 5x= 180$

$6x = 180^o$

$x = 30^o$

Question: 15

In the adjoining

Solution:

Let n be the common multiple

$x : y : z = 4 : 5 : 6,$

As we know that sum of all angles on a straight line is 180^o.

$4n + 5n + 6n =180^o$

$15n = 180^o$

$N = 12^o$

$Y = 5n = 60^o$

Question: 16

In the given figu

Solution:

As we know that sum of all angles on a straight line is 180^o.

According to question,

$\theta = 3\phi,$

$\phi + \theta = 180^o$

$\phi + 3\phi = 180^o$

$4\phi = 180^o$

$\phi = 45^o$

Question: 17

In the given figu

Solution:

AC and BD intersect at O.

$\angle AOC = \angle BOD$

$\angle AOC + \angle BOD = 130^\circ$

$\angle BOD + \angle BOD = 130^\circ$

$2\angle BOD = 130^\circ$

$\angle BOD = 65^\circ$

As we know that sum of all angles on a straight line is 180°.

$\angle AOD + \angle BOD = 180^\circ$

$\angle AOD + 65^\circ = 180^\circ$

$\angle AOD = 180^\circ - 65^\circ$

$\angle AOD = 115^\circ$

Question: 18

In the given figu

Solution:

Incident ray makes the same angle as reflected ray.

So,

$\angle AQP + \angle PQR + \angle BQR = 180^\circ$

$\angle AQP + \angle PQR + \angle AQP = 180^\circ (\angle AQP = \angle BQR)$

$2\angle AQP + 108^\circ = 180^\circ$

$2\angle AQP = 180^\circ - 108^\circ$

$2\angle AQP = 72^\circ$

$\angle AQP = 36^\circ$

Question: 19

In the given figu

Solution:

Draw a line EF such that EF || AB and EF || CD crossing point O.

$\angle$FOC + $\angle$OCD = 180° (Sum of consecutive interior angles is 180°)

$\angle$FOC = 180 – 136 = 44°

EF || AB such that AO is traversal.

$\angle$OAB + $\angle$FOA = 180°(Sum of consecutive interior angles is 180°)

$\angle$FOA = 180 – 124 = 56°

$\angle$AOC = $\angle$FOC + $\angle$FOA

= 56 + 44

=100°

Question: 20

In the given figu

Solution:

Draw a line EF such that EF || AB and EF || CD crossing point O.

$\angle$ABO + $\angle$EOB = 180^o(Sum of consecutive interior angles is 180^o)

$\angle$EOB = 180 – 35 = 145^o

EF || AB such that AO is traversal.

$\angle$CDO + $\angle$EOD = 180^o(Sum of consecutive interior angles is 180^o)

$\angle$EOD = 180 – 40 = 140^o

$\angle$BOD = $\angle$EOB + $\angle$EOD

= 145 + 140

= 285^o

Question: 21

In the given figu

Solution:

According to question,

AB || CD

AF || CD (AB is produced to F, CF is traversal)

$\angle$DCF=$\angle$BFC=110^o

Now, $\angle$BFC + $\angle$BFO = 180^o(Sum of angles of Linear pair is 180^o)

$\angle$BFO = 180^o – 110^o = 70^o

Now in triangle BOF, we have

$\angle$ABO = $\angle$BFO + $\angle$BOF

130 = 70 + $\angle$BOF

$\angle$BOF = 130 – 70 =60^o

So, $\angle$BOC = 60^o

Question: 22

In the given figu

Solution:

According to question,

AB || CD

AB || DF (DC is produced to F)

$\angle$OCD=110^o

$\angle$FCD = 180 – 110 = 70^o(linear pair)

Now in triangle FOC, we have

$\angle$FOC + $\angle$CFO + $\angle$OCF = 180^o

$\angle$FOC + 60 + 70 = 180^o

$\angle$FOC = 180 – 130

=50^o

So, $\angle$AOC = 50^o

Question: 23

In the given figu

Solution:

From O, draw E such that OE || CD || AB.

OE || CD and OC is traversal.

So,

$\angle$DCO + $\angle$COE = 180 (co –interior angles)

x + $\angle$COE = 180

$\angle$COE = (180 – x)

Now, OE || AB and AO is the traversal.

$\angle$BAO + $\angle$AOE = 180 (co –interior angles)

$\angle$BAO + $\angle$AOC + $\angle$COE = 180

100 + 30 + (180 – x) = 180

180 – x = 50

X = 180 – 50 = 130^{O}

Question: 24

In the given figu

Solution:

AB || CD

$\angle$BAC = $\angle$DCF = 80^o

$\angle$ECF + $\angle$DCF = 180^o (linear pair of angles)

$\angle$ECF =100^o

Now in triangle CFE,

$\angle$ECF + $\angle$EFC + $\angle$CEF = 180^o

$\angle$CEF = 180^o – 100^o – 25^o

=55^o

Question: 25

In the given figu

Solution:

$\angle PRD = 120^o$

$\angle PRQ = 180^o - 120^o = 60^o$

$\angle$APQ =$\angle$PQR =70^o

Now, in triangle PQR, we have

$\angle$PQR + $\angle$PRQ + $\angle$QPQ =180^o

70 + 60 + $\angle$QPQ =180^o

$\angle$QPQ =180^o – 130^o

=50^o

Question: 26

In the given figu

Solution:

AC is produced to meet OB at D.

$\angle$OEC = 180 – $(\beta+\gamma)$

So, $\angle$BEC = 180 – (180 – $(\beta+\gamma)$) = $(\beta+\gamma)$

Now, x = $\angle$BEC + $\angle$CBE (Exterior Angle)

= $(\beta+\gamma)$ + α

$=\alpha+\beta+\gamma$

Question: 27

If 3Let say $3\angle A = 4\angle B = 6\angle C = x$

$\angle$A =x/3

$\angle$B = x/4

$\angle$C = x/6

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

x/3 + x/4 + x/6 = 180

(4x + 3x + 2x)/12 = 180

9x/12 = 180

X= 240

$\angle$A =x/3 = 240/3 = 80

$\angle$B = x/4 = 240/4 = 60

$\angle$C = x/6 = 240/6 = 40

So, A:B:C = 4:3:2

Question: 28

In ΔABC, if

Solution:

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

$\angle$C = 180 – 125 = 55^o

$\angle$A + $\angle$C =113^o

$\angle$A =113 – 55 =58^o

Question: 29

In $\angle$A = $\angle$B + 42

$\angle$C = $\angle$B – 21

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

$\angle$B + 42 + $\angle$B + $\angle$B – 21 =180

3$\angle$B + 21 = 180

3$\angle$B = 159

$\angle B = 53^o$

Question: 30

In ΔABC, side BC

Solution:

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

$\angle ACB = 60^o$

$\angle ABC = 40^o$

As we know that

$\angle ACB + \angle ACB + \angle BAC = 180^o$

$\angle BAC = 180 – 60 – 40$

$=80^o$

Question: 31

Side BC of ΔABC h

Solution:

$\angle ABD + \angle ABC = 180$ (Linear pair of angles)

$\angle ABC = 180^o – 125^o=55^o$

$\angle ACE + \angle ACB = 180$ (Linear pair of angles)

$\angle ACB = 180^o – 130^o=50^o$

As we know that

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

$\angle BAC = 180 – 55 – 50$

$=75^o$

Question: 32

In the given figu

Solution:

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

$\angle ACB = 180 – 50 – 30 = 100^o$(Sum of angles of triangle is 180)

$\angle ACB + \angle ACD = 180$ (linear pair of angles)

$\angle ACD = 180 – 100 = 80^o$

In triangle ECD,

$\angle ECD + \angle CDE + \angle DEC = 180$

$\angle DEC = 180 – 80 – 40$

$= 60^o$

$\angle DEC + \angle AED = 180^o$(linear pair of angles)

$\angle AED = 180^o – 60^o$

$= 120^o$

Question: 33

In the given figu

Solution:

In triangle AEF,

$\angle BED = \angle EFA + \angle EAF$

$\angle EFA = 100 – 40 = 60^o$

$\angle CFD = \angle EFA$ (vertical opposite angles)

$= 60^o$

In triangle CFD, we have

$\angle CFD + \angle FCD + \angle CDF = 180^o$

$\angle CDF = 180^o – 90^o – 60^o$

$= 30^o$

So, $\angle BDE = 30^o$

Question: 34

In the given figu

Solution:

In ΔABC,

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

$50° + \angle B + \angle C = 180°$

$\angle B + \angle C = 180° - 50° = 130°$

$\angle B = 65°$

$\angle C = 65°$

Now in ΔOBC,

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

$\angle BOC = 180° – 65°$ ($\angle OBC + \angle OCB = 65$ because O is bisector of $\angle B$ and $\angle C$)

$= 115°$

Question: 35

In the given figu

Solution:

AB || CD and BC is traversal.

So, $\angle DCB = \angle ABC = 60^o$

Now in triangle AEB, we have

$\angle ABE + \angle BAE + \angle AEB = 180^o$

$\angle AEB = 180^o – 60^o – 50^o$

$= 70^o$

Question: 36

In the given figu

Solution:

In triangle AOB,

$\angle AOB = 180^o - 75^o - 55^o$

$= 50^o$

$\angle AOB = \angle COD = 50^o$(Opposite angles)

Now in triangle COD,

$\angle ODC = 180^o - 100^o - 50^o$

$= 30^o$

Question: 37

In a ΔABC its is

Solution:

As per question,

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

So,

$\angle A = 90^o$

$\angle B = 60^o$

$\angle C = 30^o$

$\angle ACB + \angle ACD + \angle ECD = 180^o$ (sum of angles on straight line)

$\angle ECD = 180^o - 90^o - 30^o$

$= 60^o$

Question: 38

In the given figu

Solution:

$\angle BOA = 100^o$ (Opposite pair of angles)

So,

$\angle BAO = 180^o - 100^o - 45^o$

$=35^o$

$\angle BAO = \angle CDO = 35^o$ (Corresponding Angles)

Question: 39

In the given figu

Solution:

$\angle BCE = \angle ABC = 65^o$ (Alternate Angles)

$\angle ABC = \angle ABD + \angle DBC$

$65^o = \angle ABD + 28^o$

$\angle ABD = 65 - 28$

$= 37^o$

Question: 40

For what value of

Solution:

X + 20 = 2x – 30(Corresponding Angles)

2x –x = 30 + 20

X = 50^o

Question: 41

For what value of

Solution:

4x + 3x + 5 = 180^o (Interior angles of same side of traversal)

7x + 5 = 180^o

7x = 175

X = 25^o

Question: 42

In the given figu

Solution:

∠ABC = 180 – 110 = 70^0 (Linear pair of angles)

∠BAC = 180 – 135 = 45^0 (Linear pair of angles)

So,

In Triangle ABC, we have

∠ABC + ∠BAC + ∠ACB = 180^o

∠ACB = 180 – 70 – 45 = 65^0

Question: 43

In ΔABC, BD

Solution:

In triangle BDC,

∠B= 40, ∠D = 90

So, ∠C = 180 –(90 + 40)

= 50°

Now in triangle AEC,

∠C= 50, ∠A = 30

So, ∠E = 180 – (50 + 30)

= 100°

Thus, ∠AEB = 180 – 100 (Sum of linear pair is 180°)

= 80°

Question: 44

In the given figu

Solution:

Let n be the common multiple.

Y + Z = 180

$3n + 7n = 180$

$N = 18$

So, $y = 3n = 54^o$

$z = 7n = 126^o$

$x = z$ (Pair of alternate angles)

So, $x = 126^o$

Question: 45

In the given figu

Solution:

According to question

AB || CD || EF and

$EA \perp AB$

So, $\angle D = \angle B$ (Corresponding angles)

According to question CD || EF and BE is the traversal then,

$\angle D + \angle E = 180$ (Interior angle on the same side is supplementary)

So, $\angle D = 180 – 55 = 125^o$

And $\angle B = 125^o$

Now, AB || EF and AE is the traversal.

So, $\angle BAE + \angle FEA = 180$ (Interior angle on the same side of traversal is supplementary)

$90 + x + 55 = 180$

$X + 145 = 180$

$X = 180 – 145 = 35^o$

Question: 46

In the given figu

Solution:

In triangle ABC,

$\angle B = 70^o$

$\angle C = 20^o$

So, $\angle A = 180^o – 70^o – 20^o = 90^o$

According to question, AN is bisector of $\angle A$

So, $\angle BAN = 45^o$

Now, in triangle BAM,

$\angle B = 70^o$

$\angle M = 90^o$

$\angle BAM = 180^o – 70^o – 90^o = 20^o$

Now, $\angle MAN = \angle BAN – \angle BAM$

$= 45^o – 20^o$

$= 25^o$

Question: 47

An exterior angle

Solution:

Exterior angle formed when the side of a triangle is produced is equal to the sum of the interior opposite angles.

Exterior angle = 110°

One of the interior opposite angles = 45°

Let the other interior opposite angle = x

110° = 45° + x

x = 110° – 45°

x = 65°

Therefore, the other interior opposite angle is 65°.

Question: 48

The sides BC, CA

Solution:

In Δ ABC,

we have CBF = 1 + 3 ...(i) [exterior angle is equal to the sum of opposite interior angles]
Similarly, ACD = 1 + 2 ...(ii)

and BAE = 2 + 3 ...(iii)

On adding Eqs. (i), (ii) and (iii),

we get CBF + ACD + BAE =2[1 + 2 + 3] = 2 × 180° = 4 × 90°

[by angle sum property of a triangle is 180°] CBF + ACD + BAE = 4 right angles

Thus, if the sides of a triangle are produced in order, then the sum of exterior angles so formed is equal to four right angles = 360°

Question: 49

The angles of a t

Solution:

Let x be the common multiple.

3x + 5x + 7x = 180

15x = 180

x = 180/15

x = 123x = 3 X 12 = 36

5x = 5 X 12 = 60

7x = 7 X 12 = 84

Since, all the angles are less than 90^{o}. So, it is acute angled triangle.

Question: 50

If the vertical a

Solution:

Let x and y be the bisected angles.

So in the original triangle, sum of angles is

$130 + 2x + 2y = 180$

$2(x + y) = 50$

$x + y = 25$

In the smaller triangle consisting of the original side opposite 130 and the 2 bisectors,

$x + y$ + Base Angle = 180

25 + Base Angle = 180

Base Angle = 155^o

Question: 51

The sides BC, BA

Solution:

BAC = 35^o (opposite pair of angles)

BCD = 180 – 110 = 70^o (linear pair of angles)

Now, in Triangle ABC we have,

$A + B + C = 180^o$

$35 + B + 70 = 180$

$B = 180 – 105 = 75^o$

Question: 52

In the adjoining

Solution:

$x + y + 90 = 180$ (sum of angles on a straight line)

$x + y = 90$ ....(i)

$3x + 72 = 180$ (sum of angles on a straight line)

$3x = 108$

$x = 108/3 = 36^O$

Putting this value in eq (i), we get

$x + y = 90$

$36 + y = 90$

$Y = 90 – 36 = 54^O$

Question: 53

Each question con

Solution:

Sum of triangle is = 180°

And 70 + 60 + 50 = 180°

Question: 54

Each question con

Solution:

According to linear pair of angle, sum of angles on straight line is 180

And $90 + 90 = 180^o$

Question: 55

Each question con

Solution:

No, this is not linked with the given reason.

Question: 56

Each question con

Solution:

Because when two lines intersect each other, then vertically opposite angles are always equal.

Question: 57

Each question con

Solution:

3 and 5 are pair of consecutive interior angles. It is not necessary to be always equal.

Question: 58

Match the followi

Solution:

(a) – (r), (b) – (s), (c) – (p), (d) – (q)

(a) – (r)

X + y = 90

X + 2x/3 = 90

5x/3 = 90

X = 270/5

= 54

(b) – (s)

X + y = 180 (according to question x =y)

X + x = 180

2x = 180

X = 90

(c) – (p)

X + y = 90 (according to question x =y)

X + x = 90

2x = 90

X = 45

(d) – (q)

X + y = 180 (linear pair of angles) ……………………….(i)

X – y =60 (according to question) ……………………. (ii)

Adding (i) and (ii) we get,

2x = 240

X = 120

Now putting this in (ii) we get,

Y = 120 – 60 = 60

Question: 59

Match the followi

Solution:

(a) – (r), (b) – (p), (c) – (s), (d) – (q)

(a) – (r)

2x + 3x = 180 (linear pair of angles)

5x =180

X = 36

2x = 2 X 36 = 72

(b) – (p)

2x – 10 + 3x – 10 = 180 (linear pair of angles)

5x – 20 =180

5x = 200

x = 40

AOD = 3x – 10 (opposite angles are equal)

= 120 – 10

= 110

(c) – (s)

C = 180 – (A + B) (sum of angles triangle is 180)

= 180 – (60 + 65)

= 55

ACD = 180 – 55 (sum of linear pair of angles is 180)

= 180 – 55

= 125

(d) – (q)

B = D) (alternate interior angles)

= 55

ACB = 180 – (55 + 40) (sum of angles of triangle is 180)

= 180 – 95

= 85

Exercise : FORMATIVE ASSESSMENT (UNIT TEST)

Question: 1

The angles of a t

Solution:

Let x be the common multiple.

3x + 2x + 7x = 180

12x = 180

X = 15

$3x = 45^o$

$2x = 30^o$

$7x = 105^o$

Question: 2

In a ΔABC, if

Solution:

A = B + 40

C = B – 10

A + B + C = 180

B + 40 + B + B – 10 = 180

3B + 30 = 180

3B = 180 – 30 = 150

$B = 50^O$

So, $A = B + 40 = 90^O$

$C = B – 10 = 40^O$

Question: 3

The side BC of ΔA

Solution:

B = 180 – 105 (sum of linear pair of angles is 180)

= 75

C = 180 – 110 (sum of linear pair of angles is 180)

= 70

So, A = 180 – (B + C) (sum of angles of triangle is 180)

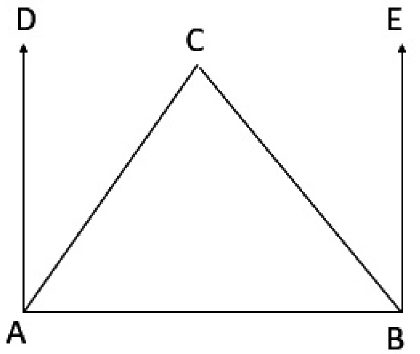
= 180 – (70 + 75)

$= 35^O$

Question: 4

Prove that the bi

Solution:



Given, ∠ DAB + EBA = 180°. CA and CB are bisectors of ∠ DAB ∠ EBA respectively.∴ ∠ DAC + ∠ CAB = 1/2 (∠ DAB).....(1)⇒ ∠ EBC + ∠ CBA = 1/2 (∠ EBA)....(2)⇒ ∠ DAB + ∠ EBA = 180°⇒ 2 (∠ CAB) + 2 (∠ CBA) = 180° [using (1) and (2)]⇒ ∠ CAB + ∠ CBA = 90°

In Δ ABC,

∠ CAB + ∠ CBA + ∠ ABC = 180° (Angle Sum property)⇒ 90° + ∠ ABC = 180°⇒ ∠ ABC = 180° - 90°⇒ ∠ ABC = 90°

Question: 5

If one angle of a

Solution:

Let $\angle A$ = x, $\angle B$ = y and $\angle C$ = z

$\angle A + \angle B + \angle C = 180$ (sum of angles of triangle is 180)

x + y + z = 180 ……………i)

According to question,

x = y + z ………….(ii)

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

x + x = 180

2x = 180

X = 90

Hence, It is a right angled triangle.

Question: 6

In the given figu

Solution:

3x – 5 + 2x + 10 = 180 (linear pair of angles)

5x + 5 =180

5x = 175

X = 175/ 5 = 35

Question: 7

In the given figu

Solution:

40 + 4x + 3x = 180 (sum of angles on a straight line)

7x + 40 =180

7x = 180 – 40

X = 140/ 7 = 20

Question: 8

The supplement of

Solution:

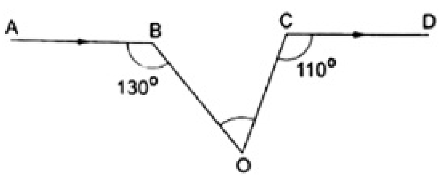
Let x be the angle then,complement = 90 – xsupplement = 180 – x

According to question,180 – x = 6(90 – x)180 – x = 540 – 6x180 + 5x = 5405x = 360x = 72^{O}

Question: 9

In the given figu

Solution:



According to question,

AB || EF

EF || CD (AB is produced to F, CF is traversal)

$\angle$FEC=130^o

Now, $\angle$BFC + $\angle$BFO = 180^o(Sum of angles of Linear pair is 180^o)

$\angle$BFO = 180^o – 130^o = 50^o

Now in triangle BOF, we have

$\angle$ABO = $\angle$BFO + $\angle$BOF

85 = 50 + $\angle$BOF

$\angle$BOF = 85 – 50 =35^o

So, x = ^{o}

Question: 10

In the given figu

Solution:

$\angle$A = $\angle$D (Pair of alternate angles)

= 30^O

Now, in triangle EDC we have

$\angle$D = 30^O and $\angle$C = 50^O

So,

$\angle$CED = 180 – ($\angle$C + $\angle$D)

= 180 – 30 – 50

=100^O

Question: 11

In the given figu

Solution:

According to question EF || BAD

Producing E to O, we get

$\angle$EFA + $\angle$AEO = 180 (Linear pair of angles)

$\angle$AEO = 180 – 55

= 125

Now, in triangle ABC we get,

$\angle$A = 125 and $\angle$C = 25

So, $\angle$ABC = 180 – ($\angle$A + $\angle$C)

= 180 – (125 + 25)

= 180 – 150

= 30^O

Question: 12

In the given figu

Solution:

In triangle BEC we have,

$\angle B = 40^{O}$ and $\angle E = 90^{O}$

So, $\angle C = 180^{O} - (90 + 40)$

$= 50^{O}$

Therefore, $\angle ACB = 50^{O}$

Now intriangle ADC we have,

$\angle A = 30^{O}$ and $\angle C = 50^{O}$

So, $\angle D = 180^{O} - (30 + 50)$

$= 100^{O}$

Therefore,

$\angle ADB + \angle ADC = 180$ (sum of angles on straight line)

$\angle ADB + 100 = 180$

$\angle ADB = 180 - 100$

$= 80^{O}$

Question: 13

In the given figu

Solution:

$\angle EGB = \angle QHP$ (Alternate Exterior Angles) $= 35^{O}$

$\angle QPH = 90^{O}$

So, in triangle QHP we have,

$\angle QPH + \angle QHP + \angle PQH = 180^{O}$

$90^{O} + 35^{O} + \angle PQH = 180^{O}$

$\angle PQH = 180^{O} - 90^{O} - 35^{O}$

$= 55^{O}$

Question: 14

In the given figu

Solution:

$\angle GEC = 180 - 130 = 50^{O}$ (linear pair of angles)

According to question,

AB || CD and EF is perpendicular to AB.

$\angle GEC = \angle EGF$ (pair of alternate interior angles)

$= 50^{O}$

Question: 15

Match the followi

Solution:

(a) – (q), (b) – (r), (c) – (s), (d) – (p)

(a) – (q)

x + x + 10 = 90

2x + 10 = 90

2x = 80

x = 40

x + 10 = 50^{O}

(b) – (r)

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

65 + $\angle$B + $\angle$B – 25 = 180

2$\angle$B + 40 = 180

2$\angle$B = 140

$\angle$B = 70^{O}

(d) – (p)

$\angle$A + $\angle$B + $\angle$C + $\angle$D =360

2x + 3x + 5x + 40 = 360

10x + 40 = 360

10x = 320

X = 32^{O}

5x = 32 X 5 = 160^{O}

Question: 16 A

In the given figu

Solution:

According to question,

$\angle AOD + \angle BOD + \angle BOC = 300^{\circ}$.

In the given figure CD is a straight line.

As we know, Sum of angle on a straight line is 180^{O}

S0,

AOD + BOD + BOC =300

AOD + 180 =300

AOD =300 – 180

= 120^{O}

Question: 16 B

In the given figu

Solution:

According to question,

PRD = 120^{O}

PRD = APR (Pair of alternate interior angles)

So,

APR = 120

APQ + QPR = 120

50 + QPR = 120

QPR = 120 – 50

= 70^{O}

Question: 17

In the given figu

Solution:

In triangle ABC we have,

A + B + C = 180

Let B = x and C = y then,

A + 2x + 2y = 180 (BE and CE are the bisector of angles B and C respectively.)

x + y + A = 180

A = 180 – (x + y) ………….(i)

Now, in triangle BEC we have,

B = x/2

C = y + ((180 – y) / 2)

= (180 + y) / 2

B + C + BEC = 180

x/2 + (180 + y) / 2 + BEC = 180

BEC = (180 – x – y) /2 ………..(ii)

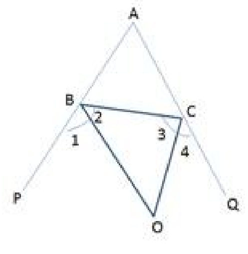
From eq (i) and (ii) we get,

BEC = A/2

Question: 18

In ΔABC, sides AB

Solution:



Here BO, CO are the angle bisectors of ∠DBC &∠ECB intersect each other at O.

∴∠1 = ∠2 and ∠3 = ∠4

Side AB and AC of ΔABC are produced to D and E respectively.

∴ Exterior of ∠DBC = ∠A + ∠C ………… (1)

And Exterior of ∠ECB = ∠A + ∠B ………… (2)

Adding (1) and (2) we get

∠DBC + ∠ECB = 2 ∠A + ∠B + ∠C.

2∠2 + 2∠3 = ∠A + 180°

$\angle 2 + \angle 3 = (1/2)\angle A + 90°$ .... (3)

But in a $\Delta BOC = \angle 2 + \angle 3 + \angle BOC = 180°$ .... (4)

From eq (3) and (4) we get

$(1/2)\angle A + 90° + \angle BOC = 180°$

$\angle BOC = 90° – (1/2)\angle A$

Question: 19

Of the three angl

Solution:

Let x be the common multiple.

So, angles will be x, 2x and 3x

X + 2x + 3x = 180

6x = 180

X =30

2x = 2 X 30 = 60

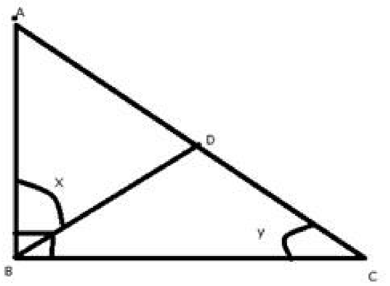
3x = 3 X 30 = 90

So, Angles are 30^O,60^O and 90^O

Question: 20

In ΔABC,

Solution:



Let $\angle ABD = x$ and $\angle ACB = y$

According to question,

$\angle B = 90^O$

In triangle BDC, we have,

$\angle BDC = 90^O$

$\angle DBC = (90 – x)^O$

$\angle BDC + \angle DBC + \angle DCB = 180^O$

$90^O + (90 – x)^O + y = 180^O$

$180^O – x + y = 180^O$

x = y

So,

$\angle ABD = \angle ACB$