RAKESH YADAV READERS PUBLICATION PVT. LTD.

A-16, CAREERWILL TOWER AZADPUR, DELHI-110033
Contact No. : 92-686-686-86

THE REVISION BOOSTER MATHS

BILINGUAL

FIRST EDITION : **2025-26**

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PREFACE

Nothing thrills a writer more than the success of his book. With this book, I hope to reach a much wider section of the student community and others, who relentlessly compete for various Government jobs.

I am thankful to Almighty and my family (My parents, brother, wife, daughters and son), who extended their help in various invisible ways.

I also express my thanks to the **Mathematics Expert Team & Typist Expert Team** who worked hard for preparing this book. I sincerely hope, the book **"The Revision Booster Maths" (Bilingual)** will meet a good response.

I would humbly appreciate suggestions, doubts etc. concerned with this book at the following.

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CONTENT | विषय-सूची

1. Geometry & Mensuration 2D (ज्यामिति और क्षेत्रमिति 2D). ..... 1 — 136

- Line and Anlge (रेखा और कोण)
- Triangle (त्रिभुज)
- Sine & Cosine (साइन और कोसाइन)
- Centre of Triangle (त्रिभुज के केंद्र)
- Similarity and Congruency (समरूपता एवं सर्वांगसमता)
- Quadrilateral (चतुर्भुज)
- Circle (वृत्त)
- Polygon (बहुभुज)

2. Mensuration 3D (क्षेत्रमिति 3D). ..... 137 — 168

- Polyhedron (बहुफलक)
- Cube (घन)
- Cuboid (घनाभ)
- Cylinder (बेलन)
- Hollow Cylinder (खोखला बेलन)
- Cone (शंकु
- Frustum of Cone (शंकु का छिन्नक)
- Sphere (गोला)
- Hemi Sphere (अर्द्ध गोला)
- Hollow Sphere (खोखला गोला)
- Hollow Hemi Sphere (खोखला अर्द्ध गोला)
- Prisms (प्रिज्म)
- Pyramids (पिरामिड)
- Tetrahedron (चतुष्फलक)

3. Algebra (बीजगणित). ..... 169 — 181

4. Polynomial & Quadratic Equation (बहुपद और द्विघात समीकरण). ..... 182 — 189

5. Trigonometry (त्रिकोणमिति). ..... 190 — 213

- Circular Measurement of Angle (कोण का वृत्तीय माप)
- Maximum and Minimum Value (अधिकतम और न्यूनतम मान)
- Height and Distance (ऊँचाई एवं दूरी)

6. Number System (संख्या पद्धति). ..... 214 — 280

- Decimal (दशमलव)
- Classification of Number (संख्या का वर्गीकरण)
- Number of digit (अंकों की संख्या)
- Unit Digit (इकाई अंक)
- Number of Trailing Zero (अनुगामी शुन्यों की संख्या)
- Divisibility (विभाज्य)
- Remainder Theorem (शेषफल प्रमेय)
- Number of Factor (संख्याओं का गुणनखण्ड)
- AP & GP (समांतर और गुणोत्तर श्रेणी)
- Compueter Number System (कम्प्यूटर संख्या पद्धति)

7. Fraction (भिन्न). ..... 281 — 288

8. Highest Common Factor & Least Common Multiple
(महत्तम समापवर्तक एवं लघुत्तम समापवर्त्य) ..... 289 — 294

9. Power, Indices and Surds (घात, घातांक एवं करणी) ..... 295 — 303

10. Simplification (सरलीकरण) ..... 304 — 311

11. Percentage (प्रतिशतता) ..... 312 — 322

12. Simple Interest (साधारण ब्याज) ..... 323 — 329

13. Compound Interest (चक्रवृद्धि ब्याज) ..... 330 — 338

14. Profit and Loss (लाभ एवं हानि) ..... 339 — 346

15. Discount छूट (बट्टा) ..... 347 — 349

16. Ratio and Proportion (अनुपात एवं समानुपात) ..... 350 — 362

- Partnership (साझेदारी)
- Age (आयु)

17. Mixture and Alligation (मिश्रण एवं पृथ्थीकरण) ..... 363 — 371

18. Average (औसत) ..... 372 — 381

19. Time and Work (समय एवं कार्य) ..... 382 — 392

- Work and Wages (कार्य एवं मजदूरी)

20. Pipe and Cistern (नल और टंकी) ..... 393 — 396

21. Time, Speed, Distance and Train (समय, चाल, दूरी और ट्रेन) ..... 397 — 410

22. Race (दौड़) ..... 411 — 415

23. Boat and Stream (नाव और धारा) ..... 416 — 418

24. Co-ordinate Geometry (निर्देशांक ज्यामिति) ..... 419 — 435

25. Probability (प्रायिकता [संभावना]) ..... 436 — 445

26. Statistics (सांख्यिकी [आँकड़े]) ..... 446 — 456

CHAPTER 01

GEOMETRY & MENSURATION 2D
ज्यामिति और क्षेत्रमिति 2D

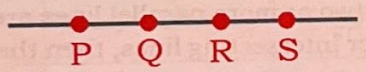
Line and Angle / रेखा और कोण

Point :–

The figure of which length, breadth and height cannot be measured is called a point.
जिस आकृति की लंबाई, चौड़ाई और ऊँचाई को नहीं मापा जा सकता, उसे बिंदु कहते हैं।

Types of point/ बिन्दु के प्रकार –

- ***Collinear point:*** If 3 or more than 3 points lie on a line close to or far from each other, then they are said to be collinear.
  सरेंख बिन्दु: यदि 3 या 3 से अधिक बिंदु एक रेखा पर एक दूसरे के निकट या दूर स्थित हो, तो वे संरेख कहलाते है।
  Eg. Points P, Q, R, S are collinear/P, Q, R, S संरेखीय बिंदु है।



- ***Non–collinear point:*** If 3 or more points are not situated on a straight line, these all point are called non-collinears point.
  असरेंख बिन्दु: यदि 3 या अधिक बिंदु एक सीधी रेखा पर स्थित नहीं हैं, तो ये सभी बिंदु असरेख बिंदु कहलाते हैं।
- ***Intersecting point:*** Intersecting lines refer to two or more lines that cross or meet at a common point, which is known as the point of intersection.
  प्रतिच्छेदी बिंदु: प्रतिच्छेदी रेखाएं दो या दो से अधिक रेखाओं को संदर्भित करती हैं जो एक उभयनिष्ठ बिंदु पर प्रतिच्छेद करती हैं या मिलती हैं, जिसे प्रतिच्छेद बिंदु के रूप में जाना जाता है।

Lines :–

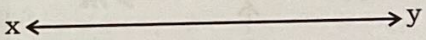
A line is an infinitely long object with no width, depth, or curvature./रेखा एक अनंत लंबी वस्तु है जिसमें कोई चौड़ाई, गहराई या वक्रता नहीं होती।
Line Segment: A line with a fixed length is called line segment./एक निश्चित लंबाई वाली रेखा को रेखाखंड कहते हैं।
Ray: A line with one end point that extends infinitely in one direction.
किरण: एक अंतबिन्दु वाली एक रेखा जो एक दिशा में अनंत तक विस्तारित होती है।

Representation

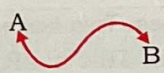
Name	Ray	Line	Line Segment
Symbol	$\overrightarrow{AB}$	$\overleftrightarrow{AB}$	$\overline{AB}$
End Points	One end point	No end point	Two end point

Types of line/ रेखा के प्रकार –

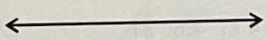
- ***Straight line:*** A straight line is an infinite length line that does not have any curves on it.
  सीधी रेखा: सीधी रेखा एक अनंत लंबाई वाली रेखा है जिस पर कोई वक्र नहीं होता है।



- ***Curved line:*** A line which change its direction is called a curved line.
  वक्र रेखा: वह रेखा जो अपनी दिशा बदलती है वक्र रेखा कहलाती है।

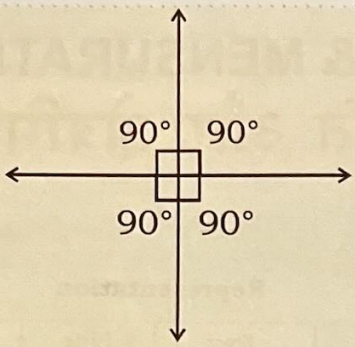


- ***Horizontal line:*** A line which is parallel to X-axis is a horizontal line.
  क्षैतिज रेखा: वह रेखा जो X-अक्ष के समान्तर होती है, क्षैतिज रेखा कहलाती है।



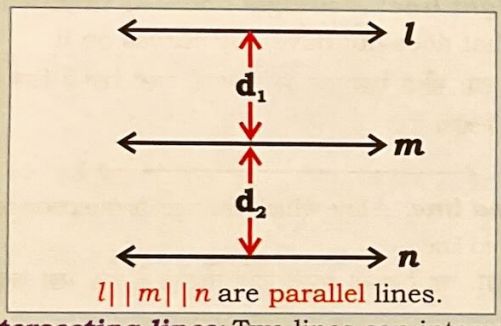
- ***Verticle line:*** A line is said to be verticle when it is perpendicular to X-axis.
  ऊर्ध्वाधर रेखा: एक रेखा तब ऊर्ध्वाधर कही जाती है जब वह X-अक्ष पर लंबवत होती है।

- ***Perpendicular lines:*** When two lines intersects each other and form an angle of 90° or make a right angles, then they are said to be perpendicular lines.
  लम्बवत रेखाएँ: जब दो रेखाएँ एक दूसरे को काटती हैं और 90° का कोण बनाती हैं या समकोण बनाती हैं, तो उन्हें लम्बवत रेखाएँ कहा जाता है।



- ***Parallel lines:*** Two lines, lying in a plane and having no common intersecting point are called parallel lines. The distance between two parallel lines is constant.

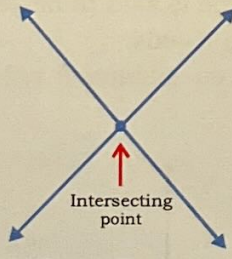
  समांतर रेखा:- दो रेखाएं, जो एक तल में स्थित हैं और जिनका कोई उभयनिष्ठ प्रतिच्छेदी बिंदु नहीं है, समानांतर रेखाएं कहलाती हैं। दो समानांतर रेखाओं के बीच की दूरी स्थिर होती है।



$l \| m \| n$ are parallel lines.

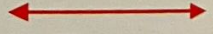
- ***Intersecting lines:*** Two lines can intersect maximum at one point. This point is called as point of intersection and these lines are called as intersecting lines.

  प्रतिच्छेदित रेखाएँ: दो रेखाएं अधिकतम एक बिंदु पर प्रतिच्छेद कर सकती हैं। इस बिंदु को प्रतिच्छेदन बिंदु कहा जाता है और इन रेखाओं को प्रतिच्छेदी रेखाएं कहा जाता है।



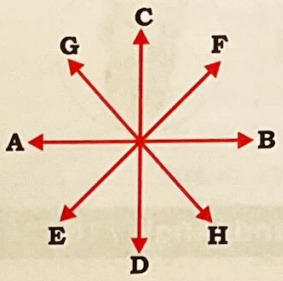
- ***Coincident lines:*** Two or more lines that covers each other completely.

  संपाती रेखाएं: दो या दो से अधिक रेखाएं जो एक दूसरे को पूर्णत: ढ़क लेती है।



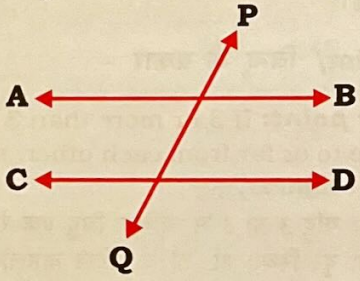
- ***Concurrent lines:*** Three or more than three lines, which pass from a single point are called concurrent lines.

  संगामी रेखाएं: तीन या तीन से अधिक रेखाएँ, जो एक बिंदु से होकर गुजरती हैं, संगामी रेखाएँ कहलाती हैं।



- ***Transversal line:*** A line that passes through two or more lines in the same plane at two distinct points.

  तिर्यक रेखा: एक तिर्यक रेखा एक रेखा है जो एक ही तल मे दो अलग-अलग बिंदुओ पर दो रेखाओं से होकर गुजरती है।



AB||CD and PQ is transversal line.

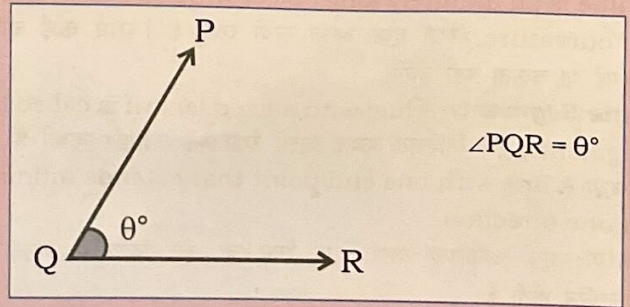
Note: When two or more parallel lines are intersected by some other intersecting lines, then the ratio of corresponding intersects are equal. An intersecting line is generally called as a transversal line.

नोट: जब दो या दो से अधिक समांतर रेखाओं को कोई अन्य प्रतिच्छेदन रेखाएँ काटती हैं, तो संगत अंत: खंडों का अनुपात बराबर होता है। एक प्रतिच्छेदी रेखा को आमतौर पर तिर्यक रेखा कहा जाता है।

Angle/ कोण –

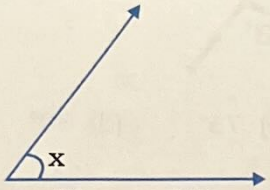
An angle is formed when two rays are joined together at a common point. The common point here is called node or vertex and the two rays are called arms of the angle. The angle is represented by the symbol '∠'

जब दो किरणें एक सामान्य बिंदु पर एक साथ जुड़ती हैं तो कोण बनता है। यहाँ सामान्य बिंदु को नोड या शीर्ष कहा जाता है और दो किरणों को कोण की भुजाएँ कहा जाता है। कोण को प्रतीक '∠' द्वारा दर्शाया जाता है।



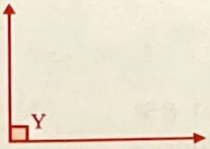
Types of Angles/ कोणों का प्रकार

Acute Angle
न्यून कोण

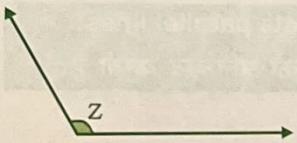


$0° < x < 90°$

Right Angle / समकोण
$y = 90°$

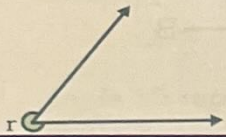


Obtuse Angle/अधिक कोण
$90° < z < 180°$

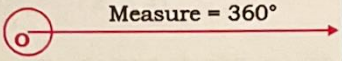


Straight Angle
ऋजु कोण/रेखीय कोण = 180°

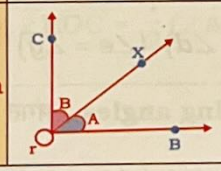
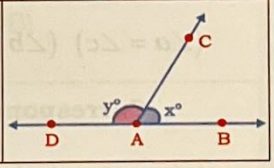
Reflex Angle/प्रतिवर्ती कोण
$180° < r < 360°$



Complete angle/सम्पूर्ण कोण
Measure = 360°



Complementary & Supplementary Angle

Angle	Complementary	Supplementary
Definition	Sum of $\angle A+\angle B = 90°$	Sum of $\angle X+\angle Y = 180°$
Representation		

Angle	Complementary	Supplementary
θ	90-θ	180-θ
10	80	170
20	70	160
30	60	150
40	50	140

Example :-

If one of angle is four times the complementary of the other angle. Find the angles./ यदि कोई कोण इसके पूरक कोण का चार गुणा हो तो कोण ज्ञात करो।

(a) 18° (b) 72° (c) 15° (d) 60°

Solution :-

माना, $\angle\alpha = x$ → पूरक कोण ∴ $\angle\beta = 4x$

ATQ, $4x + x = 90 \Rightarrow 5x = 90 \Rightarrow x = 18$

∴ $\beta = 4x = 4 \times 18 = 72°$

Example :-

If two supplementary angles are $(7x + 58)°$ and $(16x + 53)°$ then 5x is:
यदि दो संपूरक कोण $(7x + 58)°$ व $(16x + 53)°$ है तब 5x का मान क्या होगा।

(a) 3° (b) 15° (c) 9° (d) 12°

Solution :-

ATQ, $(7x + 58°) + (16x + 53°) = 180°$

$23x + 111° = 180°$

$23x = 69° \Rightarrow x = \frac{69°}{23} = 3°$

∴ $5x = 5 \times 3 = 15°$

Example :-

If the ratio of two supplementary angles is 14: 22, then what will be the smaller angle?
दो सम्पूरक कोणों का अनुपात 14 : 22 है, तो छोटा कोण क्या होगा?

(a) 60° (b) 70° (c) 56° (d) 90°

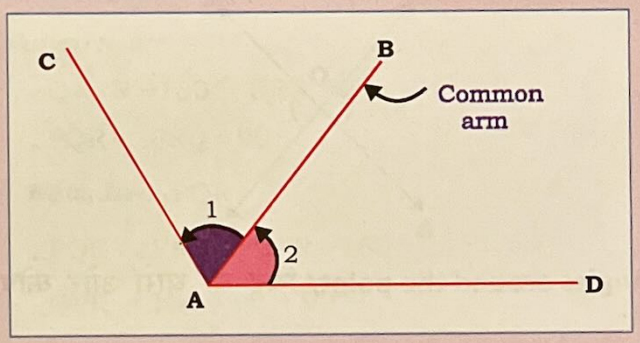
Solution :-

सम्पूरक कोणों का अनुपात = 14 : 22

ATQ, $14x + 22x = 180 \Rightarrow 36x = 180 \Rightarrow x = 5°$

∴ सबसे छोटा कोण = $14x = 14 \times 5 = 70°$

Adjacent Angles / आसन्न कोण –



Two angles are said to be adjacent angles, if.
दो कोण आसन्न कोण कहलाते है, यदि –

1. They have a common vertex (A).
   यदि उनमें एक उभयनिष्ठ शीर्ष (A) हो।
2. They have a common arm (AB).
   उनमें एक उभयनिष्ठ भुजा (AB) हो।
3. Non common arms (AC, AD) are on either side of the common arms (AB)./गैर-उभयनिष्ठ भुजाएँ (AC, AD) उभयनिष्ठ भुजा (AB) के दोनों ओर होती हैं।

- ***Linear pair:*** A linear pair is a pair of adjacent angles whose non-common sides are opposite rays.

रैखिक युग्म: एक रैखिक युग्म आसन्न कोणों का एक युग्म है जिनकी गैर उभयनिष्ठ (non-common) भुजा विपरीत किरण होती है।

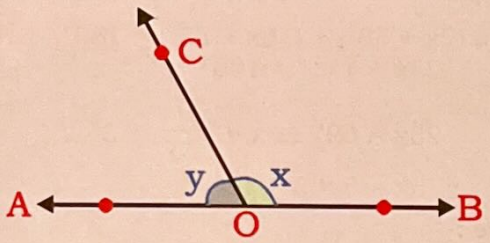
Linear pair angles are supplementary

रैखिक युग्म के कोण संपूरक होते है।

$\angle x$ and $\angle y$ are linear pair

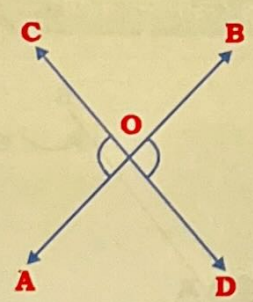
$\angle x$ और $\angle y$ एक रैखिक युग्म है

$$\angle x + \angle y = 180°$$



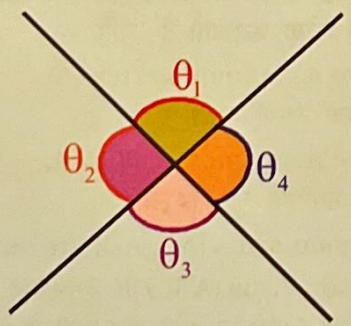
- ***Vertically opposite angles :*** Two angles are called a pair of vertically opposite angles, if their arms form two pairs of opposite rays.i.e., $\angle AOC$ and $\angle DOB$ are vertically opposite. Also, $\angle AOD$ & $\angle COB$ are vertically opposite.

शीर्षाभिमुख सम्मुख कोण: दो कोणों को शीर्षाभिमुख सम्मुख कोणों का युग्म कहा जाता है, यदि उनकी भुजाएं विपरीत किरणों के दो युग्म बनाती हैं। अर्थात, $\angle AOC$ और $\angle DOB$ शीर्षाभिमुख विपरीत हैं। इसी प्रकार $\angle AOD$ और $\angle COB$ शीर्षाभिमुख विपरीत हैं।



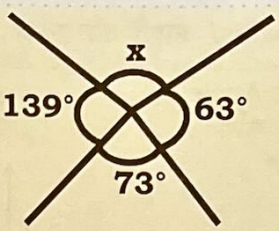
Angles around the point/ बिंदु के चारों ओर कोण

$$\theta_1 + \theta_2 + \theta_3 + \theta_4 = 360°$$



Example :-

Find the value of x/x का मान ज्ञात करें।



(a) 85° (b) 70° (c) 75° (d) 80°

Solution :-

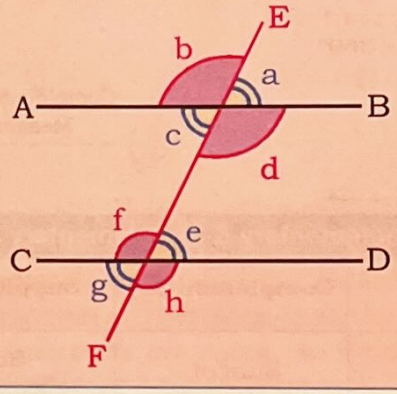
$\theta_1 + \theta_2 + \theta_3 + \theta_4 = 360°$

$x + 139° + 73° + 63° = 360°$

$x = 360° - 275° \Rightarrow x = 85°$

When a transversal line intersects parallel lines:
जब एक तिर्यक रेखा समांतर रेखाओं को प्रतिच्छेद करती है:

If AB||CD,
EF is transversal line,



Vertically opposite angles (शीर्षाभिमुख कोण)

$(\angle a = \angle c)$ $(\angle b = \angle d)$ $(\angle e = \angle g)$ $(\angle f = \angle h)$

Corresponding angles (संगत कोण)

$(\angle a = \angle e)$ $(\angle b = \angle f)$ $(\angle c = \angle g)$ $(\angle d = \angle h)$

Alternate exterior angles (बाह्य एकान्तर कोण)

$(\angle a = \angle g)$ $(\angle b = \angle h)$

Alternate interior angles (अंत: एकान्तर कोण)

$(\angle d = \angle f)$ $(\angle c = \angle e)$

Consecutive interior angles (क्रमागत अंत: कोण)

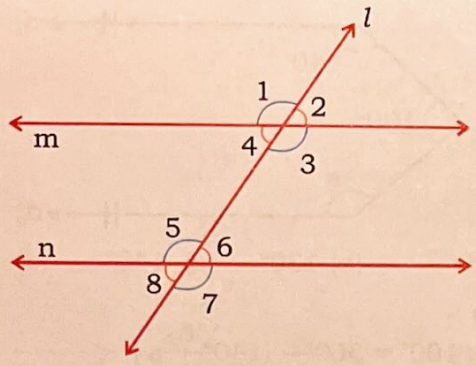
$(\angle d$ & $\angle e)$ $(\angle c$ & $\angle f)$

$\angle d + \angle e = \angle c + \angle f = 180°$

Example :-

If m || n and angles 1 and 2 are in the ratio 3:2. Determine all the angles from 1 to 8.

यदि m || n और कोण 1 और 2 का अनुपात 3 : 2 है। 1 से 8 तक के सभी कोण ज्ञात कीजिए।



Solution :-

$\angle 1 + \angle 2 = 180°$

ATQ, $3x + 2x = 180$

$x = 36°$

Now, $\angle 1 = 3 \times 36 = 108°$

$\angle 2 = 2 \times 36 = 72°$

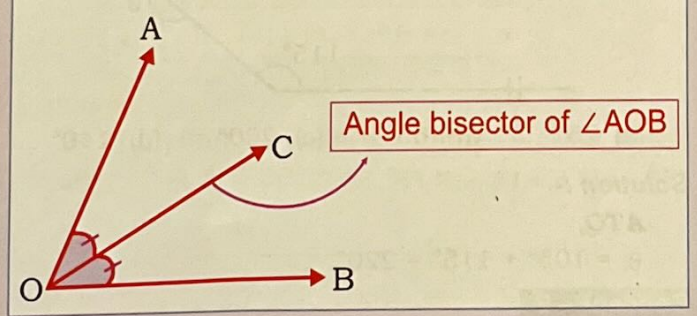
Now, $\angle 1 = \angle 3 = \angle 7 = \angle 5 = 108°$ ***and***

$\angle 2 = \angle 4 = \angle 6 = \angle 8 = 72°$

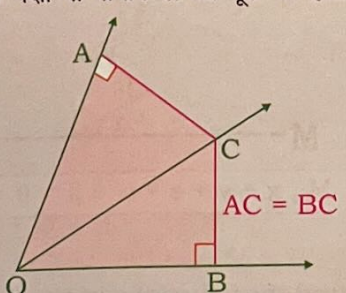
- ***Angle bisector:*** When a line segment divides an angle equally into two parts, then it is said to be the angle bisector.

  कोण समद्विभाजक: जब एक रेखाखण्ड किसी कोण को दो बराबर भागों में बांटता है, तो उसे कोण समद्विभाजक कहते हैं।

$\angle AOC = \angle BOC = \frac{1}{2}(\angle AOB)$

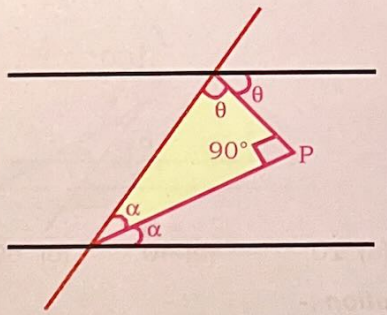


- Angle bisector equiperpendicular distance is equal from both two sides of the angle./कोण समद्विभाजक कोण के दोनों पक्षों से समान लम्बत दूरी पर होता है।



- When angle bisector of angles made on one side of transversal line./जब त्रियक रेखा के एक ही ओर बने कोणों का कोण समद्विभाजक खींचा जाता है।

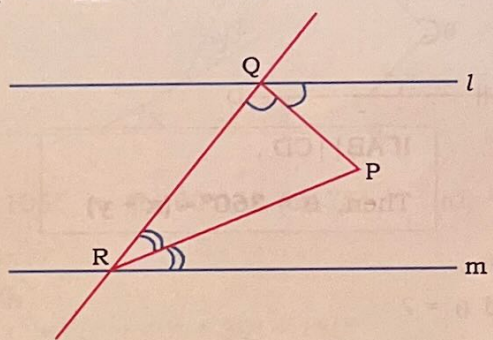
$\angle P = 90°$



Example :-

In given figure, find the value of $\angle P$. If PQ and PR are angle bisector of angle $\angle Q$ and $\angle R$ respectively?

दी गई आकृति में, $\angle P$ का मान ज्ञात कीजिए यदि PQ और PR क्रमश: कोण $\angle Q$ और $\angle R$ के कोण समद्विभाजक हैं



(a) 180° (b) 90° (c) 125° (d) 135°

Solution :-

$\angle Q + \angle R = 180°$ (अन्त: कोण)

$\angle PQR + \angle PRQ = 90°$

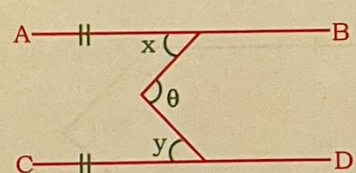
Now, In ΔPQR

$\angle PQR + \angle PRQ + \angle QPR = 180°$

$\angle QPR = 180 - 90 = 90°$

Concepts based on parallel lines

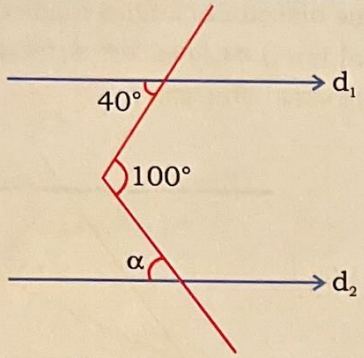
Concept – 1



If AB ||CD , Then, $\theta = x + y$

Example :-

If $d_1 || d_2$ then $\alpha = ?$



(a) 20° (b) 40° (c) 60° (d) 30°

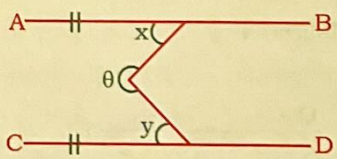
Solution :-

$\because \theta = x + y$

$\therefore 100° = 40 + \alpha$

$\alpha = 100 - 40 = 60°$

Concept – 2

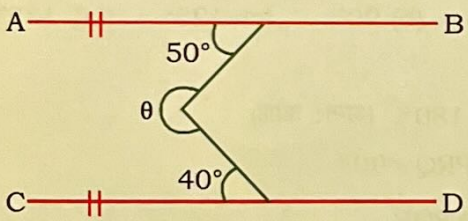


If AB | | CD ,

Then, $\theta = 360° - (x + y)$

Example :-

Find θ = ?



(a) 90° (b) 130° (c) 270° (d) 140°

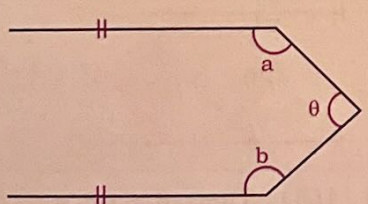
Solution :-

$\because \theta = 360° - (x + y)$

$\therefore \theta = 360° - (50 + 40)$

$= 360° - 90° = 270°$

Concept –3

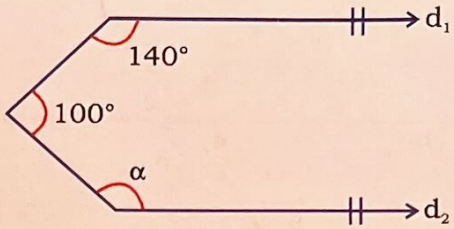


If AB | | CD,

Then, $\theta = 360 - (a + b)$

Example :-

If $d_1 \,||\, d_2$ then α = ?



(a) 60° (b) 130° (c) 140° (d) 120°

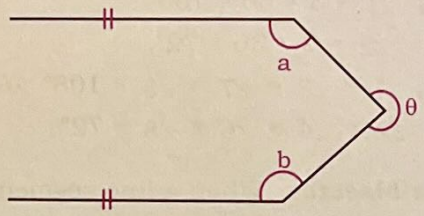
Solution :-

ATQ, $100° = 360° - (140° + \alpha)$

$100° = 360° - 140° - \alpha$

$\Rightarrow \alpha = 220° - 100° = 120°$

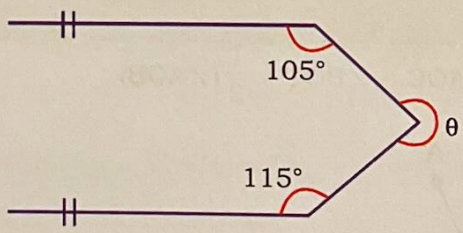
Concept – 4



If AB | | CD , Then, $\theta = (a + b)$

Example :-

Find θ = ?



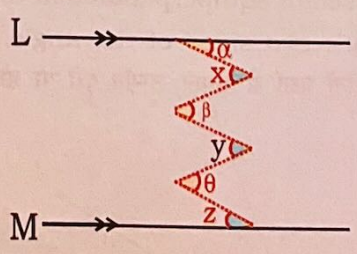
(a) 75° (b) 65° (c) 220° (d) 140°

Solution :-

ATQ,

$\theta = 105° + 115° = 220°$

Concept – 5

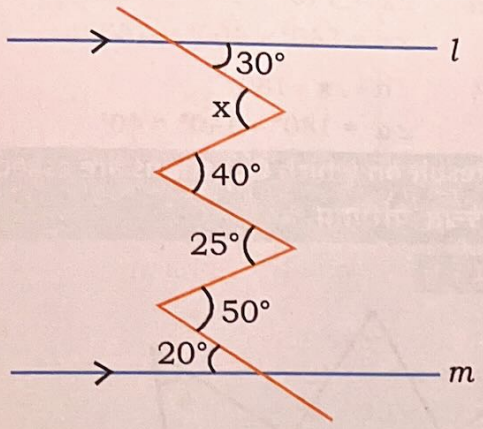


If L || M , $x + y + z = \alpha + \beta + \theta$

Example :-

If l | | m, find the value of x in the following figure.

यदि $l \,||\, m$ है तो निम्नलिखित चित्र में x का मान ज्ञात कीजिए।



(a) 105° (b) 60° (c) 75° (d) 90°

Solution :-

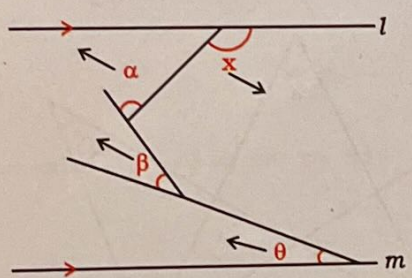
ATQ,

$x + 25° + 20° = 30° + 40° + 50°$

$x + 45° = 120°$

$\Rightarrow x = 120° - 45° = 75°$

Concept – 6

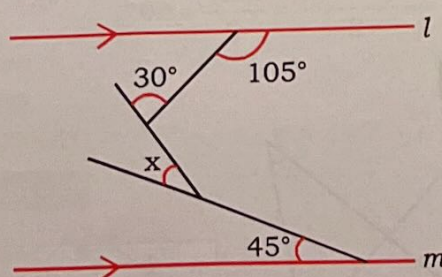


If $l \,||\, m$, $x = \theta + \beta + \alpha$

Example :-

If $l \,||\, m$, find the value of x in the following figure.

यदि $l \,||\, m$ है तो निम्नलिखित चित्र में x का मान ज्ञात कीजिए।



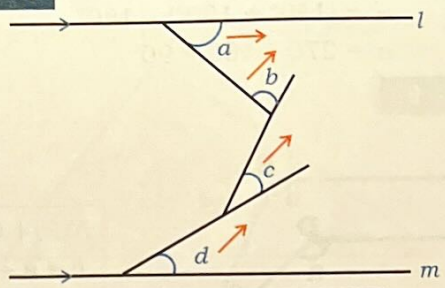
(a) 30° (b) 60° (c) 70° (d) 90°

Solution :-

ATQ, $45° + x° + 30° = 105°$

$x° = 105° - 75° = 30°$

Concept – 7

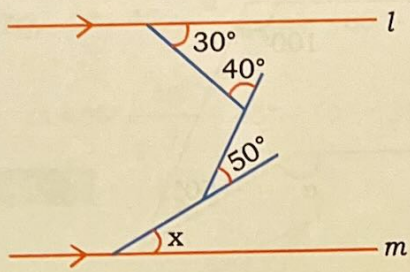


If $l \,||\, m$, $a + b + c + d = 180°$

Example :-

If $l \,||\, m$, find the value of x in the following figure.

यदि $l \,||\, m$ है तो निम्नलिखित चित्र में x का मान ज्ञात कीजिए।



(a) 105° (b) 60° (c) 75° (d) 90°

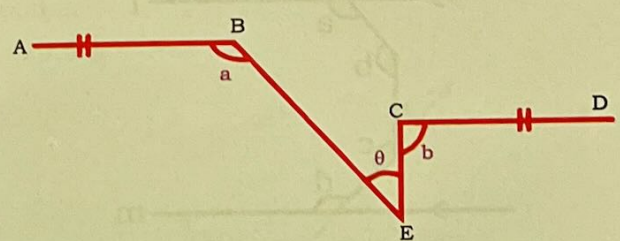
Solution :-

ATQ,

$x° + 50° + 40° + 30° = 180°$

$x = 180° - 120° = 60°$

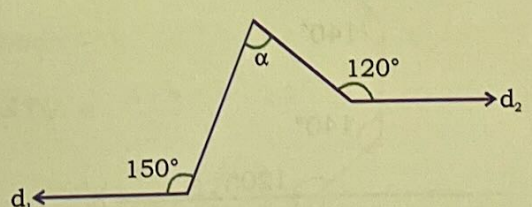
Concept – 8



If AB || CD,
$\theta = 180° - (a+b)$ ***or*** $\theta = (a+b) - 180°$

Example :-

If $d_1 \,||\, d_2$ then $\alpha = ?$



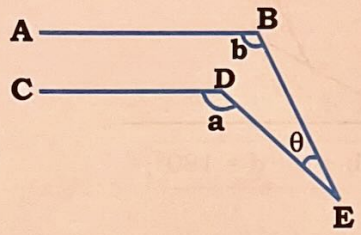
(a) 75° (b) 40° (c) 90° (d) 60°

Solution :-

ATQ, $\alpha = (150° + 120°) - 180°$

$\alpha = 270 - 180 = 90°$

Concept – 9

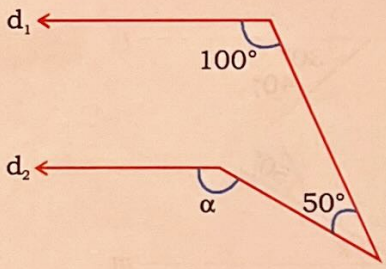


AB || CD

$\theta = a - b$

Example :-

If $d_1 || d_2$ then α = ?



(a) 90° (b) 150° (c) 160° (d) 70°

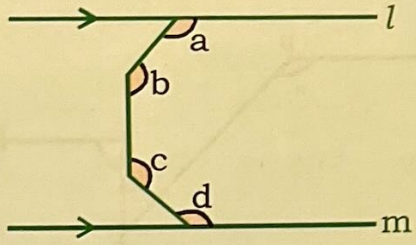
Solution :-

ATQ, $\alpha - 100° = 50$

$\alpha = 50 + 100 = 150°$

Concept – 10

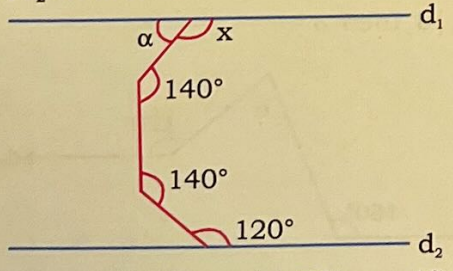
Sum of angles = n × 180° Number of lines = 3



Sum = $\angle a + \angle b + \angle c + \angle d = 3 \times 180° = 540°$

Example :-

If $d_1 || d_2$ then α = ?



(a) 90° (b) 40° (c) 70° (d) 80°

Solution :-

ATQ, $\angle x + 140° + 140° + 120° = 540°$

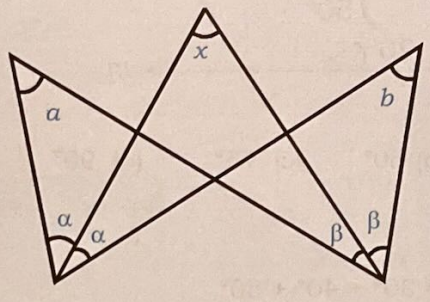
$\angle x = 540° - 400° = 140$

Now, $\angle \alpha + \angle x = 180°$

$\angle \alpha = 180° - 140° = 40°$

Direct Result on which Questions are asked
कुछ निश्चित परिणाम –

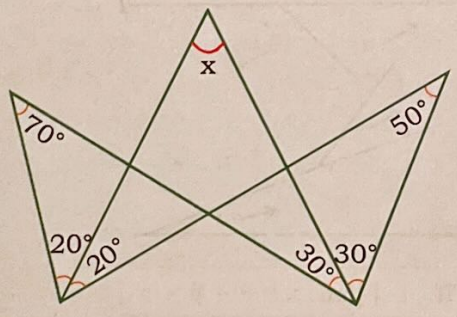
Concept – 1



$x = \frac{a+b}{2}$

Example :-

In the following figure find the value of x
निम्नलिखित चित्र में x का मान ज्ञात कीजिए?

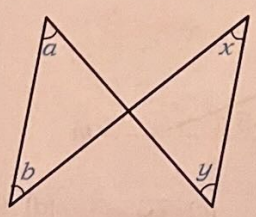


(a) 30° (b) 40° (c) 50° (d) 60°

Solution :-

ATQ, $x = \frac{70° + 50°}{2} = \frac{120°}{2} = 60°$

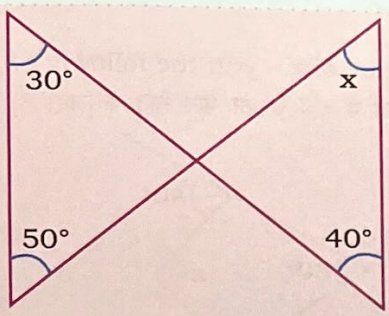
Concept – 2



$a + b = x + y$

Example :-

Find the value of x./x का मान ज्ञात करें?



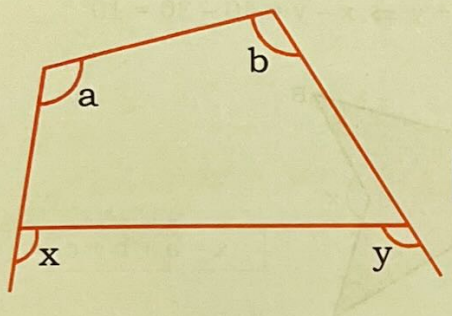
(a) 30° (b) 40° (c) 50° (d) 60°

Solution :-

ATQ, $a + b = x + y \Rightarrow 30 + 50 = x + 40$

$x = 80 - 40 = 40°$

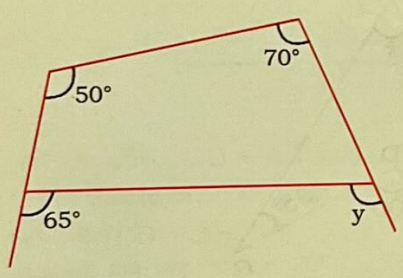
Concept – 3



$a + b = x + y$

Example :-

Find the value of y./y का मान ज्ञात करें?



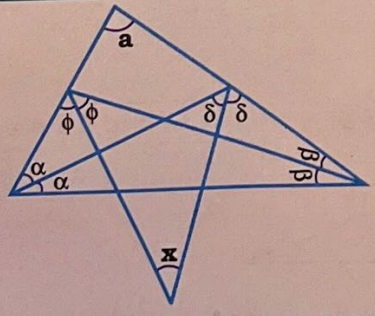
(a) 45° (b) 55° (c) 65° (d) 75°

Solution :-

ATQ,

$50° + 70° = 65° + y \Rightarrow y = 120° - 65° = 55°$

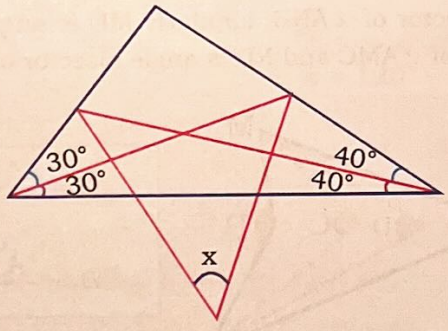
Concept – 4



$\angle x = 45° - \frac{a}{4}$

Example :-

Find the value of x./x का मान ज्ञात करें?



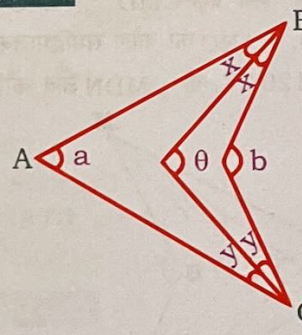
(a) 25° (b) 35° (c) 45° (d) 55°

Solution :-

ATQ, $\angle x = 45° - \frac{a}{4}$ [$\because a = 180° - (80+60) = 40°$]

$\therefore \angle x = 45° - \frac{40°}{4} = 45° - 10° = 35°$

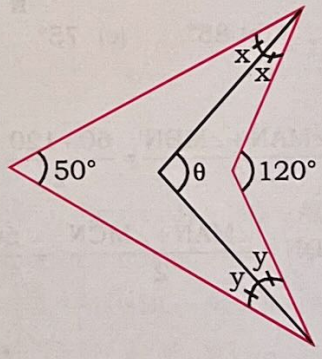
Concept – 5



$\theta = \frac{a+b}{2}$

Example :-

Find θ = ?



(a) 85° (b) 86° (c) 87° (d) 88°

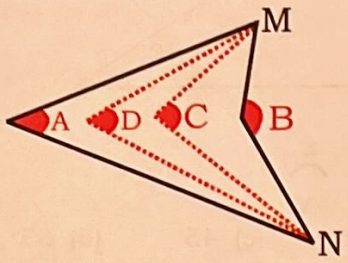
Solution :-

ATQ, $\theta = \frac{a+b}{2}$

$\theta = \frac{50+120}{2} = \frac{170}{2} = 85°$

Concept – 6

If MC is angle Bisector of ∠AMB and NC is angle bisector of ∠ANB, similarly MD is angle bisector of ∠AMC and ND is angle bisector of ∠ANC.



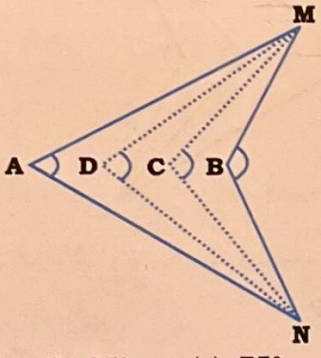
$$\angle C = \frac{\angle A + \angle B}{2}$$

$$\angle D = \frac{\angle A + \angle C}{2}$$

Example :-

If MC is angle Bisector of ∠AMB and NC is angle bisector of ∠ANB, similary MD is angle bisector of ∠AMC and ND is angle bisector of ∠ANC. If ∠A = 60°, ∠B = 120° find ∠MDN =?

यदि MC, ∠AMB का कोण समद्विभाजक है और NC, ∠ANB का कोण समद्विभाजक है, इसी प्रकार MD, ∠AMC का कोण समद्विभाजक है और ND, ∠ANC का कोण समद्विभाजक है। यदि ∠A = 60°, ∠B = 120° है, तो ∠MDN ज्ञात कीजिए।



(a) 65° (b) 85° (c) 75° (d) 95°

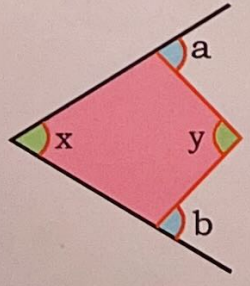
Solution :-

$$\angle MCN = \frac{\angle MAN + \angle MBN}{2} = \frac{60+120}{2} = 90°$$

Now, $$\angle MDN = \frac{\angle MAN + \angle MCN}{2} = \frac{60+90}{2} = 75°$$

Concept – 7

In the given figure

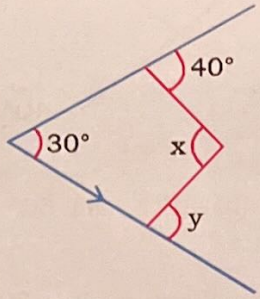


$$x + y = a + b$$

Example :-

Find the value of x – y in the following figure.

निम्नलिखित चित्र में x – y का मान ज्ञात कीजिए।



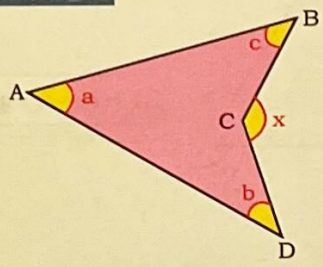
(a) 10° (b) 20° (c) 30° (d) 40°

Solution :-

ATQ,

30° + x = 40 + y ⇒ x – y = 40 – 30 = 10°

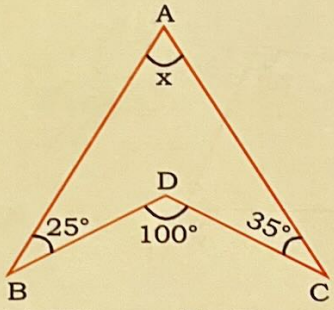
Concept – 8



$$x = a + b + c$$

Example :-

Find x = ?



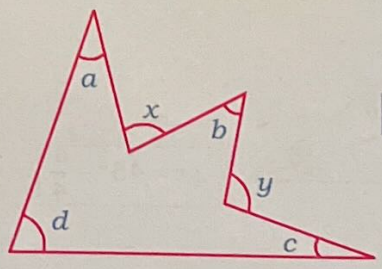
(a) 50° (b) 60° (c) 30° (d) 40°

Solution :-

ATQ,

x + 25 + 35 = 100° ⇒ x + 60 = 100 ⇒ x = 40°

Concept – 9

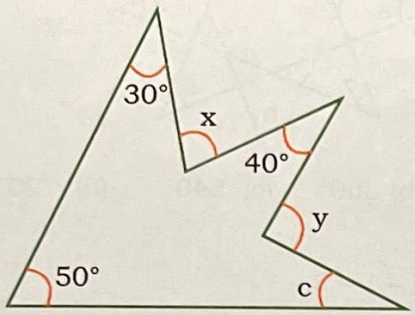


$$a + b + c + d = x + y$$

Example :-

If x + y = 150 find value of c

यदि x + y = 150 है तो c का मान ज्ञात कीजिए?



(a) 30° (b) 40° (c) 50° (d) 60°

Solution :-

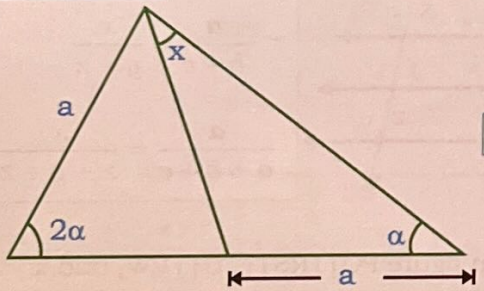
ATQ,

$30 + 40 + 50 + \angle c = x + y$

$120 + \angle c = 150°$

$\angle c = 150 - 120 = 30°$

Concept – 10

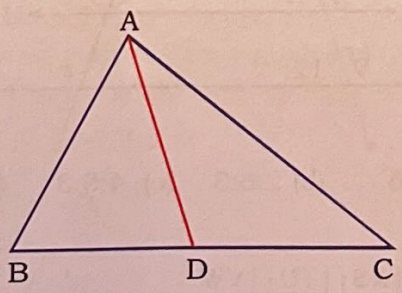


$x = \alpha$

Example :-

In the $\triangle ABC$, CD = AB and $\angle ABC = 2\angle ACD$, find the value of $\angle DAC$. If $\angle ACD = 30°$

$\triangle ABC$ में, CD = AB तथा $\angle ABC = 2\angle ACD$ है, तो $\angle DAC$ का मान ज्ञात कीजिए। यदि $\angle ACD = 30°$



(a) 60° (b) 40° (c) 30° (d) 35°

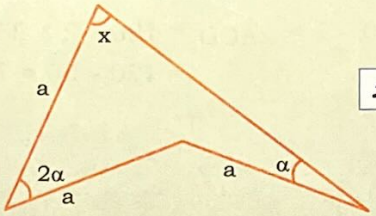
Solution :-

ATQ, CD = AB

$\therefore \angle DAC = \angle ACD$

$\angle DAC = 30°$

Concept – 11

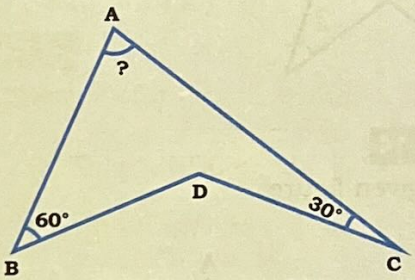


$x = 120° - \alpha$

Example :-

In the following figure AB = BD = DC and $\angle ABD = 2\angle ACD$, if $\angle ABD = 60°$, find the value of $\angle BAC$.

निम्नलिखित आकृति में AB = BD = DC तथा $\angle ABD = 2\angle ACD$, यदि $\angle ABD = 60°$, तो $\angle BAC$ का मान ज्ञात कीजिए।



(a) 60° (b) 90° (c) 70° (d) 40°

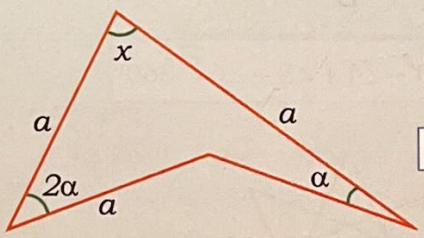
Solution :-

$\because$ AB = BD = DC

ATQ, $x = 120 - \alpha$

$\angle BAC = 120 - 30 = 90°$

Concept – 12

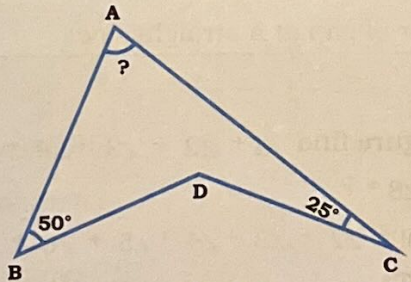


$x = 120° - 2\alpha$

Example :-

In the following figure AB = BD = AC and $\angle ABD = 2\angle ACD$. find the value of $\angle BAC$, if $\angle ACD = 25°$?

निम्नलिखित आकृति में AB = BD = AC तथा $\angle ABD = 2\angle ACD$ है। $\angle BAC$ का मान ज्ञात कीजिए, यदि $\angle ACD = 25°$ है।



(a) 60° (b) 90° (c) 70° (d) 40°