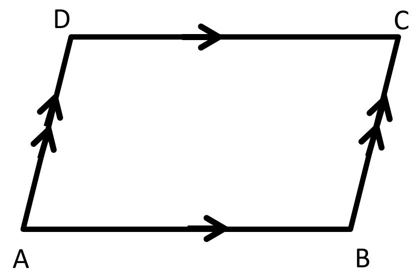
Introduction

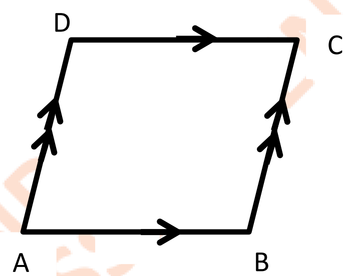
Some important definitions

1) Parallelogram: It is a quadrilateral in which both pairs of its opposite sides are parallel.



ABCD is a parallelogram with AB//CD and AD//BC

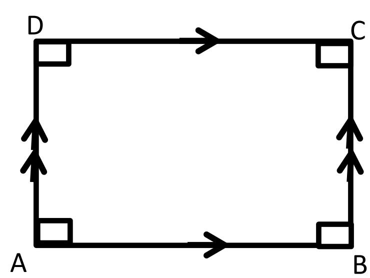
2) Rhombus: It is a parallelogram in which all sides are equal.



ABCD is a rhombus with AB//CD and AD//BC

Also, AB = BC = CD = DA

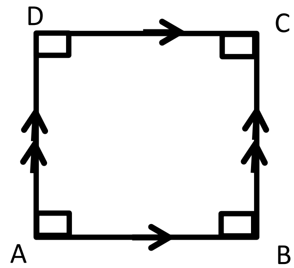
3) Rectangle: It is a parallelogram in which each angle is a right angle.



ABCD is a rectangle with AB//CD and AD//BC

And, AB = CD, AD = BC and each angle = 90º

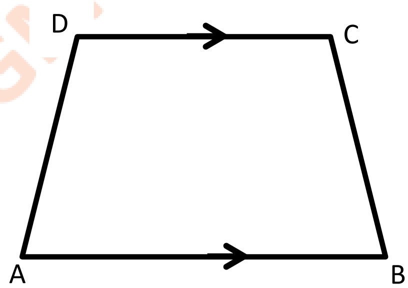
4) Square: It is a parallelogram in which each angle is a right angle and all sides are equal.



ABCD is a square with AB//CD and AD//BC

And, AB = CD = AD = BC and each angle = 90º

5) Trapezium: It is a quadrilateral which is having exactly one pair of parallel sides.



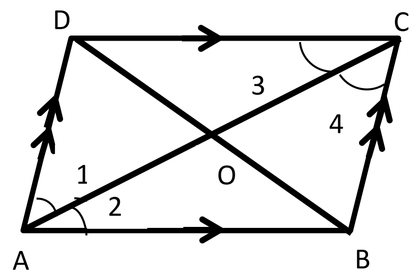
ABCD is a trapezium in which AB//CD

Properties of a parallelogram:

Result 1: Prove that in a parallelogram:

(a) The opposite sides are equal
(b) The opposite angles are equal
(c) Diagonals bisect each other

Proof



Let ABCD be a parallelogram. We join diagonal AC

Since AB//CD and AD//BC

*L*1 = *L*4 and *L*2 = *L*3 (alternate interior angles)

In triangle ABC and ACD,

*L*1 = *L*4

*L*2 = *L*3

AC = AC (common)

=> ΔABC ≅ ΔACD (by ASA congruency)

Thus, AB = CD, AD = BC and *L*B = *L*D (by cpct) ⟶ 1

Similarly if we join diagonal BD, we can prove that ΔABD ≅ ΔBCD (by ASA congruency)

Thus, *L*A = *L*C (by cpct) ⟶ 2

Therefore, from 1 and 2 we can say that opposite sides and opposite angles are equal.

Now, in triangle AOB and COD

*L*AOB = *L*COD (vertically opposite angles)

AB = CD (Proved above)

*L*2 = *L*3 (alternate interior angles)

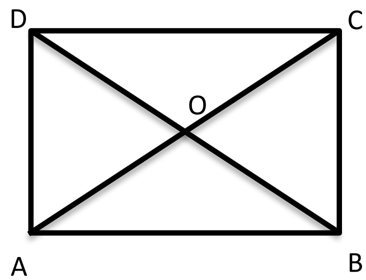
Thus, by ASA congruency, ΔAOB ≅ ΔCOD

So, OA = OC and OB = OD (by Cpct)

Therefore, diagonals of parallelogram bisect each other.

Result 2: Prove that the diagonals of a rectangle are equal and bisect each other.

Proof



Let ABCD be a rectangle with diagonals AC and BD intersect at O

In triangle ABC and BAD,

AB = AB (common)

*L*ABC = *L*BAD = 90^o

AD = BC (opposite sides of rectangle are equal)

Thus, by SAS congruency, ΔABC ≅ ΔBAD

So, AC = BD (by Cpct)

Hence, diagonals of rectangle are equal.

Now, to show they bisect each other,

Consider ΔOAB and ΔOCD, we have

AB = CD (opposite sides of rectangle are equal)

AC = BD (proved above)

*L*AOB = *L*COD (vertically opposite angles)

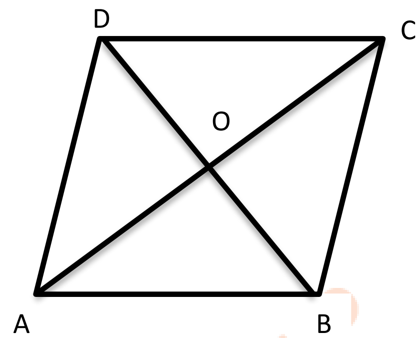
Thus, by ASA congruency, ΔAOB ≅ ΔCOD

So, OA = OC and OB = OD (by Cpct)

Therefore, diagonals of rectangle bisect each other.

Result 3: Prove that the diagonals of a rhombus bisect each other at right angles.

Proof



Let ABCD be a rhombus whose diagonals intersect each other at O.

Since we know that rhombus is a parallelogram and also diagonals of parallelogram bisect each other

Thus, diagonals of rhombus also bisect each other

=> OA = OC and OB = OD

Now, in ΔCOB and ΔCOD

OC = OC (common)

CD = BC (all sides of rhombus are equal)

OB = OD (proved above)

Thus, by SSS congruency, $\Delta COB \cong \Delta COD$

So, $\angle COB = \angle COD$ (by Cpct)

But, $\angle COB + \angle COD = 180^o$ (linear pair)

=> $\angle COB + \angle COB = 180$

=> $2 \angle COB = 180$

=> $\angle COB = 90^o$

And $\angle COD = 90^o$

Thus, the diagonals of a rhombus bisect each other at right angles.

Result 4: **Prove that the diagonals of a square are equal and bisect each other at right angles.**

Proof: Since we know that every square is a rectangle and diagonals of rectangle are equal

Thus, diagonals of square are also equal.

Also every square is a rhombus and diagonals of rhombus bisect each other at 90^o

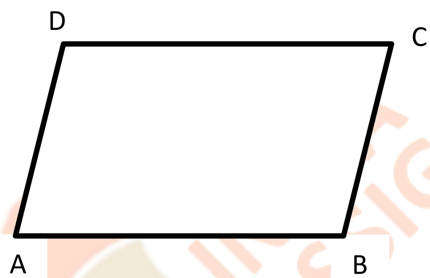
Thus, diagonals of square bisect each other at 90^o

Hence, the diagonals of a square are equal and bisect each other at right angles.

Examples

Example 1 – Prove that any two adjacent angles of a parallelogram are supplementary

Solution -



To prove: any two adjacent angles of parallelogram are supplementary

Proof: Let ABCD be a parallelogram

Then, AD//BC and AB is a transversal

Since, we know that sum of interior angles on the same side of transversal is 180^o

Thus, $\angle A + \angle B = 180^o$

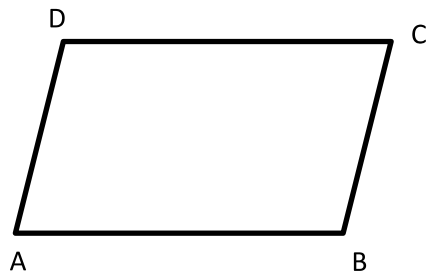
Similarly, $\angle B + \angle C = 180^o$, $\angle C + \angle D = 180^o$, $\angle A + \angle D = 180^o$

Thus, the sum of any two adjacent angles of a parallelogram is 180^o

Hence, any two adjacent angles of parallelogram are supplementary

Example 2 – Two adjacent angles of a parallelogram are as 2:3. Find the measure of each of its angles.

Solution -



Let ABCD be a parallelogram.

Let two adjacent angles of parallelogram be 2x and 3x

Suppose $\angle A = 2x$ and $\angle B = 3x$

We know that the sum of any two adjacent angles of a parallelogram is 180°

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

=> $2x + 3x = 180$

=> $5x = 180$

=> $x = 36^\circ$

So, $\angle A = 2(36) = 72^\circ$

$\angle B = 3(36) = 108^\circ$

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

=> $108 + \angle C = 180^\circ$

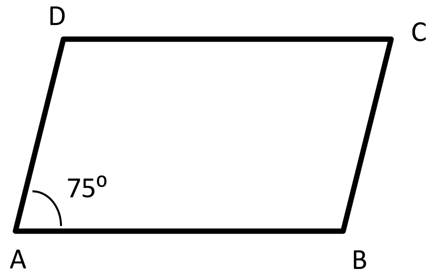
=> $\angle C = 180 - 108 = 72^\circ$

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

=> $72 + \angle D = 180^\circ$

=> $\angle D = 180 – 72 = 108^\circ$

Example 3 – In the adjoining figure, ABCD is a parallelogram in which ∠A = 75°. Find the measure of each of the angles ∠B, ∠C and ∠D.



Solution - It is given that ABCD is a parallelogram and ∠A = 75°

To find: ∠B, ∠C and ∠D

Since we know that sum of any two adjacent angles of a parallelogram is 180°

Thus, ∠A + ∠B = 180°

=> 75 + ∠B = 180°

=> ∠B = 180 – 75 = 105

Also, ∠B + ∠C = 180°

=> 105 + ∠C = 180°

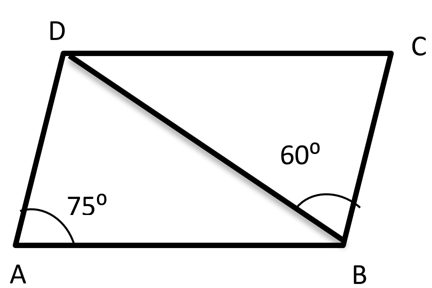
=> ∠C = 180 - 105 = 75°

∠C + ∠D = 180°

=> 75 + ∠D = 180°

=> ∠D = 180 – 75 = 105°

Example 4 – In the adjoining figure, ABCD is a parallelogram in which ∠BAD = 75° and ∠DBC = 60°. Calculate (a) ∠CDB and (b) ∠ADB.



Solution - It is given that ABCD is a parallelogram and *L BAD* = 75^o and *L DBC* = 60^o

To find: *L*CDB and *L*ADB

We know that opposite angles of parallelogram are equal

Thus, *L BAD* = *L BCD* = 75^o

In ∆BCD, by angle sum property of triangle

L BCD + *L CDB* + *L DBC* = 180

=> 75 + 60 + *L CDB* = 180

=> *L CDB* = 180 – 135

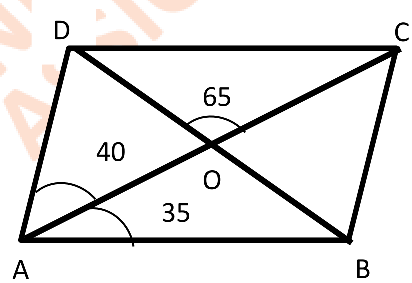
=> *L CDB* = 45^o

Now, Since AD//BC and BD is a transversal

Thus, *L ADB* = *L DBC* = 60^o (alternate interior angles)

Example 5 – In the adjoining figure, ABCD is a parallelogram in which *L*CAD = 40^o, *L*BAC = 35^o and *L*COD = 65^o.

Calculate: (a) *L*ABD (b) *L*BDC (c) *L*ACB (d) *L*CBD



Solution - It is given that ABCD is a parallelogram and *L CAD* = 40^o, *L* BAC = 35^o and *L COD* = 65^o

To find: *L*ABD, *L*BDC, *L*ACB, *L*CBD

(a) *L AOB = L COD = 65^o (*vertically opposite angles)

In ∆AOB, by angle sum property of triangle

L OAB + *L ABO* + *L AOB* = 180

=> 35 + 65 + *L ABO* = 180

=> *L ABO* = 180 – 100

=> *L ABO* = 80º

=> *L ABO* = *L ABD* = 80º

(b) Since AB//DC and BD is a transversal

Thus, *L*BDC = *L ABD* = 80º (alternate interior angles)

(c) Since AD//BC and AC is a transversal

Thus, *L*ACB = *L C*AD = 40º (alternate interior angles)

(d) Since *L*BCD = *L BAD = 35+40 = 75*

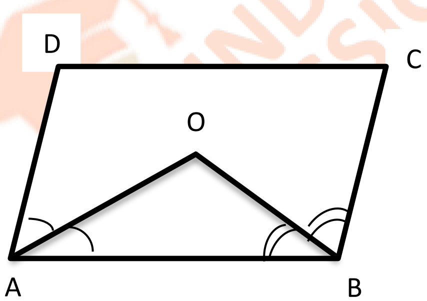
In In ΔBCD, by angle sum property of triangle

L BCD + *L CDB* + *L CBD* = 180

=> 75 + 80 + *L CBD* = 180

=> *L CBD* = 180 – 155 = 25º

Example 6 – In the adjoining figure, ABCD is a parallelogram. AO and BO are the bisectors of *L*A and *L*B respectively. Prove that *L*AOB = 90º.



Solution - It is given that ABCD is a parallelogram

AO and BO are the bisectors of A and B respectively

To prove: *L* AOB = 90º

Since AO and BO are the bisectors of A and B respectively

Thus, *L* OAB = $\frac{L\,A}{2}$ and *L* OBA = $\frac{L\,B}{2}$

In ΔAOB, by angle sum property of triangle

$LOAB + L\ ABO + L\ AOB = 180$

$=> \frac{L\ A}{2} + \frac{L\ B}{2} + L\ ABO = 180$

$=> LABO = 180 - \frac{1}{2}(L\ A + LB)$ ⟶ 1

But L A and LB are adjacent angles

Thus, L A + LB = 180 ⟶ 2

Substitute 2 in 1, we get

$L\ ABO = 180 - \frac{1}{2}(L\ A + LB)$

$=> L\ ABO = 90^o$

Example 7 – The ratio of two sides of a parallelogram is 4:3. If its perimeter is 56 cm, find the lengths of its sides.

Solution **-** Let the two sides of parallelogram be 4x and 3x respectively

Given that perimeter of parallelogram = 56 cm

2(4x+3x) = 56

=> 2(7x) = 56

=> 14x = 56

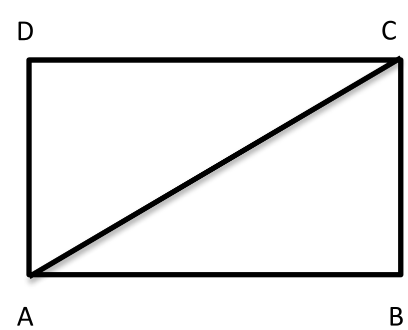
=> x = 4

Thus, one side = 4(4) = 16 cm and other side = 5(4) = 20cm

Example 8 – The lengths of a rectangle is 8 cm and each of its diagonals measures 10 cm. Find its breadth.

Solution **-** Given that length of rectangle = 8 cm

Each of its diagonal = 10 cm



Breadth =?

AB = 8cm

AC = 10 cm

And, we know that each angle of rectangle is 90º

Thus, in ΔABC, by Pythagoras theorem

$AC^2 = AB^2 + BC^2$

=> $10^2 = 8^2 + BC^2$

=> 100 = 64 + BC^2

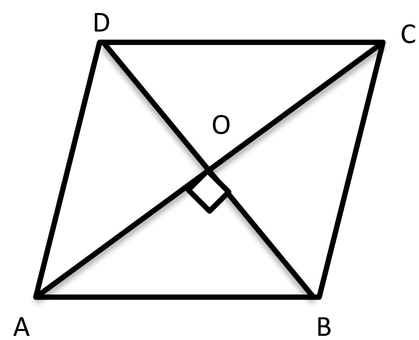
=> 100 – 64 = BC^2

=> $BC^2 = 36$

=> BC = 6 cm

Hence, breadth = 6 cm

Example 9 – In the adjacent figure, ABCD is a rhombus whose diagonals AC and BD intersect at a point O. If side AB = 10 cm and Diagonal BD = 16 cm, find the length of diagonal AC.



Solution - It is given that ABCD is a rhombus whose diagonals AC and BD intersect at a point O.

AB = 10 cm, BD = 16 cm

To find: AC

We know that diagonals of rhombus bisect each other at 90º

BD = 16 cm

So, OB = BD/2 = 16/2 = 8 cm

Now, in ΔOAB, by Pythagoras theorem

$AB^2 = AO^2 + BO^2$

=> $10^2 = AO^2 + 8^2$

=> 100 = 64 + AO^2

=> 100 – 64 = AO^2

=> $AO^2 = 36$

=> AO = 6 cm

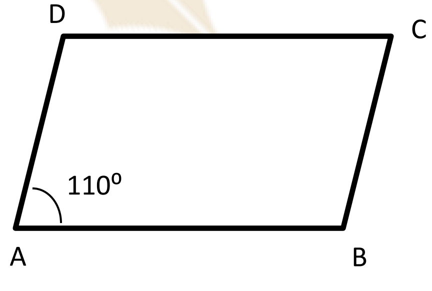
Thus, AC = 2 (AO) = 2 (6) = 12 cm

Exercise 16A

Question 1 – ABCD is a parallelogram in which *L*A = 110º. Find the measure of each of the angles *L*B, *L*C and *L*D

Solution **-** It is given that ABCD is a parallelogram and *L* A = 110º

To find: *L* B, *L* C, *and L* D



Since, we know that sum of any two adjacent angles of a parallelogram is 180º

Thus, *L*A + *L*B = 180º

=> 110 + *L*B = 180º

=> *L*B = 180 – 110 = 70

Also, ∠B + ∠C = 180°

=> 70 + ∠C = 180°

=> ∠C = 180 - 70 = 110°

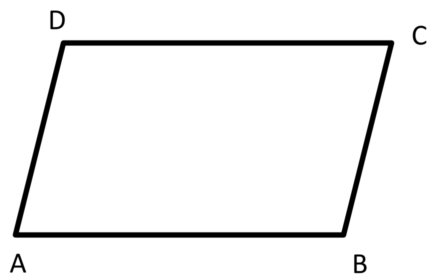
∠C + ∠D = 180°

=> 110 + ∠D = 180°

=> ∠D = 180 – 110 = 70°

Question 2 – Two adjacent angles of a parallelogram are equal. What is the measure of each of these angles?

Solution -



Let ABCD be a parallelogram.

Let two equal adjacent angles of parallelogram be x° each

Suppose ∠A =x and ∠B = x

We know that the sum of any two adjacent angles of a parallelogram is 180°

=> ∠A + ∠B = 180°

=> x + x = 180

=> 2x = 180

=> x = 90°

So, ∠A = 90°

∠B = 90°

Also, ∠B + ∠C = 180°

=> 90 + ∠C = 180°

=> *L*C = 180 - 90 = 90º

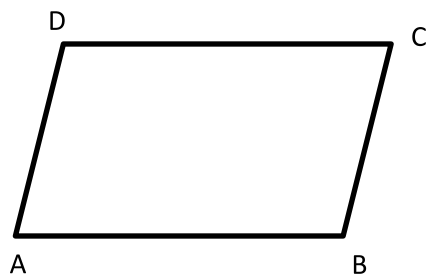
*L*C + *L*D = 180º

=> 90 + *L*D = 180º

=> *L*D = 180 – 90 = 90º

Question 3 – Two adjacent angles of a parallelogram are in the ratio 4:5. Find the measure of each of its angles.

Solution -



Let ABCD be a parallelogram.

Let two adjacent angles of parallelogram be 4x and 5x

Suppose *L*A =4x and *L*B = 5x

We know that the sum of any two adjacent angles of a parallelogram is 180º

=> *L*A + *L*B = 180º

=> 4x + 5x = 180

=> 9x = 180

=> x = 20º

So, *L*A =4(20) = 80º

*L*B = 5(20) = 100º

Also, *L*B + *L*C = 180º

=> 100 + *L*C = 180º

=> *L*C = 180 - 100 = 80º

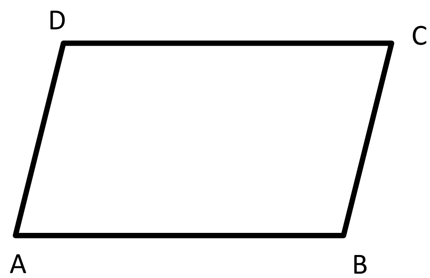
*L*C + *L*D = 180º

=> 80 + *L*D = 180^o

=> *L*D = 180 – 80 = 100^o

Question 4 – Two adjacent angles of a parallelogram are (3x – 4)^o and (3x + 16)^o. Find the value of x and hence find the measure of each of its angles.

Solution -



Let ABCD be a parallelogram.

Given two adjacent angles of parallelogram be (3x-4)^o and (3x+16)^o

Suppose *L*A = (3x-4)^o and *L*B = (3x+16)^o

We know that the sum of any two adjacent angles of a parallelogram is 180^o

=> *L*A + *L*B = 180^o

=> 3x-4 + 3 x +16 = 180

=> 6x +12= 180

=> 6x = 180^o-12

=> 6x = 168

=> x = 28

So, *L*A =3(28)-4 = 80^o

*L*B = 3(28) +16 = 100^o

Also, *L*B + *L*C = 180^o

=> 100 + *L*C = 180^o

=> *L*C = 180 - 100 = 80^o

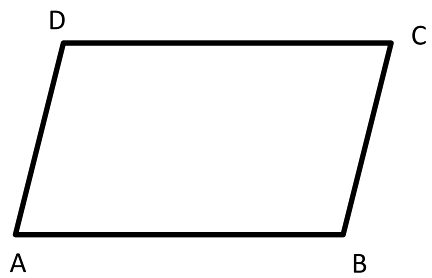
*L*C + *L*D = 180^o

=> 80 + *L*D = 180º

=> *L*D = 180 – 80 = 100º

Question 5 – The sum of two opposite angles of a parallelogram is 130º. Find the measure of each of its angles.

Solution -



Let ABCD be a parallelogram.

Given that sum of two opposite angles of a parallelogram is 130º

Suppose *L*A + *L*C = 130º

And, we know that opposite angles of parallelogram are equal

=> *L*A = *L*C

So, *L*A + *L*A = 130º

=> 2 *L*A = 130º

=> *L*A = 65º

Then, *L*C = 65º

Now, *L*A + *L*B = 180º (sum of adjacent angles is 180)

=> 65 + *L*B = 180º

=> *L*B = 180º-65 = 115º

Also, LA + *L*D = 180º (sum of adjacent angles is 180)

=> 65 + *L*D = 180º

=> *L*D = 180º-65 = 115º

Question 6 – Two sides of a parallelogram are in the ration 5:3. If its perimeter is 64 cm, find the lengths of its sides.

Solution - Let the two sides of parallelogram be 5x and 3x respectively

Given that perimeter of parallelogram = 64 cm

2(5x+3x) = 64

=> 2(8x) = 64

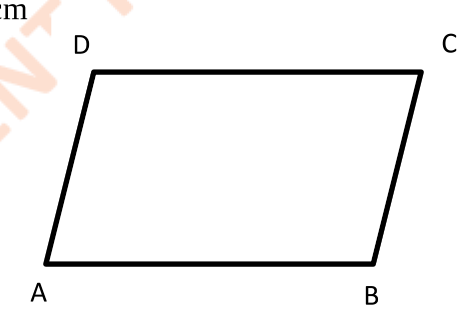
=> 16x = 64

=> x = 4

Thus, one side = 5(4) = 20 cm and other side = 3(4) = 12cm

Question 7 – The perimeter of a parallelogram is 140 cm. If one of the sides is longer than the other by 10 cm, find the length of each of its sides.

Solution - It is given that perimeter of a parallelogram is 140 cm



Let one side of parallelogram be x cm

Then, other side = (x +10) cm

Suppose BC = x cm and AB = (x + 10) cm

Now, perimeter of a parallelogram = 140 cm

=> 2(x+x+10) = 140

=> 2(2x+10) = 140

=> (4x+20) = 140

=> 4x = 140-20 = 120

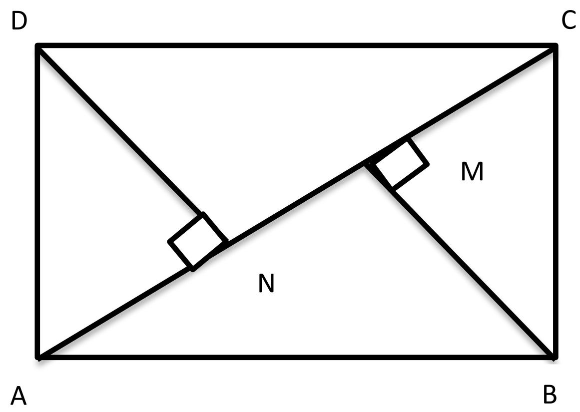
=> x = 30

Thus, BC = 30 cm = AD (opposite sides of parallelogram are equal)

AB = 30+10 = 40 cm

AB = CD = 40 cm (opposite sides of parallelogram are equal)

Question 8 – In the adjacent figure, ABCD is a rectangle. If BM and DN are perpendiculars from B and D on AC, prove that ΔBMC ≅ ΔDNA. Is it true that BM = DN?



Solution - Given: ABCD is a rectangle. BM and DN are perpendiculars from B and D on AC.

To Prove: ΔBMC ≅ ΔDNA

Proof: In ΔBMC and ΔDNA

*L*BCM = *L*DAN (Since AD//BC and AC is transversal so they are alternate interior angles)

*L*DNA = *L*BMC = 90º (Given)

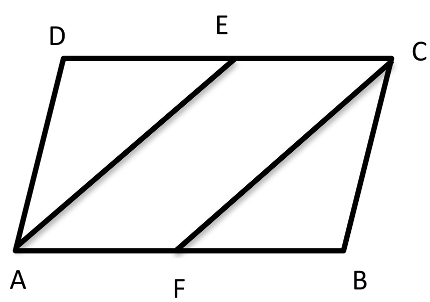
AD = BC (opposite sides of rectangle are equal)

Thus, by AAS congruency, ΔBMC ≅ ΔDNA

So BM = DN (by CPCT)

ΔBMC ≅ ΔDNA

Question 9 – In the adjacent figure, ABCD is a parallelogram and line segments AE and CF bisect the angles A and C respectively. Show that AE//CF.



Solution - Given that ABCD is a parallelogram and AE & CF bisect the angles A and C

To prove: AE//CF

Proof: Since *L*A = *L*C

=> *L*A/2 = *L*C/2 (As AE and CF bisect angles A and C)

=> *L*DAE = *L*BCF

Now, In ΔADE and ΔBCF

AD = BC (opposite sides of parallelogram are equal)

*L*B = *L*D (opposite angles of parallelogram are equal)

*L*DAE = *L*BCF (proved above)

Thus, by ASA congruency, ΔADE ≅ ΔBCF

So, DE = BF (Cpct)

Also, CD = AB (opposite sides of parallelogram are equal)

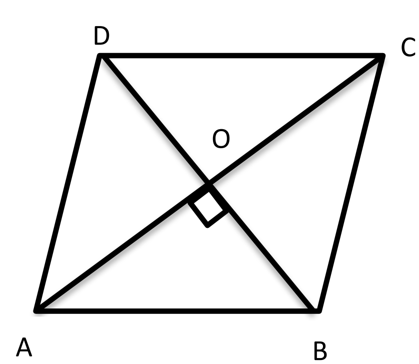
=> CD – DE = AB – BF

=> CE = AF

Thus, AECF is a parallelogram.

Hence, AE//CF

Question 10 – The lengths of the diagonals of a rhombus are 16 cm and 12 cm respectively. Find the length of each of its sides.



Solution - It is given that AC = 16 cm and BD = 12 cm

To find: each side of rhombus.

We know that each side of rhombus is equal.

Also, we know that diagonals of rhombus bisect each other at 90º

So, OA = OC = 16/2 = 8 cm

OB = OD = 12/2 = 6 cm

In triangle AOB, by Pythagoras theorem

$AB^2 = AO^2 + BO^2$

=> $AB^2 = 8^2 + 6^2$

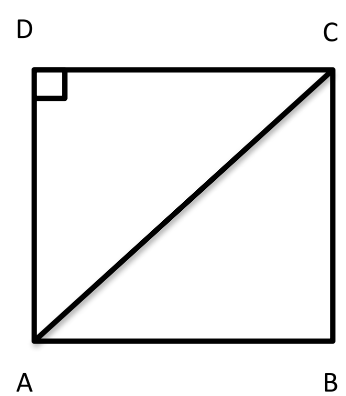
=> AB^2 = 64 + 36

=> AB^2= 100

=> $AB = 10$ cm

Thus, length of each side of rhombus = 10 cm

Question 11 – In the given figure ABCD is a square. Find the measure of ∠CAD



Solution - It is given that ABCD is a square

To find: ∠CAD

Since, all sides of square are equal

So, in triangle ACD, we have

AD = CD

=> $\angle CAD = \angle DAC$

Let $\angle CAD = \angle DAC = x^{o}$

$\angle CAD + \angle DAC + \angle ADC = 180^{o}$ (*Angle* sum property of triangle)

=> $x + x + 90 = 180^{o}$

=> $2x + 90 = 180^{o}$

=> $2x = 90$ => $x = 45$

So, $\angle CAD = 45^{o}$

Question 12 – The sides of a rectangle are in the ratio 5:4 and its perimeter is 90 cm. Find its length and breadth.

Solution - Let the sides of rectangle be 5x and 4x respectively

Suppose length = 5x and breadth = 4x

Perimeter of rectangle = 90 cm

=> 2(length + breadth) = 90 cm

=> 2(5x + 4x) = 90

=> 2(9x) = 90

=> 18x = 90

=> x = 5 cm

Thus, length = 5(5) = 25 cm

Breadth = 4(5) = 20 cm

Question 13 – Name each of the following parallelograms.

(a) The diagonals are equal and the adjacent sides are unequal.

Solution - Rectangle is the parallelogram in which diagonals are equal and the adjacent sides are unequal.

(b) The diagonals are equal and the adjacent sides are equal.

Solution - Square is the parallelogram in which diagonals are equal and the adjacent sides are equal.

(c) The diagonals are unequal and the adjacent sides are equal.

Solution - Rhombus is the parallelogram in which diagonals are unequal and the adjacent sides are equal.

(d) All the sides are equal and one angle is 60^o.

Solution - Rhombus is the parallelogram in which all the sides are equal and one angle is 60^o

(e) All the sides are equal and one angle is 90^o.

Solution - Square is the parallelogram in which all the sides are equal and one angle is 90^o

(f) All the angles are equal and the adjacent sides are unequal.

Solution - Rectangle is the parallelogram in which all angles are equal and the adjacent sides are unequal.

Question 14 – Which of the following statements are true and which are false?

(a) The diagonals of a parallelogram are equal.

Solution - False

The diagonals of parallelogram bisect each other but are not equal in length

(b) The diagonals of a rectangle are perpendicular to each other.

Solution - False

The diagonals of rectangle are equal and bisect each other but are not perpendicular to each other.

(c) The diagonals of a rhombus are equal.

Solution - False

The sides of rhombus are equal but the diagonals are not equal.

(d) Every rhombus is a kite.

Solution - True

(e) Every rectangle is a square.

Solution - False

Every square is rectangle but every rectangle may not be square.

(f) Every square is a parallelogram.

Solution - True

(g) Every square is a rhombus

Solution -True

(h) Every rectangle is a parallelogram.

Solution - True

(i) Every parallelogram is a rectangle.

Solution - False

A rectangle is a special type of parallelogram but every parallelogram is not a rectangle.

(j) Every rhombus is a parallelogram.

Solution - True

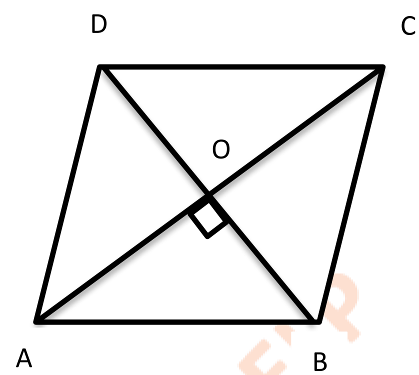
Exercise 16B

Question 1 – The two diagonals are not necessarily equal in a?

Solution - The two diagonals are not necessarily equal in a rhombus

Question 2 – The lengths of the diagonals of a rhombus are 16 cm and 12 cm. The length of each side of the rhombus is?

Solution -



It is given that AC = 16 cm and BD = 12 cm

To find: each side of rhombus.

We know that each side of rhombus is equal.

Also, we know that diagonals of rhombus bisect each other at 90º

So, OA = OC = 16/2 = 8 cm

OB = OD = 12/2 = 6 cm

In triangle AOB, by Pythagoras theorem

$AB^2 = AO^2 + BO^2$

=> $AB^2 = 8^2 + 6^2$

=> AB^2 = 64 + 36

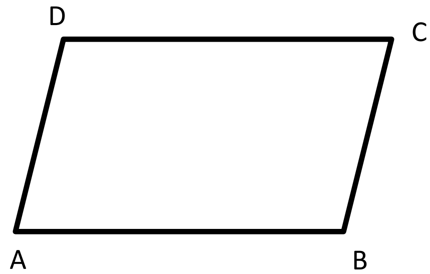
=> AB^2= 100

=> $AB = 10$ cm

Thus, length of each side of rhombus = 10 cm

Question 3 – Two adjacent angles of a parallelogram are $(2x + 25)^o$ and $(3x – 5)^o$. The value of x is?

Solution -



Let ABCD be a parallelogram.

Given two adjacent angles of parallelogram be $(2x+25)^o$ and $(3x-5)^o$

Suppose $LA = (2x+25)^o$ and $LB = (3x-5)^o$

We know that the sum of any two adjacent angles of a parallelogram is 180^o

=> $LA + LB = 180^o$

=> 2x+25+3x-5 = 180

=> 5x +20= 180

=> $5x = 180^o-20$

=> 5x = 160

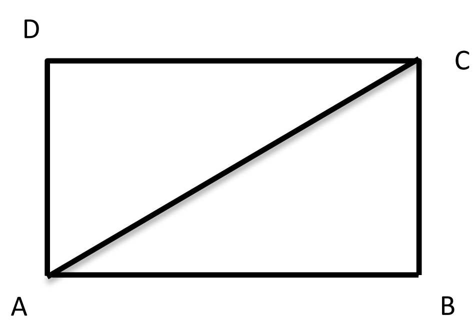
=> $x = 32^o$

Question 4 – The diagonals do not necessarily intersect at right angles in a?

Solution - Parallelogram

Question 5 – The length and breadth of a rectangle are in the ratio 4:3. If the diagonal measures 25 cm then the perimeter of the rectangle is?

Solution -



Let the length of rectangle be 4x and breadth of rectangle be 3x

Diagonal AC = 25

To find: perimeter of rectangle

In triangle ABC, $\angle B = 90^\circ$

Thus, by Pythagoras theorem,

$AC^2 = AB^2 + BC^2$

=> $25^2 = (4x)^2 + (3x)^2$

=> $625 = 16x^2 + 9x^2$

=> $625 = 25x^2$

=> $x^2 = 25$

=> x = 5 cm

Length = 4(5) = 20cm

Breadth = 3(5) = 15cm

Perimeter = 2 (l + b)

= 2 (20+15) = 2(35) = 70 cm

Question 6 – The bisectors of any two adjacent angles of a parallelogram intersect at?

Solution - The bisector of any two adjacent angles of a parallelogram intersect at 90°

Question 7 – If an angle of a parallelogram is two-thirds of its adjacent angle, the smallest angle of the parallelogram is?

Solution **-** Let one angle of parallelogram be x°

Then, angle adjacent to it = $(2x/3)^\circ$

Now, sum of adjacent angles of parallelogram = 180°

=> x + (2x/3) = 180

=> 5x/3 = 180

=> 5x = 540

=> $x = 108^o$

Thus, smallest angle is $(2x/3) = (2(108)/3) = 72^o$

Question 8 – The diagonals do not necessarily bisect the interior angles at the vertices in a?

Solution - Rectangle

Question 9 – In a square ABCD, AB = (2x + 3) cm and BC = (3x – 5) cm. Then, the value of x is?

Solution - It is given that in a square, AB = 2x+3 and BC = 3x-5

We know that all sides of square is equal

Thus, AB = BC

=> 2x+3 = 3x-5

=> 8 = x

Question 10 – If one angle of a parallelogram is 24^o less than twice the smallest angle then the largest angle of the parallelogram is?

Solution - Let smallest angle of parallelogram be x^o

Then, other angle = $(2x-24)^o$

Now, sum of adjacent angles of parallelogram = 180^o

=> x + (2x-24) = 180

=> 3x-24 = 180

=> 3x = 180+24

=> $3x = 204^o$

=> $x = 68^o$

Thus, largest angle is $2(68)-24 = 112^o$