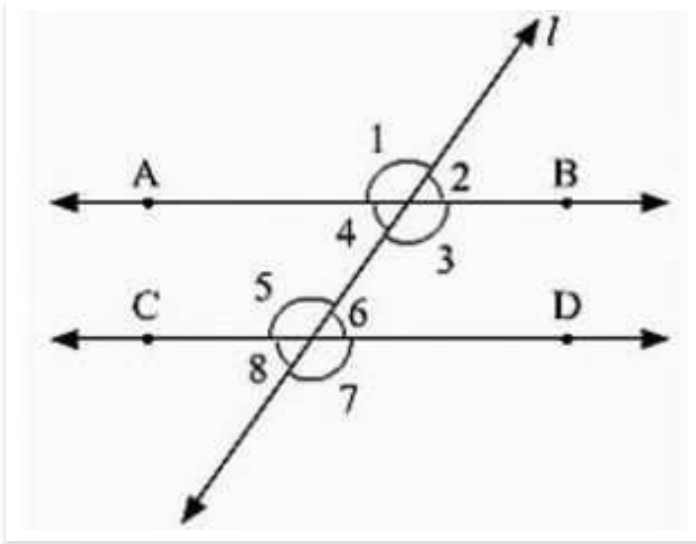


Q 1: In below fig. AB CD and  $\angle 1$  and  $\angle 2$  are in the ratio 3 : 2. Determine all angles from 1 to 8.



Ans : Let  $\angle 1 = 3x$  and  $\angle 2 = 2x$

$\angle 1$  and  $\angle 2$  are linear pair of angle

Now,  $\angle 1$  and  $\angle 2$

$$\Rightarrow 3x + 2x = 180$$

$$\Rightarrow 5x = 180$$

$$\Rightarrow x = 180 / 5$$

$$\Rightarrow x = 36$$

$$\angle 1 = 3x = 108^\circ, \angle 2 = 2x = 72^\circ$$

We know, Vertically opposite angles are equal

$$\angle 1 = \angle 3 = 108^\circ$$

$$\angle 2 = \angle 4 = 72^\circ$$

$$\angle 6 = \angle 7 = 108^\circ$$

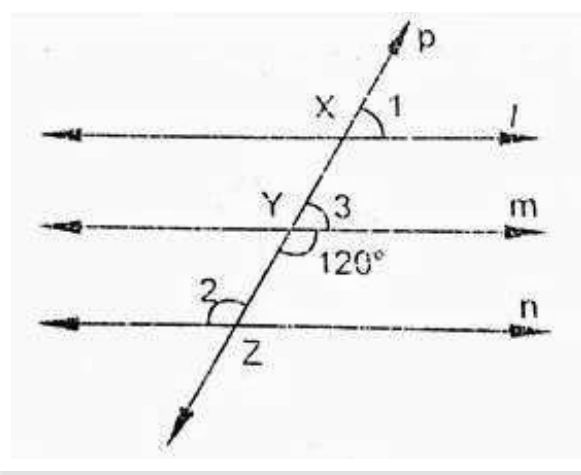
$$\angle 5 = \angle 8 = 72^\circ$$

We also know, corresponding angles are equal

$$\angle 1 = \angle 5 = 108^\circ$$

$$\angle 2 = \angle 6 = 72^\circ$$

Q 2: In the below fig, l, m and n are parallel lines intersected by transversal p at X, Y and Z respectively. Find  $\angle 1$ ,  $\angle 2$  and  $\angle 3$



Ans : From the given figure :

$$\angle 3 + \angle mYZ = 180^\circ \quad [\text{Linear pair}]$$

$$\Rightarrow \angle 3 = 180 - 120$$

$$\Rightarrow \angle 3 = 60^\circ$$

Now line l parallel to m

$$\angle 1 = \angle 3 \quad [\text{Corresponding angles}]$$

$$\angle 1 = 60^\circ$$

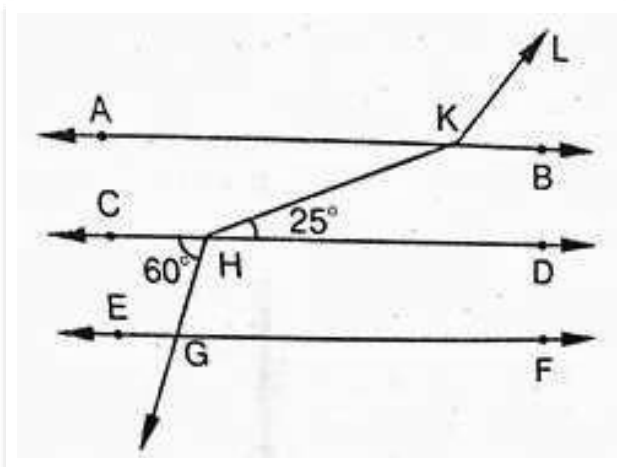
Also m parallel to n

$$\Rightarrow \angle 2 = 120^\circ \quad [\text{Alternative interior angle}]$$

$$\text{Hence, } \angle 1 = \angle 3 = 60^\circ$$

$$\angle 2 = 120^\circ$$

3. In the below fig,  $AB \parallel CD \parallel EF$  and  $GH \parallel KL$  Find  $\angle HKL$



Ans : Produce LK to meet GF at N.

Now, alternative angles are equal

$$\angle CHG = \angle HGN = 60^\circ$$

$$\angle HGN = \angle KNF = 60^\circ \quad [\text{Corresponding angles}]$$

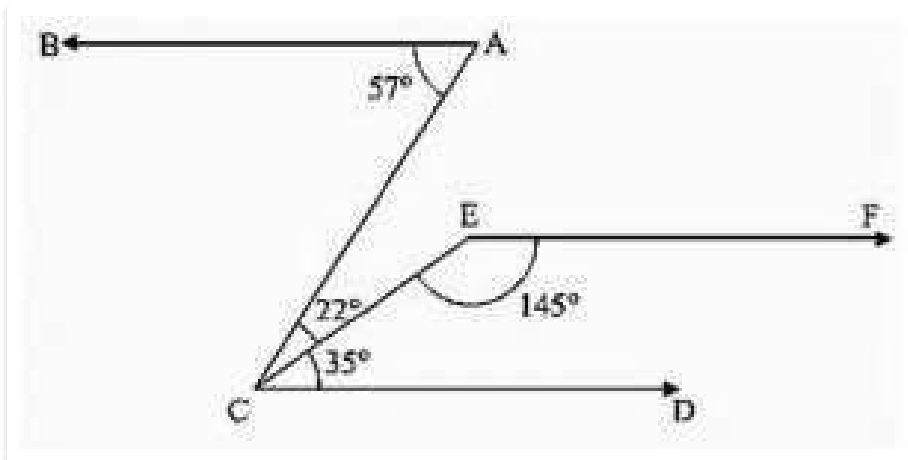
$$\text{Hence, } \angle KNG = 180 - 60 = 120$$

$\Rightarrow \angle GNK = \angle AKL = 120^\circ$  [Corresponding angles]

$\angle AKH = \angle KHD = 25^\circ$  [alternative angles]

Therefore,  $\angle HKL = \angle AKH + \angle AKL = 25 + 120 = 145^\circ$

Q 4 : In the below fig, show that  $AB \parallel EF$



Ans : Produce EF to intersect AC at K.

Now,  $\angle DCE + \angle CEF = 35 + 145 = 180^\circ$

Therefore,  $EF \parallel CD$  (Since Sum of Co-interior angles is 180) ---(1)

Now,  $\angle BAC = \angle ACD = 57^\circ$

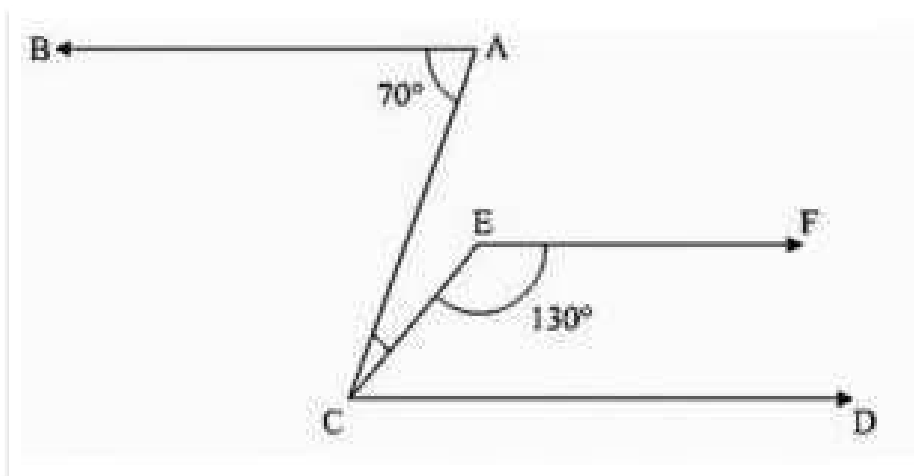
$\Rightarrow BA \parallel EF$  [Alternative angles are equal] ---(2)

From (1) and (2)

$AB \parallel EF$  [Since, Lines parallel to the same line are parallel to each other]

Hence proved.

Q 5 : If below fig. if  $AB \parallel CD$  and  $CD \parallel EF$ , find  $\angle ACE$ .



Ans : Since  $EF \parallel CD$

Therefore,  $\angle EFC + \angle ECD = 180$  [co-interior angles are supplementary]

$\Rightarrow \angle ECD = 180 - 130 = 50$

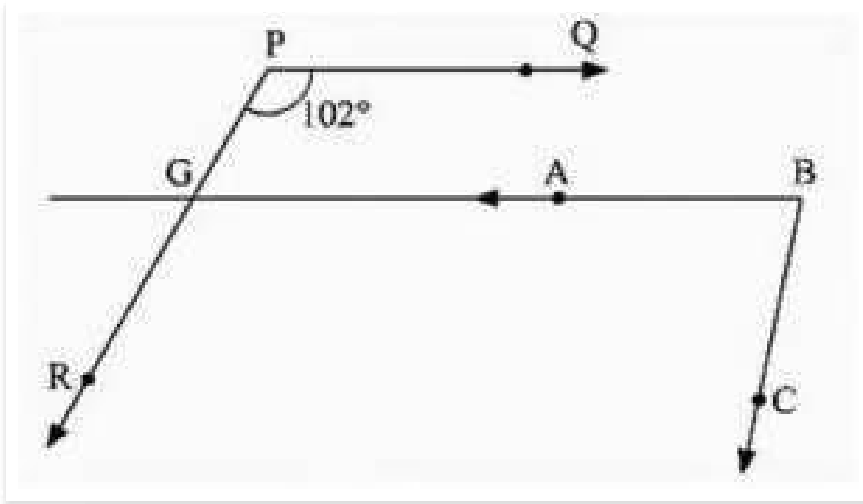
Also  $BA \parallel CD$

$$\Rightarrow \angle BAC = \angle ACD = 70 \quad [\text{alternative angles}]$$

$$\text{But, } \angle ACE + \angle ECD = 70$$

$$\Rightarrow \angle ACE = 70 - 50 = 20$$

Q 6 : In the below fig,  $PQ \parallel AB$  and  $PR \parallel BC$ . If  $\angle QPR = 102^\circ$ , determine  $\angle ABC$  Give reasons.



Ans : AB is produce to meet PR at K

Since  $PQ \parallel AB$

$$\angle QPR = \angle BKR = 102^\circ \quad [\text{corresponding angles}]$$

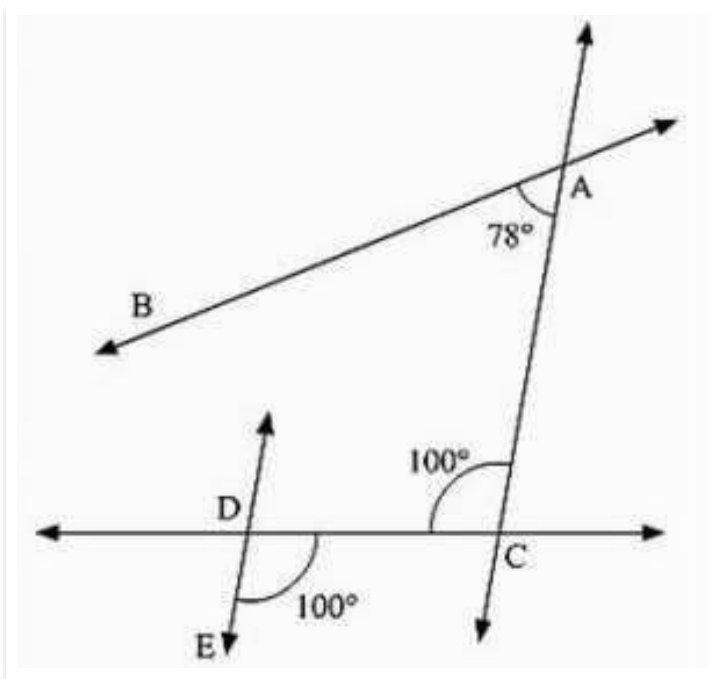
Since  $PR \parallel BC$

$$\angle RKB + \angle CBK = 180^\circ \quad [\text{Since Corresponding angles are supplementary}]$$

$$\angle CKB = 180 - 102 = 78$$

$$\therefore \angle CKB = 78^\circ$$

Q 7 : In the below fig, state Which lines are parallel and why?



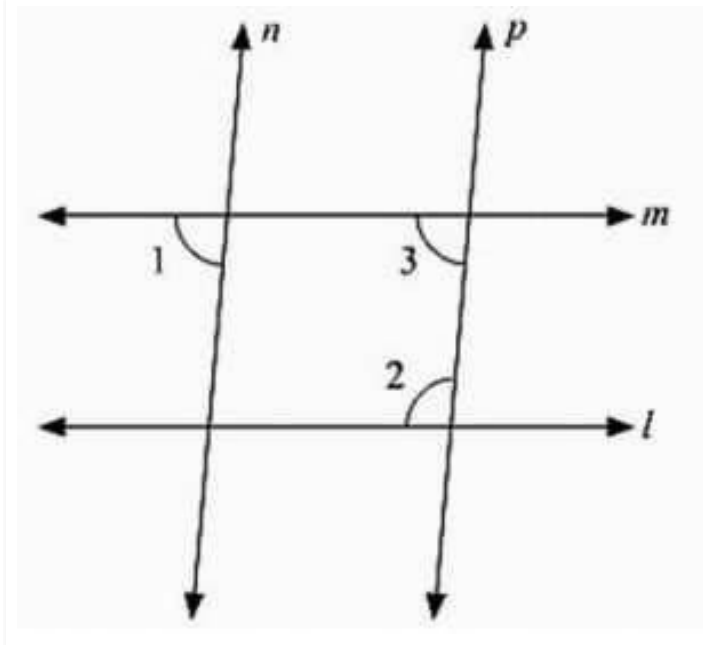
Ans : Vertically opposite angles are equal

$$\Rightarrow \angle EOC = \angle DOK = 100^\circ$$

$$\angle DOK = \angle ACO = 100^\circ$$

Here two lines EK and CA cut by a third line and the corresponding angles to it are equal Therefore,  $EK \parallel AC$ .

8. In the below fig. if  $l \parallel m$ ,  $n \parallel p$  and  $\angle 1 = 85^\circ$ . find  $\angle 2$ .



Ans : Corresponding angles are equal

$$\Rightarrow \angle 1 = \angle 3 = 85^\circ$$

By using the property of co-interior angles are supplementary

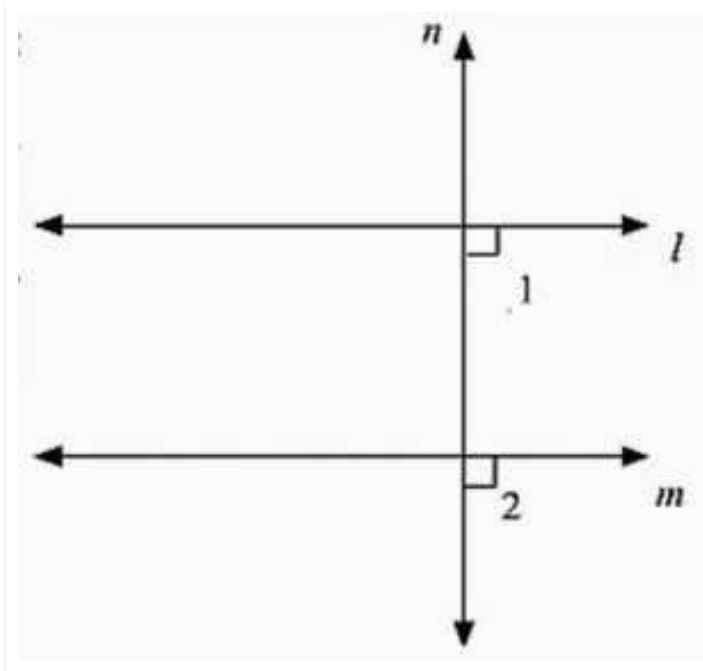
$$\angle 2 + \angle 3 = 180^\circ$$

$$\angle 2 + 85 = 180$$

$$\angle 2 = 180 - 85$$

$$\angle 2 = 95^\circ$$

Q 9 : If two straight lines are perpendicular to the same line, prove that they are parallel to each other.



Ans : Given  $m$  perpendicular to  $n$  and  $l$  perpendicular to  $n$

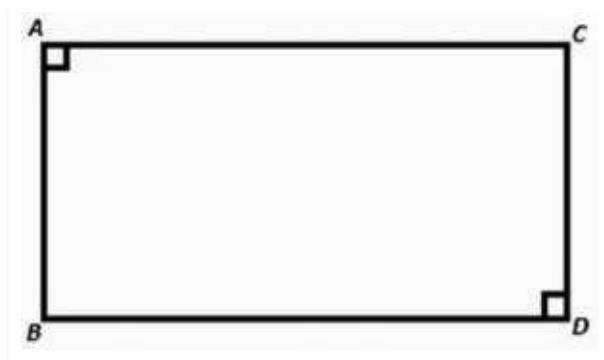
$$\angle 1 = \angle 2 = 90^\circ$$

Since,  $l$  and  $m$  are two lines and  $n$  is transversal and the corresponding angles are equal

$l \parallel m$

Hence proved

Q 10 : Prove that if the two arms of an angle are perpendicular to the two arms of another angle. then the angles are either equal or supplementary.



Ans : Consider the angles  $\angle AOB$  and  $\angle ACB$

Given  $OA$  perpendicular to  $OC$ , also  $OB$  perpendicular to  $OD$

To prove :  $\angle AOB + \angle ACB = 180^\circ$  (or)  $\angle AOB + \angle ACB = 180^\circ$

Proof : In a quadrilateral  $\angle A + \angle O + \angle B + \angle C = 360^\circ$

[ Sum of angles of quadrilateral is 360 ]

$$\Rightarrow 180 + O + B + C = 360$$

$$\Rightarrow O + C = 360 - 180$$

$$\text{Hence } \angle AOB + \angle ACB = 180 \quad \text{---(1)}$$

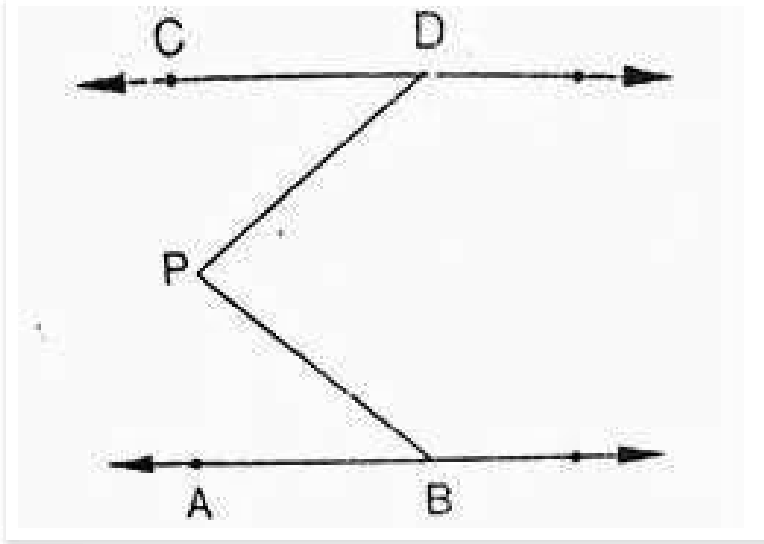
$$\text{Also, } \angle B + \angle ACB = 180$$

$$\Rightarrow \angle ACB = 180 - 90 = \angle ACES = 90^\circ \quad \text{---(2)}$$

From (i) and (ii),  $\angle ACB = \angle AOB = 90$

Hence, the angles are equal as well as supplementary.

Q 11 : In the below fig, lines AB and CD are parallel and P is any point as shown in the figure. Show that  $\angle ABP + \angle CDP = \angle DPB$ .



Ans :

Given that  $AB \parallel CD$

Let EF be the parallel line to AB and CD which passes through P

It can be seen from the figure

Alternative angles are equal

$$\angle ABP = \angle BPF$$

Alternative angles are equal

$$\angle CDP = \angle DPF$$

$$\angle ABP + \angle CDP = \angle BPF + \angle DPF$$

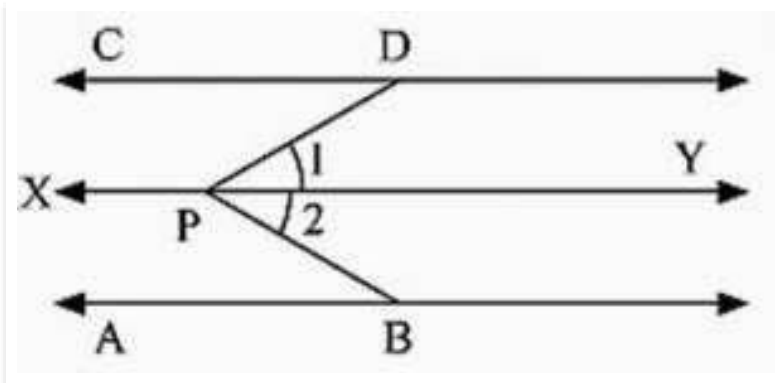
$$\angle ABP + \angle CDP = \angle DPB$$

Hence proved

AB parallel to CD, P is any point

To prove:  $\angle ABP + \angle BPD + \angle CDP = 360^\circ$

Construction : Draw  $EF \parallel AB$  passing through P



Proof : Since  $AB \parallel EF$  and  $AB \parallel CD$ , Therefore  $EF \parallel CD$  to each other)

[Lines parallel to the same line are parallel

$$\angle ABP + \angle EPB = 180^\circ \quad [\text{Sum of co-interior angles is } 180^\circ]$$

$$\angle EPD + \angle COP = 180^\circ \quad \text{---(1) } [\text{Sum of co-interior angles is } 180^\circ]$$

$$\angle EPD + \angle CDP = 180^\circ \quad \text{---(2)}$$

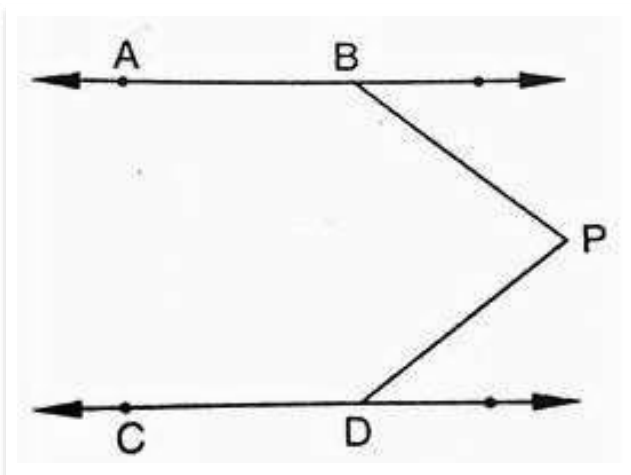
By adding (1) and (2)

$$\angle ABP + \angle EPB + \angle EPD + \angle CDP = (180 + 180)^\circ$$

$$\angle ABP + \angle EPB + \angle COP = 360^\circ$$

Q 12 : In the below fig,  $AB \parallel CD$  and P is any point shown in the figure. Prove that :

$$\angle ABP + \angle BPD + \angle CDP = 360^\circ$$



Ans : Through P, draw a line PM parallel to AB or CD.

Now,

$$AB \parallel PM \Rightarrow \angle ABP + \angle BPM = 180$$

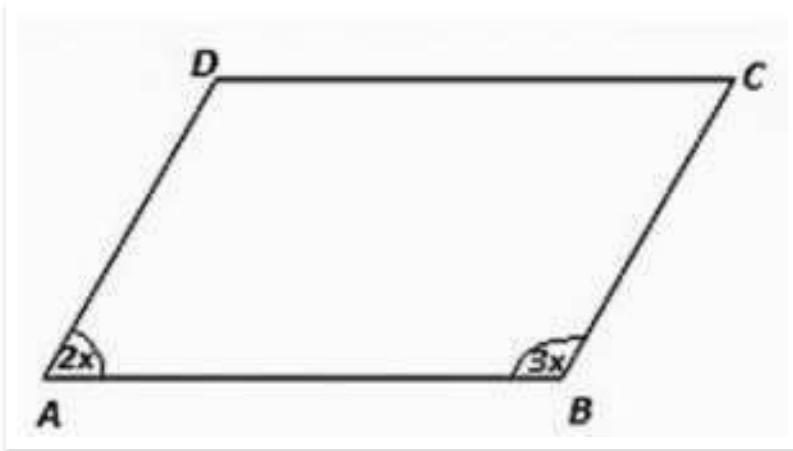
And

$$CD \parallel PM \Rightarrow \angle MPD + \angle CDP = 180$$

$$\text{Adding (i) and (ii), we get } \angle ABP + (\angle BPM + \angle MPD) + \angle CDP = 360$$

$$\Rightarrow \angle ABP + \angle BPD + \angle CDP = 360$$

Q 13 : Two unequal angles of a parallelogram are in the ratio 2 : 3. Find all its angles in degrees.



Ans : Let  $A = 2x$  and  $B = 3x$

Now,  $A + B = 180$  [Co-interior angles are supplementary]

$2x + 3x = 180$  [AD || BC and AB is the transversal]

$$\Rightarrow 5x = 180$$

$$x = 180/5$$

$$x = 36$$

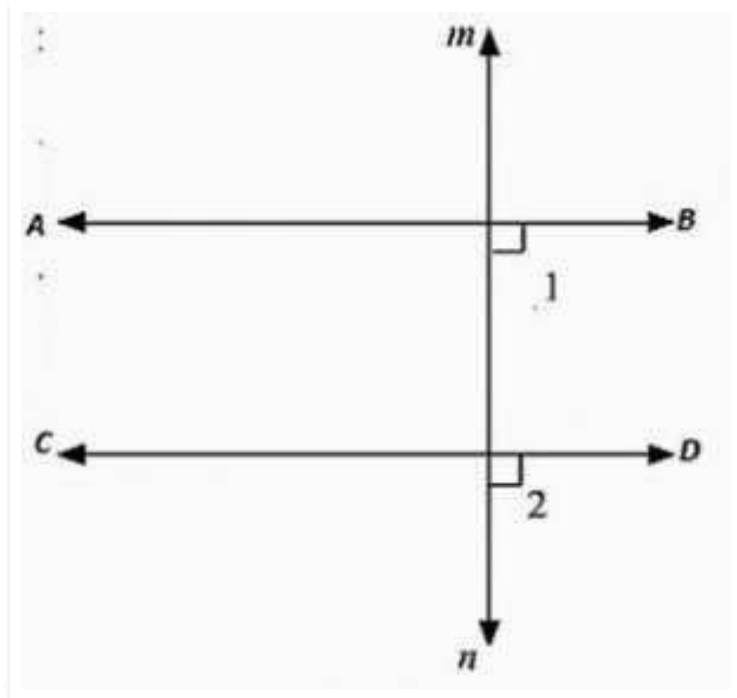
$$\text{Therefore, } A = 2 \times 36 = 72$$

$$B = 3 \times 36 = 108$$

Now,  $A = C = 72$  [Opposite side angles of a parallelogram are equal]

$$B = D = 108$$

Q 14 : If each of the two lines is perpendicular to the same line, what kind of lines are they to each other?



Ans :

Let AB and CD be perpendicular to MN

$\angle ABD = 90^\circ$  [AB perpendicular to MN]                      -- (i)

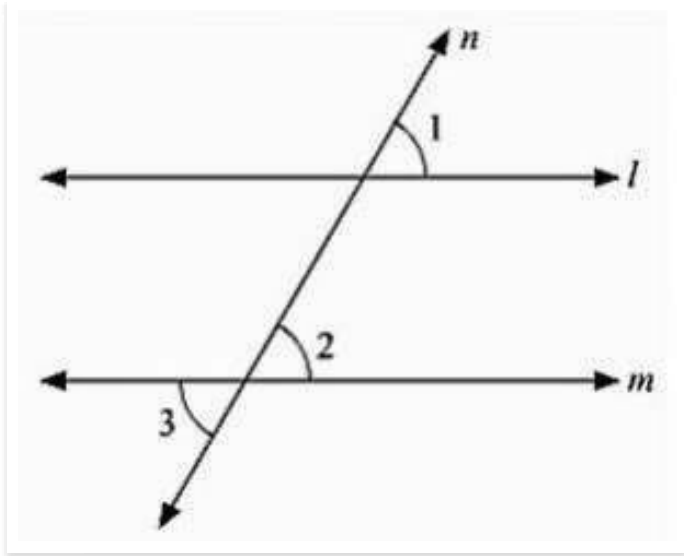
$\angle CON = 90^\circ$  [CO perpendicular to MN]                      -- (ii)

Now,  $\angle ABD = \angle CDN = 90^\circ$  (From (i) and (ii))

AB parallel to CD,

Since corresponding angles are equal

Q 15 : In the below fig,  $\angle 1 = 60^\circ$  and  $\angle 2 = (\frac{2}{3})^{\text{rd}}$  of a right angle. Prove that  $l \parallel m$ .



Ans :    Given :

$\angle 1 = 60^\circ$  and  $\angle 2 = (\frac{2}{3})^{\text{rd}}$  of a right angle

To prove :  $l \parallel m$     Drawn to m

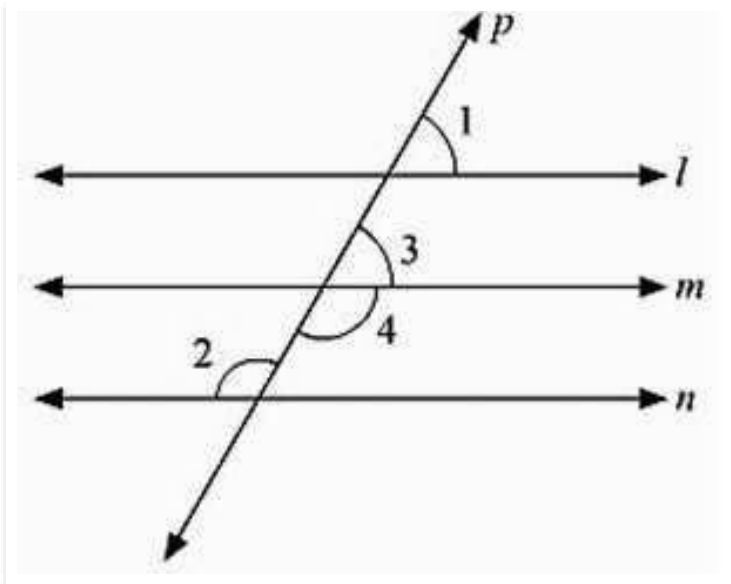
Proof  $\angle 1 = 60^\circ$

$\angle 2 = (\frac{2}{3}) \times 90 = 60^\circ$

Since  $\angle 1 = \angle 2 = 60^\circ$

Therefore,  $l \parallel m$  as pair of corresponding angles are equal.

16. In the below fig, if  $l \parallel m \parallel n$  and  $\angle 1 = 60^\circ$ . Find  $\angle 2$ .



Ans : Since  $l$  parallel to  $m$  and  $p$  is the transversal

Therefore, Given:  $l \parallel m \parallel n$

$$\angle 1 = 60^\circ$$

To find  $\angle 2$

$$\angle 1 = \angle 3 = 60^\circ \quad [\text{Corresponding angles}]$$

Now,  $\angle 3$  and  $\angle 4$  are linear pair of angles

$$\angle 3 + \angle 4 = 180^\circ$$

$$60 + \angle 4 = 180$$

$$\angle 4 = 180 - 60$$

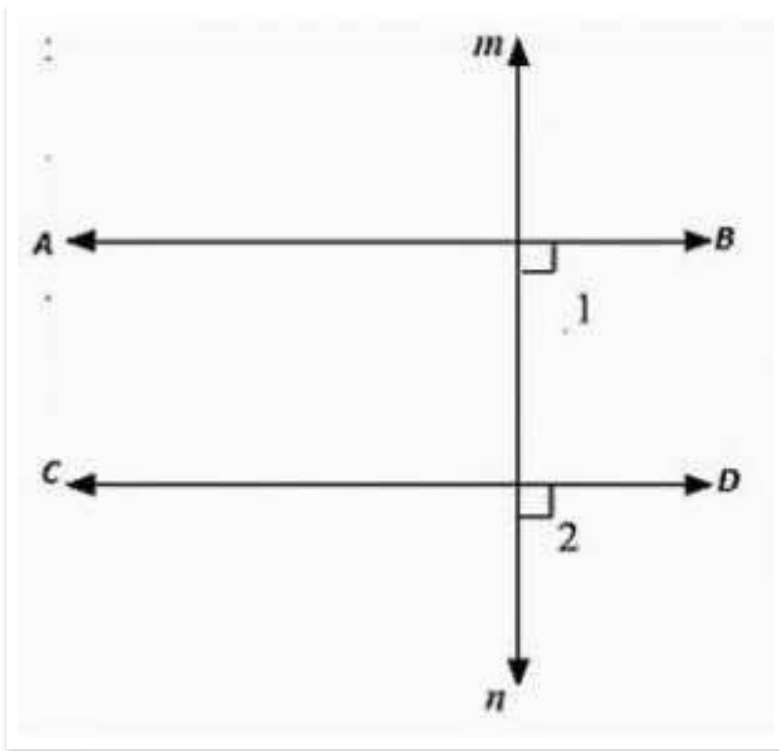
$$\Rightarrow 120$$

Also,  $m \parallel n$  and  $P$  is the transversal

Therefore  $\angle 4 = \angle 2 = 120$  (Alternative interior angle]

$$\text{Hence } 2 \angle 2 = 120$$

Q 17 : Prove that the straight lines perpendicular to the same straight line are parallel to one another.



Ans : Let AB and CD be drawn perpendicular to the Line MN

$\angle ABD = 90^\circ$  [ AB is perpendicular to MN ] --(i)

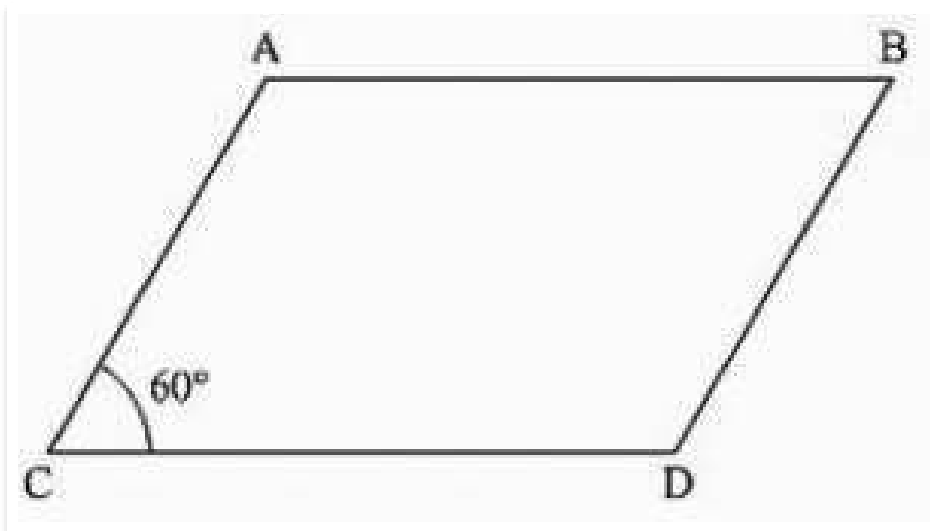
$\angle CON = 90^\circ$  [CD is perpendicular to MN ] --(ii)

Now,

$\angle ABD = \angle CDN = 90^\circ$  [From (i) and (ii)]

Therefore,  $AB \parallel CD$ , Since corresponding angles are equal.

Q 18 : The opposite sides of a quadrilateral are parallel. If one angle of the quadrilateral is  $60^\circ$ . Find the other angles.



Ans : Given  $AB \parallel CD$

$AD \parallel BC$

Since  $AB \parallel CD$  and AD is the transversal

Therefore,  $A + D = 180$  (Co-interior angles are supplementary)

$$60 + D = 180$$

$$D = 180 - 60$$

$$D = 120$$

Now,  $AD \parallel BC$  and  $AB$  is the transversal

$$A + B = 180 \quad (\text{Co-interior angles are supplementary})$$

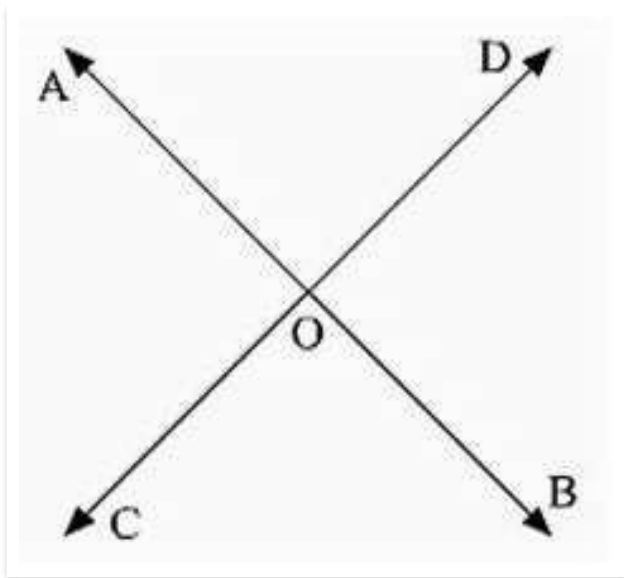
$$60 + B = 180$$

$$B = 180 - 60$$

$$= 120$$

Hence,  $\angle A = \angle C = 60^\circ$  and  $\angle B = \angle D = 120^\circ$

Q 19 : Two lines  $AB$  and  $CD$  intersect at  $O$ . If  $\angle AOC + \angle COB + \angle BOD = 270^\circ$ , find the measures of  $\angle AOC$ ,  $\angle COB$ ,  $\angle BOD$ ,  $\angle DOA$



Ans :

$$\text{Given : } \angle AOC + \angle COB + \angle BOD = 270^\circ$$

To find :  $\angle AOC$ ,  $\angle COB$ ,  $\angle BOD$ ,  $\angle DOA$

$$\text{Here, } \angle AOC + \angle COB + \angle BOD = 270^\circ \quad [\text{Complete angle}]$$

$$\Rightarrow 270 + AOD = 360$$

$$\Rightarrow AOD = 360 - 270$$

$$\Rightarrow AOD = 90$$

$$\text{Now, } AOD + BOD = 180 \quad [\text{Linear pair}]$$

$$90 + BOD = 180$$

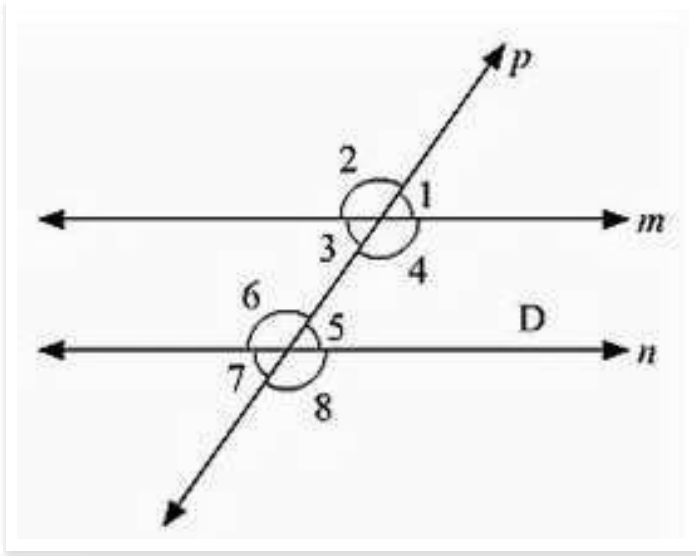
$$\Rightarrow BOD = 180 - 90$$

$$\Rightarrow BOD = 90$$

$\angle AOD = \angle BOC = 90^\circ$  [Vertically opposite angles]

$\angle BOD = \angle AOC = 90^\circ$  [Vertically opposite angles]

Q 20. In the below figure,  $p$  is a transversal to lines  $m$  and  $n$ ,  $\angle 2 = 120^\circ$  and  $\angle 5 = 60^\circ$ . Prove that  $m \parallel n$ .



Ans :

Given that

$$\angle 2 = 120^\circ \text{ and } \angle 5 = 60^\circ$$

To prove,

$$\angle 2 + \angle 1 = 180^\circ \quad [\text{Linear pair}]$$

$$120 + \angle 1 = 180$$

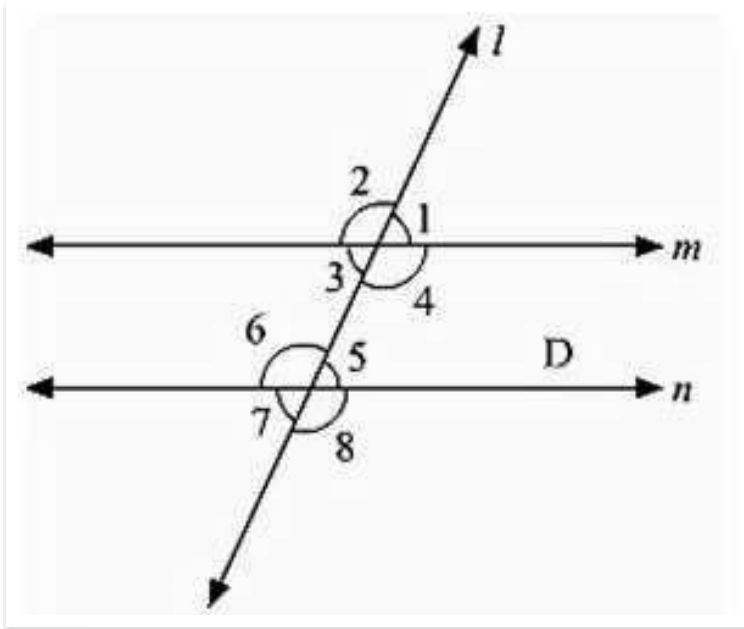
$$\angle 1 = 180 - 120$$

$$\angle 1 = 60^\circ$$

$$\text{Since } \angle 1 = \angle 5 = 60^\circ$$

Therefore,  $m \parallel n$  [As pair of corresponding angles are equal]

Q 21 : In the below fig. transversal  $t$  intersects two lines  $m$  and  $n$ ,  $\angle 4 = 110^\circ$  and  $\angle 7 = 65^\circ$ . Is  $m \parallel n$  ?



Ans : Given :

$$\angle 4 = 110^\circ \text{ and } \angle 7 = 65^\circ$$

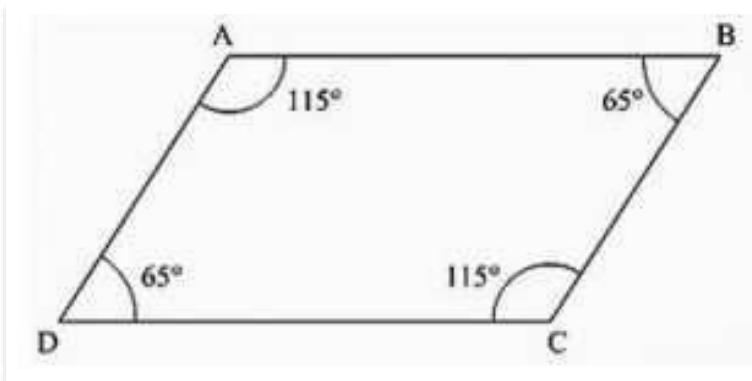
To find : Is  $m \parallel n$

Here,  $\angle 7 = \angle 5 = 65^\circ$  [Vertically opposite angle]

$$\text{Now, } \angle 4 + \angle 5 = 110 + 65 = 175^\circ$$

Therefore,  $m$  is not parallel to  $n$  as the pair of co interior angles is not supplementary.

Q 22 : Which pair of lines in the below fig. is parallel ? give reasons.



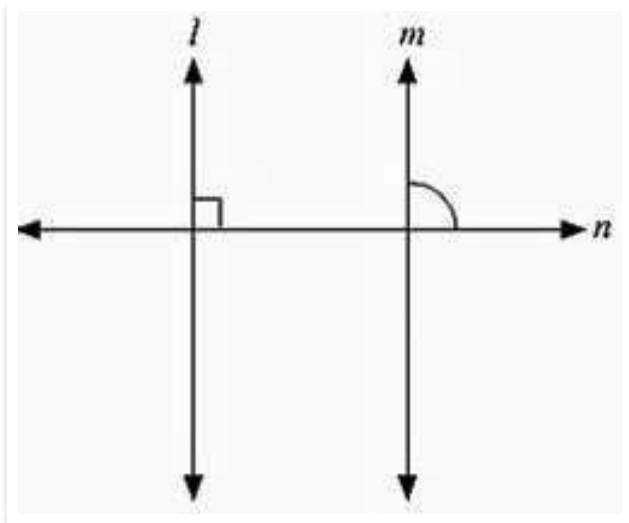
$$\text{Ans : } \angle A + \angle B = 115 + 65 = 180^\circ$$

Therefore,  $AB \parallel DC$  [ As sum of co interior angles are supplementary]

$$\angle B + \angle C = 65 + 115 = 180^\circ$$

Therefore,  $AB \parallel CD$  (As sum of interior angles are supplementary)

Q 23 : If  $l, m, n$  are three lines such that  $l \parallel m$  and  $n$  perpendicular to  $l$ , prove that  $n$  perpendicular to  $m$ .



Ans :

Given,  $l \parallel m$ ,  $n$  perpendicular to  $l$

To prove:  $n$  perpendicular to  $m$

Since  $l \parallel m$  and  $n$  intersects

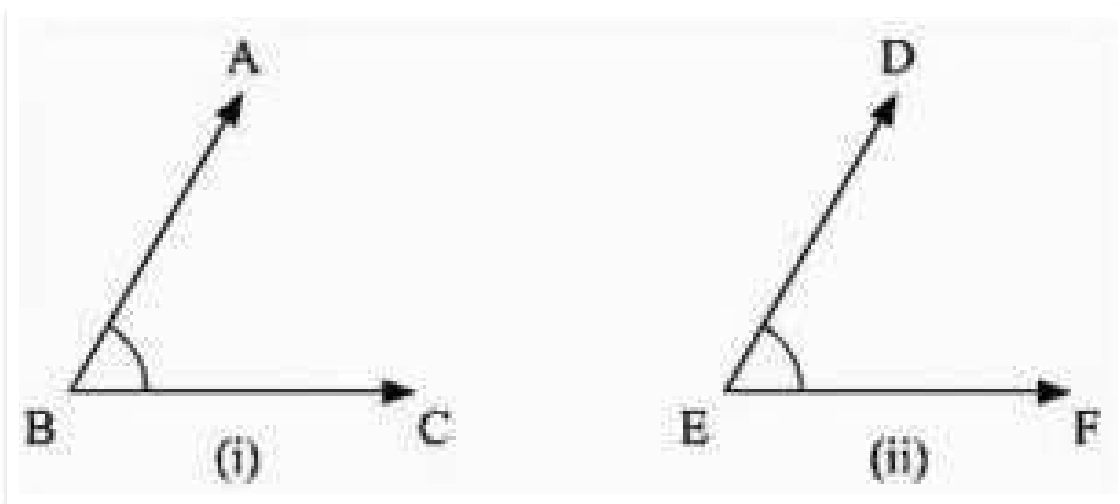
$\therefore \angle 1 = \angle 2$  [Corresponding angles]

But,  $\angle 1 = 90^\circ$

$\Rightarrow \angle 2 = 90^\circ$

Hence  $n$  is perpendicular to  $m$

Q 24 : In the below fig, arms  $BA$  and  $BC$  of  $\angle ABC$  are respectively parallel to arms  $ED$  and  $EF$  of  $\angle DEF$ . Prove that  $\angle ABC = \angle DEF$ .



Ans :

Given

$AB \parallel DE$  and  $BC \parallel EF$

To prove :  $\angle ABC = \angle DEF$

Construction: Produce  $BC$  to  $x$  such that it intersects  $DE$  at  $M$ .

Proof : Since  $AB \parallel DE$  and  $BX$  is the transversal

$$\angle ABC = \angle DMX \quad [\text{Corresponding angle}] \quad \text{---(i)}$$

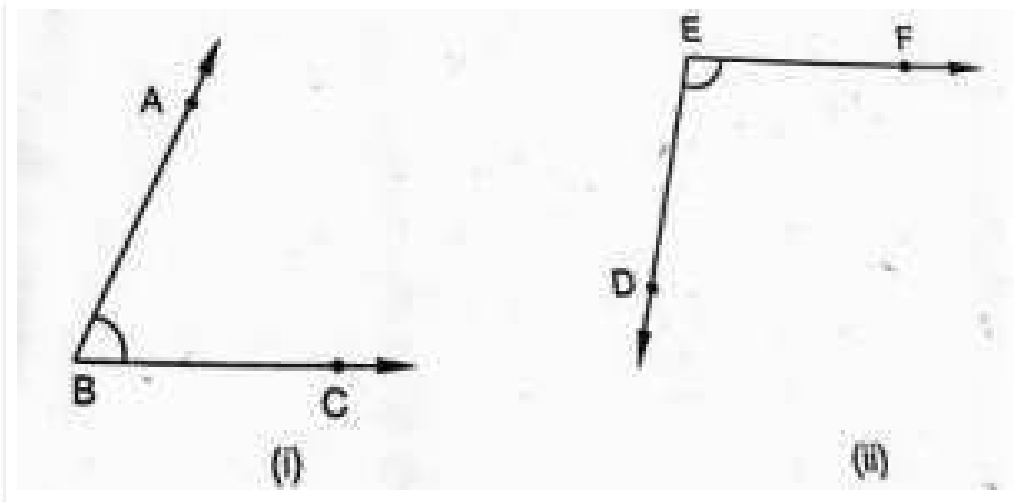
Also,  $BX \parallel EF$  and  $DE$  is the transversal

$$\angle DMX = \angle DEF \quad [\text{Corresponding angles}] \quad \text{---(ii)}$$

From (i) and (ii)

$$\angle ABC = \angle DEF$$

Q 25: In the below fig, arms  $BA$  and  $BC$  of  $\angle ABC$  are respectively parallel to arms  $ED$  and  $EF$  of  $\angle DEF$ . Prove that  $\angle ABC + \angle DEF = 180^\circ$



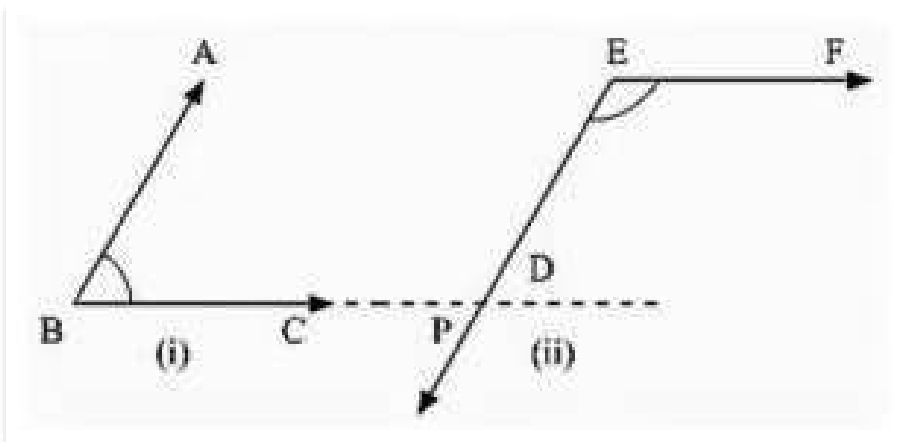
Ans :

Given:

$AB \parallel DE$ ,  $BC \parallel EF$

To prove:  $\angle ABC + \angle DEF = 180^\circ$

Construction: Produce  $BC$  to intersect  $DE$  at  $M$



Proof :

Since  $AB \parallel EM$  and  $BM$  is the transversal

$$\angle ABC = \angle EML \quad [\text{Corresponding angle}] \quad \text{---(i)}$$

Also,

EF || ML and EM is the transversal

By the property of co-interior angles are supplementary

$$\angle DEF + \angle EML = 180^\circ \quad (ii)$$

From (i) and (ii) we have

$$\text{Therefore } \angle DEF + \angle ABC = 180^\circ$$

Q 26 : With of the following statements are true (T) and which are false (F)? Give reasons.

- (1) If two lines are intersected by a transversal, then corresponding angles are equal.
- (ii) If two parallel lines are intersected by a transversal, then alternate interior angles are equal.
- (ii) Two lines perpendicular to the same line are perpendicular to each other.
- (iv) Two lines parallel to the same line are parallel to each other.
- (v) If two parallel lines are intersected by a transversal, then the interior angles on the same side of the transversal are equal.

Ans :

- (i) False
- (ii) True
- (iii) False
- (iv) True
- (v) False

Q 27: Fill in the blanks in each of the following to make the statement true:

- (i) If two parallel lines are intersected by a transversal, then each pair of corresponding angles are \_\_\_\_\_
- (ii) If two parallel lines are intersected by a transversal, then interior angles on the same side of the transversal are \_\_\_\_\_
- (iii) Two lines perpendicular to the same line are \_\_\_\_\_ to each other
- (iv) Two lines parallel to the same line are \_\_\_\_\_ to each other.
- (v) If a transversal intersects a pair of lines in such a way that a pair of alternate angles are equal. then the lines are \_\_\_\_\_
- (vi) If a transversal intersects a pair of lines in such a way that the sum of interior angles on the same side of transversal is  $180^\circ$ . then the lines are \_\_\_\_\_

Ans :

- (i) Equal
- (ii) Parallel
- (iii) Supplementary
- (iv) Parallel
- (v) Parallel
- (vi) Parallel