

# Lines and Angles

1. If a ray stands on a line, then the sum of adjacent angles formed is  $180^\circ$ .

**Ans.** Given: A ray RT standing on (PQ)  $\leftrightarrow$  such that  $\angle PRT$  and  $\angle QRT$  are formed.

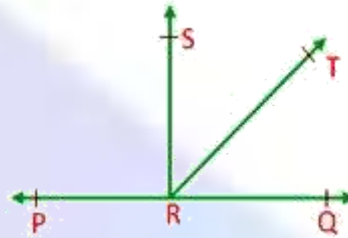
Construction: Draw RS  $\perp$  PQ.

Proof: Now  $\angle PRT = \angle PRS + \angle SRT$  ..... (1)

Also  $\angle QRT = \angle QRS - \angle SRT$  ..... (2)

Adding (1) and (2),

$$\begin{aligned}\angle PRT + \angle QRT &= \angle PRS + \angle SRT + \angle QRS - \angle SRT \\ &= \angle PRS + \angle QRS \\ &= 90^\circ + 90^\circ \\ &= 180^\circ\end{aligned}$$



2. The sum of all the angles around a point is equal to  $360^\circ$ .

**Ans.** Given: A point O and rays OP, OQ, OR, OS, OT which make angles around O.

Construction: Draw OX opposite to ray OP

Proof: Since, OQ stands on XP therefore

$$\angle POQ + \angle QOX = 180^\circ$$

$$\angle POQ + (\angle QOR + \angle ROX) = 180^\circ$$

$$\angle POQ + \angle QOR + \angle ROX = 180^\circ \text{ ..... (i)}$$

Again OS stands on XP, therefore

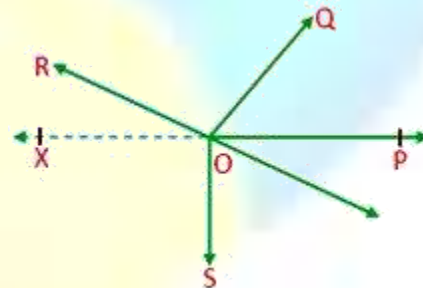
$$\angle XOS + \angle SOP = 180^\circ$$

$$\angle XOS + (\angle SOT + \angle TOP) = 180^\circ$$

$$\angle XOS + \angle SOT + \angle TOP = 180^\circ \text{ ..... (ii)}$$

Adding (i) and (ii),

$$\begin{aligned}\angle POQ + \angle QOR + \angle ROX + \angle XOS + \angle SOT + \angle TOP \\ &= 180^\circ + 180^\circ \\ &= 360^\circ\end{aligned}$$



3. If two lines intersect, then vertically opposite angles are equal.

Ans. Given: PQ and RS intersect at point O.

Proof: OR stands on PQ.

Therefore,  $\angle POR + \angle ROQ = 180^\circ$  ..... (i)

PO stands on RS

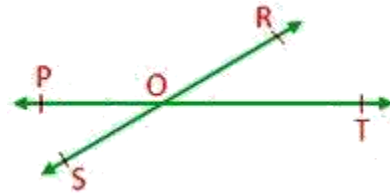
$\angle POR + \angle POS = 180^\circ$  ..... (ii)

From (i) and (ii),

$\angle POR + \angle ROQ = \angle POR + \angle POS$

$\angle ROQ + \angle POS$

Similarly,  $\angle POR = \angle QOS$  can be proved.



4. Find the complement of:

(a)  $68^\circ$

(b)  $27^\circ 20'$

(c)  $x + 52^\circ$

Ans.

(a)  $68^\circ$

Solution:

$90^\circ - 68^\circ$

$= 22^\circ$

Therefore, the complement of  $68^\circ$  is  $22^\circ$

(b)  $27^\circ 20'$

Solution:

$90^\circ - 27^\circ 20'$

$= 89^\circ 60' - 27^\circ 20'$

$= 62^\circ 40'$

Therefore, the complement of  $27^\circ 20'$  is  $62^\circ 40'$

(c)  $x + 52^\circ$

Solution:

$90^\circ - (x + 52^\circ)$

$= 90^\circ - x + 52^\circ$

$= 38^\circ - x$

Therefore, the complement of  $x + 52^\circ$  is  $38^\circ - x$

5. Find the complement of the angle  $(10 + y)^\circ$ .

**Ans.** Complement of the angle  $(10 + y)^\circ = 90^\circ - (10 + y)^\circ$   
 $= 90^\circ - 10^\circ - y^\circ$   
 $= (80 - y)^\circ$

6. Find the measure of an angle which is  $46^\circ$  less than its complement.

**Ans.** Let the unknown angle be  $x$ , then measure of its complement  $= 90 - x$

According to the question,

$$(90 - x) - x = 46^\circ$$

$$90 - x - x = 46^\circ$$

$$90 - 2x = 46^\circ$$

$$90 - 90 - 2x = 46^\circ - 90$$

$$-2x = 46^\circ - 90$$

$$-2x = 46^\circ - 90$$

$$-2x = -44^\circ$$

$$2x = 44^\circ$$

$$x = 44/2$$

$$x = 22^\circ$$

Therefore,  $90 - x$  (Put the value of  $x = 22^\circ$ )

$$= 90 - 22^\circ$$

$$= 68^\circ$$

Therefore, the pair of complementary angles are  $68^\circ$  and  $22^\circ$

7. Verify if  $115^\circ$ ,  $65^\circ$  are a pair of supplementary angles.

**Ans.**  $115^\circ + 65^\circ = 180^\circ$

Hence, they are a pair of supplementary angles.

8. Find the supplement of the angle  $(20 + y)^\circ$ .

**Ans.** Supplement of the angle  $(20 + y)^\circ = 180^\circ - (20 + y)^\circ$   
 $= 180^\circ - 20^\circ - y^\circ$   
 $= (160 - y)^\circ$

9. If angles of measures  $(x - 2)^\circ$  and  $(2x + 5)^\circ$  are a pair of supplementary angles. Find the measures.

**Ans.** Since  $(x - 2)^\circ$  and  $(2x + 5)^\circ$  represent a pair of supplementary angles, then their sum must be equal to  $180^\circ$ .

$$\text{Therefore, } (x - 2) + (2x + 5) = 180$$

$$x - 2 + 2x + 5 = 180$$

$$x + 2x - 2 + 5 = 180$$

$$3x + 3 = 180$$

$$3x + 3 - 3 = 180 - 3$$

$$3x = 180 - 3$$

$$3x = 177$$

$$x = \frac{177}{3}$$

$$x = 59^\circ$$

Therefore, we know the value of  $x = 59^\circ$ , put the value in place of  $x$

$$x - 2$$

$$= 59 - 2$$

$$= 57^\circ$$

And again,  $2x + 5$

$$= 2 \times 59 + 5$$

$$= 118 + 5$$

$$= 123^\circ$$

Therefore, the two supplementary angles are  $57^\circ$  and  $123^\circ$ .

10. Two supplementary angles are in the ratio 7 : 8. Find the measure of the angles.

**Ans.** Let the common ratio be  $x$ .

If one angle is  $7x$ , then the other angle is  $8x$ .

$$\text{Therefore, } 7x + 8x = 180$$

$$15x = 180$$

$$x = \frac{180}{15}$$

$$x = 12$$

Put the value of  $x = 12$

One angle is  $7x$

$$= 7 \times 12 = 84^\circ$$

And the other angle is  $8x = 8 \times 12 = 96^\circ$

Therefore, the two supplementary angles are  $84^\circ$  and  $96^\circ$ .

11. In the given figure find the measure of the unknown angle.

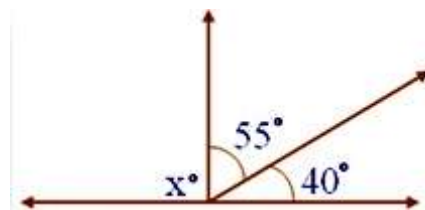
**Ans.**  $x + 55^\circ + 40^\circ = 180^\circ$

The sum of angles at a point on a line on one side of it is  $180^\circ$

Therefore,  $x + 95^\circ = 180^\circ$

$x + 95^\circ - 95^\circ = 180^\circ - 95^\circ$

$x = 85^\circ$



12. Find the complement of the angle  $\frac{2}{3}$  of  $90^\circ$ .

**Ans.** Convert  $\frac{2}{3}$  of  $90^\circ$

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

Complement of  $60^\circ = 90^\circ - 60^\circ = 30^\circ$

Therefore, complement of the angle  $\frac{2}{3}$  of  $90^\circ = 30^\circ$

13. Find the supplement of the angle  $\frac{4}{5}$  of  $90^\circ$ .

**Ans.** Convert  $\frac{4}{5}$  of  $90^\circ$

$\frac{4}{5} \times 90^\circ = 72^\circ$

Supplement of  $72^\circ = 180^\circ - 72^\circ = 108^\circ$

Therefore, supplement of the angle  $\frac{4}{5}$  of  $90^\circ = 108^\circ$

14. The measure of two complementary angles are  $(2x - 7)^\circ$  and  $(x + 4)^\circ$ . Find the value of x.

**Ans.** According to the problem,  $(2x - 7)^\circ$  and  $(x + 4)^\circ$ , are complementary angles' so we get;

$(2x - 7)^\circ + (x + 4)^\circ = 90^\circ$

or,  $2x - 7^\circ + x + 4^\circ = 90^\circ$

or,  $2x + x - 7^\circ + 4^\circ = 90^\circ$

or,  $3x - 3^\circ = 90^\circ$

or,  $3x - 3^\circ + 3^\circ = 90^\circ + 3^\circ$

or,  $3x = 93^\circ$

or,  $x = \frac{93}{3}$

or,  $x = 31^\circ$

Therefore, the value of  $x = 31^\circ$ .

15. The measure of two supplementary angles are  $(3x + 15)^\circ$  and  $(2x + 5)^\circ$ . Find the value of  $x$ .

Ans. According to the problem,  $(3x + 15)^\circ$  and  $(2x + 5)^\circ$ , are complementary angles' so we get;

$$(3x + 15)^\circ + (2x + 5)^\circ = 180^\circ$$

$$\text{or, } 3x + 15^\circ + 2x + 5^\circ = 180^\circ$$

$$\text{or, } 3x + 2x + 15^\circ + 5^\circ = 180^\circ$$

$$\text{or, } 5x + 20^\circ = 180^\circ$$

$$\text{or, } 5x + 20^\circ - 20^\circ = 180^\circ - 20^\circ$$

$$\text{or, } 5x = 160^\circ$$

$$\text{or, } x = \frac{160}{5}$$

$$\text{or, } x = 32^\circ$$

Therefore, the value of  $x = 32^\circ$ .

16. In adjoining figure  $l \parallel m$  is cut by the transversal  $t$ . If  $\angle 1 = 70^\circ$ , find the measure of  $\angle 3$ ,  $\angle 5$ ,  $\angle 6$ .

Ans. We have  $\angle 1 = 70^\circ$

$$\angle 1 = \angle 3 \text{ (Vertically opposite angles)}$$

$$\text{Therefore, } \angle 3 = 70^\circ$$

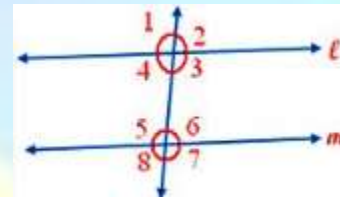
$$\text{Now, } \angle 1 = \angle 5 \text{ (Corresponding angles)}$$

$$\text{Therefore, } \angle 5 = 70^\circ$$

$$\text{Also, } \angle 3 + \angle 6 = 180^\circ \text{ (Co-interior angles)}$$

$$70^\circ + \angle 6 = 180^\circ$$

$$\text{Therefore, } \angle 6 = 180^\circ - 70^\circ = 110^\circ$$



17. In the given figure  $AB \parallel CD$ ,  $\angle BEO = 125^\circ$ ,  $\angle CFO = 40^\circ$ . Find the measure of  $\angle EOF$ .

Ans. Draw a line  $XY$  parallel to  $AB$  and  $CD$  passing through  $O$  such that  $AB \parallel XY$  and  $CD \parallel XY$

$$\angle BEO + \angle YO E = 180^\circ \text{ (Co-interior angles)}$$

$$\text{Therefore, } 125^\circ + \angle YO E = 180^\circ$$

$$\text{Therefore, } \angle YO E = 180^\circ - 125^\circ = 55^\circ$$

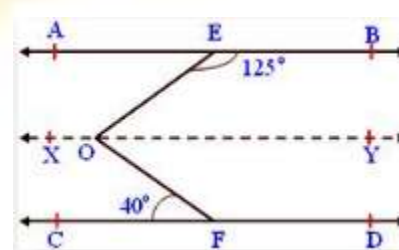
$$\text{Also, } \angle CFO = \angle YO F \text{ (Alternate angles)}$$

$$\text{Given } \angle CFO = 40^\circ$$

$$\text{Therefore, } \angle YO F = 40^\circ$$

$$\text{Then } \angle EOF = \angle EO Y + \angle FO Y$$

$$= 55^\circ + 40^\circ = 95^\circ$$



18. In the given figure  $AB \parallel CD \parallel EF$  and  $AE \perp AB$ . Also,  $\angle BAE = 90^\circ$ . Find the values of  $\angle x$ ,  $\angle y$  and  $\angle z$ .

Ans.  $y + 45^\circ = 180^\circ$

Therefore,  $\angle y = 180^\circ - 45^\circ$  (Co-interior angles)

$= 135^\circ$

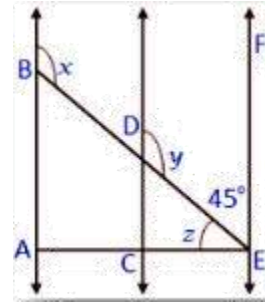
$\angle y = \angle x$  (Corresponding angles)

Therefore,  $\angle x = 135^\circ$

Also,  $90^\circ + \angle z + 45^\circ = 180^\circ$

Therefore,  $135^\circ + \angle z = 180^\circ$

Therefore,  $\angle z = 180^\circ - 135^\circ = 45^\circ$



19. Construction of an Angle of  $60^\circ$  by using Compass.

Ans. Step of Construction:

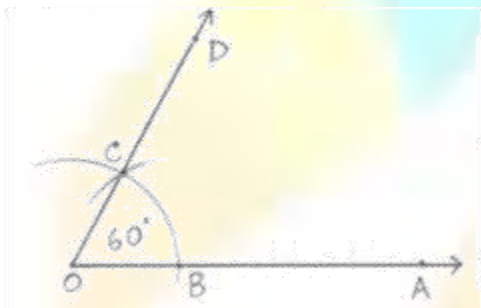
(i) Draw a ray OA.

(ii) With O as centre and any suitable radius draw an arc above OA cutting it at a point B.

(iii) With B as centre and the same radius as before, draw another arc to cut the previous arc at C.

(iv) Join OC and produce it to D.

Then  $\angle AOD = 60^\circ$ .



20. Construction of an Angle of  $120^\circ$  by using Compass.

Ans. Step of Construction:

(i) Draw a ray OA.

(ii) With O as centre and any suitable radius draw an arc cutting OA at B.

(iii) With B as centre and the same radius cut the arc at C, then with C as centre and same radius cut the arc at D.

Join OD and produce it to E.

