

# NCERT Solutions of Line and Angle

## Exercise 5.1

### Question 1

Find the complement of each of the following angles



### Solution

The sum of the measures of complementary angles is  $90^\circ$ .

(i)  $20^\circ$

$$\text{Complement} = 90^\circ - 20^\circ$$

$$= 70^\circ$$

(ii)  $63^\circ$

$$\text{Complement} = 90^\circ - 63^\circ$$

$$= 27^\circ$$

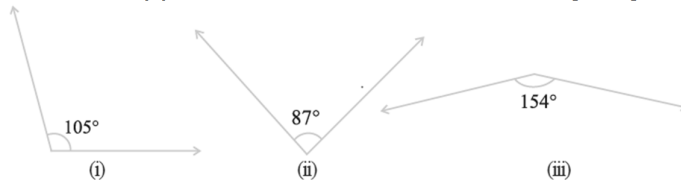
(iii)  $57^\circ$

$$\text{Complement} = 90^\circ - 57^\circ$$

$$= 33^\circ$$

### Question 2

Find the supplement of each of the following angles



### Solution

The sum of the measures of supplementary angles is  $180^\circ$ .

(i)  $105^\circ$

$$\text{Supplement} = 180^\circ - 105^\circ$$

$$= 75^\circ$$

(ii)  $87^\circ$

$$\text{Supplement} = 180^\circ - 87^\circ$$

$$= 93^\circ$$

(iii)  $154^\circ$

$$\text{Supplement} = 180^\circ - 154^\circ$$

$$= 26^\circ$$

### Question 3

Identify which of the following pairs of angles are complementary and which are supplementary.

(i)  $65^\circ$ ,  $115^\circ$

(ii)  $63^\circ$ ,  $27^\circ$

(iii)  $112^\circ$ ,  $68^\circ$

(iv)  $130^\circ$ ,  $50^\circ$

(v)  $45^\circ$ ,  $45^\circ$  (vi)  $80^\circ$ ,  $10^\circ$

**Solution**

The sum of the measures of complementary angles is  $90^\circ$  and that of supplementary angles is  $180^\circ$ .

(i)  $65^\circ$ ,  $115^\circ$

Sum of the measures of these angles =  $65^\circ + 115^\circ = 180^\circ$

Hence, these angles are supplementary angles.

(ii)  $63^\circ$ ,  $27^\circ$

Sum of the measures of these angles =  $63^\circ + 27^\circ = 90^\circ$

Hence, These angles are complementary angles.

(iii)  $112^\circ$ ,  $68^\circ$

Sum of the measures of these angles =  $112^\circ + 68^\circ = 180^\circ$

Hence, These angles are supplementary angles.

(iv)  $130^\circ$ ,  $50^\circ$

Sum of the measures of these angles =  $130^\circ + 50^\circ = 180^\circ$

Hence, These angles are supplementary angles.

(v)  $45^\circ$ ,  $45^\circ$

Sum of the measures of these angles =  $45^\circ + 45^\circ = 90^\circ$

Hence, These angles are complementary angles.

(vi)  $80^\circ$ ,  $10^\circ$

Sum of the measures of these angles =  $80^\circ + 10^\circ = 90^\circ$

Hence, These angles are complementary angles.

**Question 4**

Find the angle which is equal to its complement.

**Solution**

Let the angle be  $z$ .

Now As per the question,

Complement of this angle =  $z$

Now we know that

The sum of the measures of a complementary angle pair is  $90^\circ$ .

So,  $z + z = 90^\circ$

$2z = 90^\circ$

$z = 45^\circ$

**Question 5**

Find the angle which is equal to its supplement.

**Solution**

Let the angle be  $y$

Supplement of this angle is also  $y$

Now we know that

sum of the measures of a supplementary angle pair =  $180^\circ$ .

$$\text{So, } y + y = 180^\circ$$

$$2y = 180^\circ$$

$$y = 90^\circ$$

### Question 6

In the given figure,  $\angle 1$  and  $\angle 2$  are supplementary angles. If  $\angle 1$  is decreased, what changes should take place in  $\angle 2$  so that both the angles remain supplementary.



### Solution

$\angle 1$  and  $\angle 2$  are supplementary angles.

If  $\angle 1$  is reduced, then  $\angle 2$  should be increased by the same measure so that this angle pair remains supplementary.

### Question 7

Can two angles be supplementary if both are

(i) Acute? (ii) Obtuse? (iii) Right?

### Solution

The sum of the measures of supplementary angles is  $180^\circ$ .

So, we need to check if the angles sum up to  $180^\circ$

(i) No. Acute angle is always lesser than  $90^\circ$ . It can be observed that two angles, even of  $89^\circ$ , cannot add up to  $180^\circ$ .

Hence, two acute angles cannot be in a supplementary angle pair.

(ii) No. Obtuse angle is always greater than  $90^\circ$ . It can be observed that two angles, even of  $91^\circ$ , will always add up to more than  $180^\circ$ . Therefore, two obtuse angles cannot be in a supplementary angle pair.

(iii) Yes. Right angles are of  $90^\circ$  and  $90^\circ + 90^\circ = 180^\circ$

Therefore, two right angles form a supplementary angle pair together.

### Question 8

An angle is greater than  $45^\circ$ . Is its complementary angle greater than  $45^\circ$  or equal to  $45^\circ$  or less than  $45^\circ$ ?

### Solution

Let X and Y are two angles making a complementary angle pair and X is greater than  $45^\circ$ .

$$X > 45^\circ$$

Now

$$X + Y = 90^\circ$$

$$Y = 90^\circ - X$$

As  $X > 45^\circ$

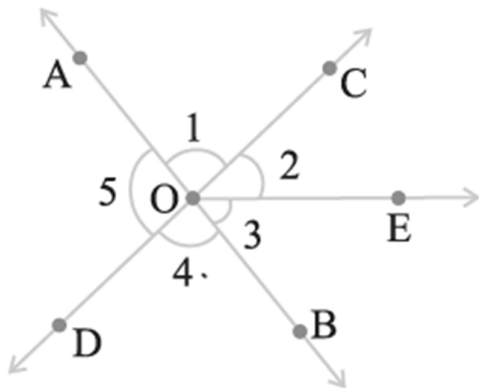
$Y < 45^\circ$

Therefore, Y will be lesser than  $45^\circ$ .

### Question 9

In the adjoining figure

- (i) Is  $\angle 1$  adjacent to  $\angle 2$ ?
- (ii) Is  $\angle AOC$  adjacent to  $\angle AOE$ ?
- (iii) Do  $\angle COE$  and  $\angle EOD$  form a linear pair?
- (iv) Are  $\angle BOD$  and  $\angle DOA$  supplementary?
- (v) Is  $\angle 1$  vertically opposite to  $\angle 4$ ?
- (vi) What is the vertically opposite angle of  $\angle 5$ ?



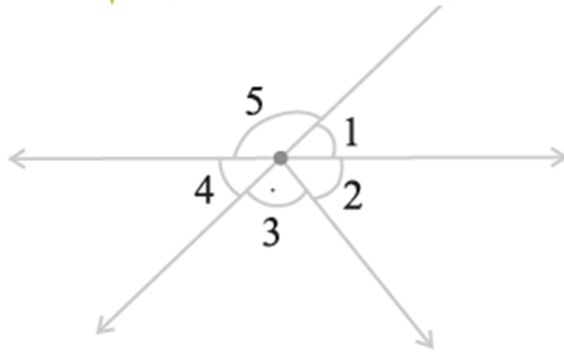
### Solution

- (i) Yes. Since they have a common vertex O and a common arm OC. Also, their non-common arms, OA and OE, are on either side of the common arm.
- (ii) No. They have a common vertex O and a common arm OA. However, their noncommon arms, OC and OE, are on the same side of the common arm. Therefore, these are not adjacent to each other.
- (iii) Yes. Since they have a common vertex O and a common arm OE. Also, their noncommon arms, OC and OD, are opposite rays.
- (iv) Yes. Since  $\angle BOD$  and  $\angle DOA$  have a common vertex O and their non-common arms are opposite to each other.
- (v) Yes. Since these are formed due to the intersection of two straight lines (AB and CD).
- (vi)  $\angle COB$  is the vertically opposite angle of  $\angle 5$  as these are formed due to the intersection of two straight lines, AB and CD.

### Question 10

Indicate which pairs of angles are

- (i) Vertically opposite angles. (ii) Linear pairs.

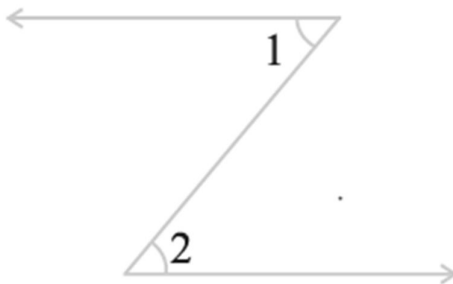


**Solution**

- (i)  $\angle 1$  and  $\angle 4$ ,  $\angle 5$  and  $\angle 2 + \angle 3$  are vertically opposite angles as these are formed due to the intersection of two straight lines.
- (ii)  $\angle 1$  and  $\angle 5$ ,  $\angle 5$  and  $\angle 4$  as these have a common vertex and also have non-common arms opposite to each other.

**Question 11**

In the following figure, is  $\angle 1$  adjacent to  $\angle 2$ ? Give reasons.

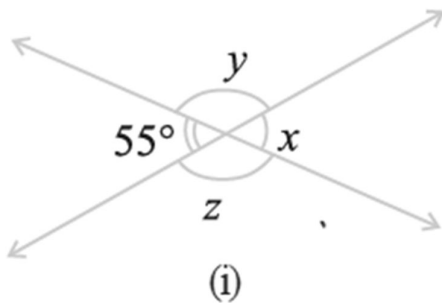


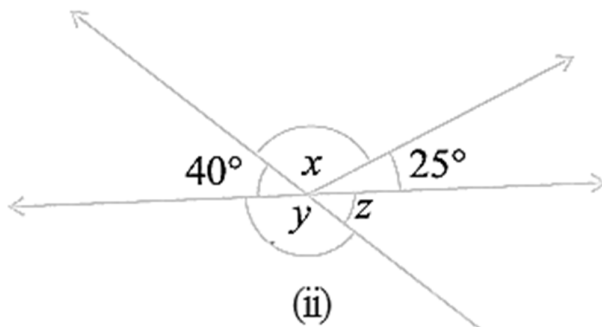
**Solution**

$\angle 1$  and  $\angle 2$  are not adjacent angles because their vertex is not common.

**Question 12**

Find the value of the angles  $x$ ,  $y$ , and  $z$  in each of the following




**Solution**

(i) Since  $\angle x$  and  $\angle 55^\circ$  are vertically opposite angles,

$$\angle x = 55^\circ$$

$$\angle x + \angle y = 180^\circ \text{ (Linear pair)}$$

$$55^\circ + \angle y = 180^\circ$$

$$\angle y = 180^\circ - 55^\circ = 125^\circ$$

$$\angle y = \angle z \text{ (Vertically opposite angles)}$$

$$\angle z = 125^\circ$$

(ii)  $\angle z = 40^\circ$  (Vertically opposite angles)

$$\angle y + \angle z = 180^\circ \text{ (Linear pair)}$$

$$\angle y = 180^\circ - 40^\circ = 140^\circ$$

$$40^\circ + \angle x + 25^\circ = 180^\circ \text{ (Angles on a straight line)}$$

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

$$\angle x = 180^\circ - 65^\circ = 115^\circ$$

**Question 13**

Fill in the blanks

(i) If two angles are complementary, then the sum of their measures is \_\_\_\_\_.

(ii) If two angles are supplementary, then the sum of their measures is \_\_\_\_\_.

(iii) Two angles forming a linear pair are \_\_\_\_\_.

(iv) If two adjacent angles are supplementary, they form a \_\_\_\_\_.

(v) If two lines intersect at a point, then the vertically opposite angles are always \_\_\_\_\_.

(vi) If two lines intersect at a point, and if one pair of vertically opposite angles are acute angles, then the other pair of vertically opposite angles are \_\_\_\_\_.

**Solution**

(i)  $90^\circ$

(ii)  $180^\circ$

(iii) Supplementary

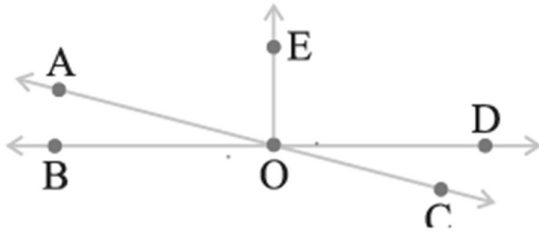
(iv) Linear pair

(v) Equal

(vi) Obtuse angles

**Question 14**

In the adjoining figure, name the following pairs of angles.



- (i) Obtuse vertically opposite angles
- (ii) Adjacent complementary angles
- (iii) Equal supplementary angles
- (iv) Unequal supplementary angles
- (v) Adjacent angles that do not form a linear pair

**Solution**

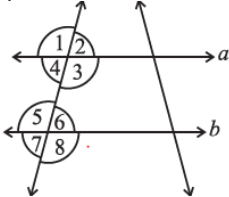
- (i)  $\angle AOD$ ,  $\angle BOC$
- (ii)  $\angle EOA$ ,  $\angle AOB$
- (iii)  $\angle EOB$ ,  $\angle EOD$
- (iv)  $\angle EOA$ ,  $\angle EOC$
- (v)  $\angle AOB$  and  $\angle AOE$ ,  $\angle AOE$  and  $\angle EOD$ ,  $\angle EOD$  and  $\angle COD$

**Exercise 5.2**

**Question 1**

State the property that is used in each of the following statements?

- (i) If  $a \parallel b$ , then  $\angle 1 = \angle 5$
- (ii) If  $\angle 4 = \angle 6$ , then  $a \parallel b$
- (iii) If  $\angle 4 + \angle 5 = 180^\circ$ , then  $a \parallel b$



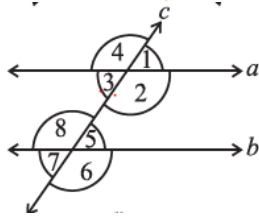
**Solution**

- (i) Corresponding angles property
- (ii) Alternate interior angles property
- (iii) Interior angles on the same side of transversal are supplementary.

**Question 2**

In the adjoining figure, identify

- (i) The pairs of corresponding angles
- (ii) The pairs of alternate interior angles
- (iii) The pairs of interior angles on the same side of the transversal
- (iv) The vertically opposite angles

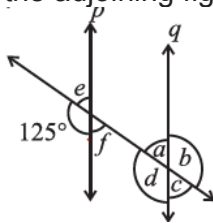


**Solution**

- (i)  $\angle 1$  and  $\angle 5$ ,  $\angle 2$  and  $\angle 6$ ,  $\angle 3$  and  $\angle 7$ ,  $\angle 4$  and  $\angle 8$
- (ii)  $\angle 2$  and  $\angle 8$ ,  $\angle 3$  and  $\angle 5$
- (iii)  $\angle 2$  and  $\angle 5$ ,  $\angle 3$  and  $\angle 8$
- (iv)  $\angle 1$  and  $\angle 3$ ,  $\angle 2$  and  $\angle 4$ ,  $\angle 5$  and  $\angle 7$ ,  $\angle 6$  and  $\angle 8$

**Question 3**

In the adjoining figure,  $p \parallel q$ . Find the unknown angles.

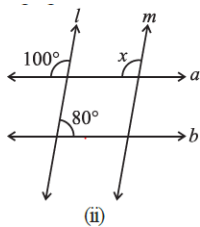
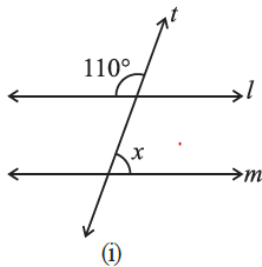


**Solution**

- $\angle d = 125^\circ$  (Corresponding angles)
- $\angle e = 180^\circ - 125^\circ = 55^\circ$  (Linear pair)
- $\angle f = \angle e = 55^\circ$  (Vertically opposite angles)
- $\angle c = \angle f = 55^\circ$  (Corresponding angles)
- $\angle a = \angle e = 55^\circ$  (Corresponding angles)
- $\angle b = \angle d = 125^\circ$  (Vertically opposite angles)

**Question 4**

Find the value of  $x$  in each of the following figures if  $l \parallel m$ .



**Solution**

(i)



$\angle y = 110^\circ$  (Corresponding angles)

$\angle x + \angle y = 180^\circ$  (Linear pair)

$\angle y = 180^\circ - 110^\circ$

$= 70^\circ$

(ii)

$\angle x = 100^\circ$  (Corresponding angles)

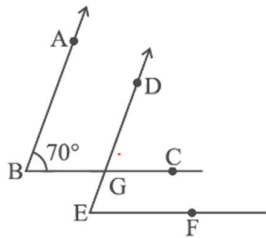
### Question 5

In the given figure, the arms of two angles are parallel.

If  $\angle ABC = 70^\circ$ , then find

(i)  $\angle DGC$

(ii)  $\angle DEF$



### Solution

(i) Consider that  $AB \parallel DG$  and a transversal line  $BC$  is intersecting them.

$\angle DGC = \angle ABC$  (Corresponding angles)

$\angle DGC = 70^\circ$

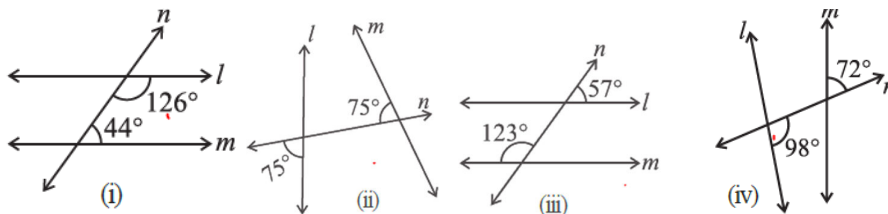
(ii) Consider that  $BC \parallel EF$  and a transversal line  $DE$  is intersecting them.

$\angle DEF = \angle DGC$  (Corresponding angles)

$\angle DEF = 70^\circ$

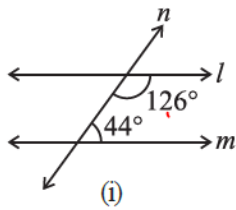
### Question 6

In the given figures below, decide whether  $l$  is parallel to  $m$ .



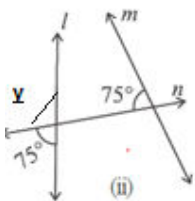
### Solution

(i)



Consider two lines,  $l$  and  $m$ , and a transversal line  $n$  which is intersecting them. Sum of the interior angles on the same side of transversal =  $126^\circ + 44^\circ = 170^\circ$ . As the sum of interior angles on the same side of transversal is not  $180^\circ$ , therefore,  $l$  is not parallel to  $m$ .

(ii)

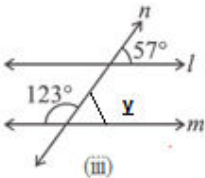


$$y + 75^\circ = 180^\circ \text{ (Linear pair on line l)}$$

$$y = 180^\circ - 75^\circ = 105^\circ$$

For  $l$  and  $m$  to be parallel to each other, corresponding angles ( $75^\circ$  and  $\angle y$ ) should be equal. However, here their measures are  $75^\circ$  and  $105^\circ$  respectively. Hence, these lines are not parallel to each other.

(iii)

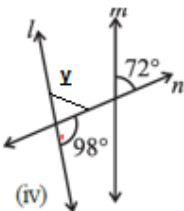


$$\angle y + 123^\circ = 180^\circ \text{ (Linear pair)}$$

$$\angle y = 180^\circ - 123^\circ = 57^\circ$$

For  $l$  and  $m$  to be parallel to each other, corresponding angles ( $57^\circ$  and  $\angle y$ ) should be equal. Here, their measures are  $57^\circ$  and  $57^\circ$  respectively. Hence, these lines are parallel to each other.

iv.



$$98 + \angle y = 180^\circ \text{ (Linear pair)}$$

$$\angle y = 82^\circ$$

For  $l$  and  $m$  to be parallel to each other, corresponding angles ( $72^\circ$  and  $\angle y$ ) should

be equal. However, here their measures are  $72^\circ$  and  $82^\circ$  respectively. Hence, these lines are not parallel to each other.

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