1. Find the complement of each of the following angles:

    (i)   (ii)   (iii)
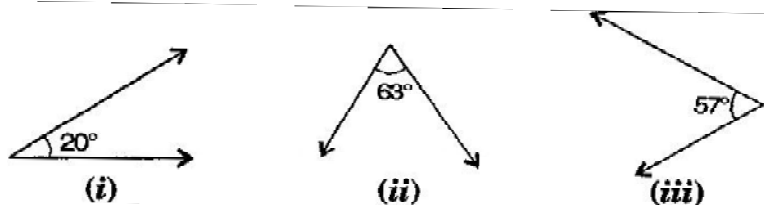
2. Find the supplement of each of the following angles:


    (i)   (ii)   (iii)
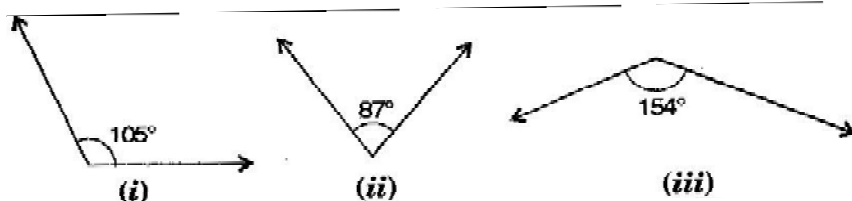
3. Identify which of the following pairs of angles are complementary and which are supplementary:

    (i) $65°, 115°$ (ii) $63°, 27°$ (iii) $112°, 68°$

    (iv) $130°, 50°$ (v) $45°, 45°$ (vi) $80°, 10°$

4. Find the angle which is equal to its complement:

5. Find the angle which is equal to its supplement.

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 still remain supplementary?
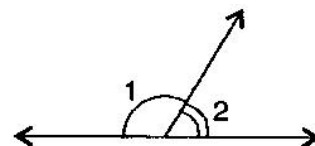

7. Can two angles be supplementary if both of them are:

    (i)   acute   (ii)   obtuse   (iii) right?

8. An angle is greater than $45°$. Is its complementary angle greater than $45°$ or equal to $45°$ or less than $45°$?
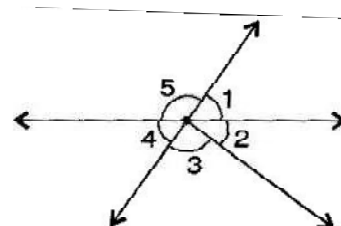
9. In the adjoining figure:

    (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 $\angle 4$?

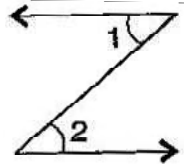   (vi)   What is the vertically opposite angle of $\angle 5$?
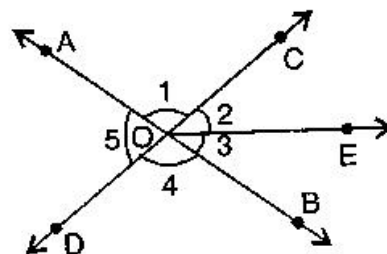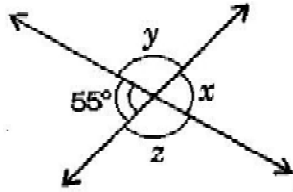

10. Indicate which pairs of angles are:

    (i)   Vertically opposite angles?
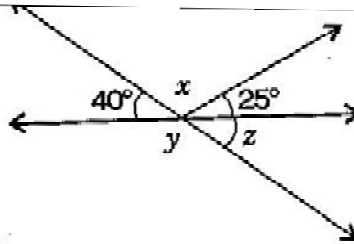
    (ii)   Linear pairs?

11. In the following figure, is ∠1 adjacent to ∠2? Give reasons.

12. Find the values of the angles x, y and z in each of the following:

(i)

(ii)

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 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 _____.

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.
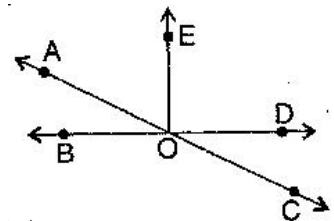
1. Complementary angle $= 90° -$ given angle
    (i)   Complement of $20° = 90° - 20° = 70°$
    (ii)   Complement of $63° = 90° - 63° = 27°$
    (iii)   Complement of $57° = 90° - 57° = 33°$
2. Supplementary angle $= 180° -$ given angle
    (i)   Supplement of $105° = 180° - 105° = 75°$
    (ii)   Supplement of $87° = 180° - 87° = 93°$
    (iii)   Supplement of $154° = 180° - 154° = 26°$
3. If sum of two angles is $180°$, then they are called supplementary angles.
    If sum of two angles is $90°$, then they are called complementary angles.
    (i) $65° + 115° = 180°$ These are supplementary angles.
    (ii) $63° + 27° = 90°$ These are complementary angles.
    (iii) $112° + 68° = 180°$ These are supplementary angles.
    (iv) $130° + 50° = 180°$ These are supplementary angles.
    (v) $45° + 45° = 90°$ These are complementary angles.
    (vi) $80° + 10° = 90°$ These are complementary angles.
4. Let one of the two equal complementary angles be x.

    $\therefore$ $x + x = 90°$ $\Rightarrow$ $2x = 90°$ $\Rightarrow$ $x = \dfrac{90°}{2} = 45°$

    Thus, $45°$ is equal to its complement.
5. Let x be two equal angles of its supplement.
    Therefore, $x + x = 180°$ [Supplementary angles]
    $\Rightarrow$ $2x = 180°$
    $\Rightarrow$ $x = \dfrac{180°}{2} = 90°$

    Thus, $90°$ is equal to its supplement.
6. I f $\angle 1$ is decreased then, $\angle 2$ will increase with the same measure, so that both the angles still remain supplementary.
7. (i)   No, because sum of two acute angles is less than $180°$.
    (ii)   No, because sum of two obtuse angles is more than $180°$.
    (iii)   Yes, because sum of two right angles is $180°$.
8. Let the complementary angles be x and y, i.e., $x + y = 90°$

    It is given that $x > 45°$

    Adding y both sides, $x + y > 45° + y$

    $\Rightarrow$ $90° > 45° + y$ $\Rightarrow$ $90° - 45° > y$ $\Rightarrow$ $y < 45°$

    Thus, its complementary angle is less than $45°$.

9. (i) Yes, in ∠AOE, OC is common arm.
   (ii) No, they have no non-common arms on opposite side of common arm.
   (iii) Yes, they form linear pair.
   (iv) Yes, they are supplementary.
   (v) Yes, they are vertically opposite angles.
   (vi) Vertically opposite angles of ∠5 is ∠COB.
10. (i) Vertically opposite angles, ∠1, ∠4;   ∠5,   ∠2 + ∠3.
    (ii) Linear pairs   ∠1, ∠5;   ∠5, ∠4.
11. ∠1 and ∠2 are not adjacent angles because their vertex is not common.
12. (i) $x = 55°$ [Vertically opposite angles]

          Now $55° + y = 180°$ [Linear pair]

          $\Rightarrow$ $y = 180° - 55° = 125°$

          Also $y = z = 125°$ [Vertically opposite angles]

          Thus, $x = 55°, y = 125°$ and $z = 125°$.

    (ii) $40° + x + 25° = 180°$ [Angles on straight line]

          $\Rightarrow$ $65° + x = 180°$

          $\Rightarrow$ $x = 180° - 65° = 115°$

          Now $40° + y = 180°$ [Linear pair]

          $\Rightarrow$ $y = 180° - 40° = 140°$ ....(i)

          Also $y + z = 180°$ [Linear pair]

          $\Rightarrow$ $140° + z = 180°$ [From eq. (i)]

          $\Rightarrow$ $z = 180° - 140° = 40°$

    Thus, $x = 115°, y = 140°$ and $z = 40°$.

13. (i) $90°$ (ii) $180°$ (iii)   supplementary
    (iv)   linear pair   (v)   equal   (vi)   obtuse angles
14. (i) Obtuse vertically opposite angles means greater than $90°$ and equal ∠AOD = ∠BOC.
    (ii) Adjacent complementary angles means angles have common vertex, common arm, non-common arms are on either side of common arm and sum of angles is $90°$.
    (iii) Equal supplementary angles means sum of angles is 180° and supplement angles are equal.
    (iv) Unequal supplementary angles means sum of angles is 180° and supplement angles are unequal.
          i.e.,   ∠AOE, ∠EOC;   ∠AOD, ∠DOC and ∠AOB, ∠BOC
    (v) Adjacent angles that do not form a linear pair mean, angles have common ray but the angles in a linear pair are not supplementary.
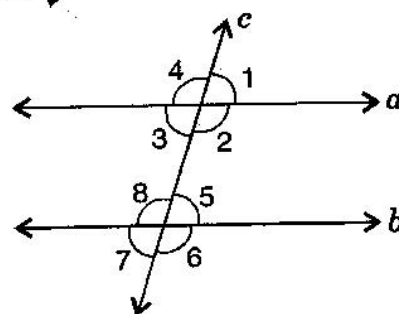   i.e.,   ∠AOB, ∠AOE;   ∠AOE, ∠EOD and ∠EOD, ∠COD

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 $a \parallel b$.
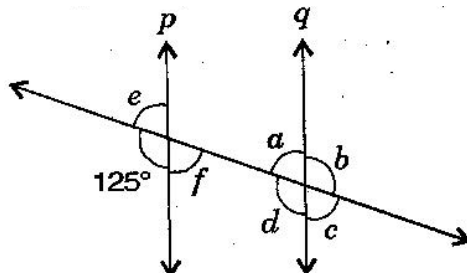   (iii) If $\angle 4 + \angle 5 + 180°$, then $a \parallel b$.
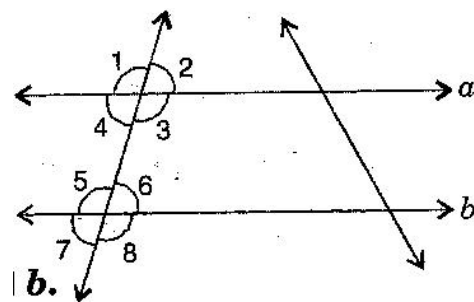
2. In the adjoining figure, identify:
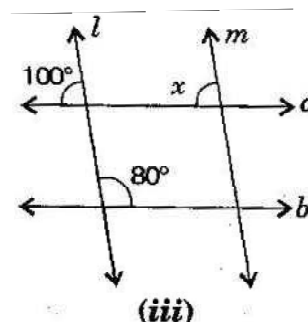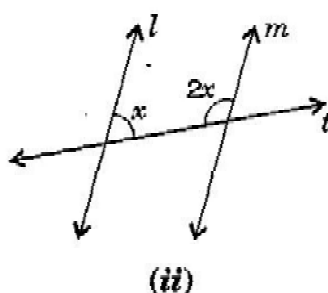   (i)   the pairs of corresponding angles.
    (ii) the pairs of alternate interior angles.
    (iii) the pairs of interior angles on the same side of the transversal.
    (iv) the vertically opposite angles.

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

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

    (i)   (ii)   (iii)
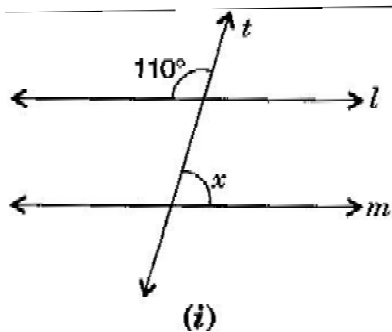
5. In the given figure, the arms of two angles are parallel. If $\triangle ABC = 70°$, then find:
    (i) $\angle DGC$ (ii) $\angle DEF$

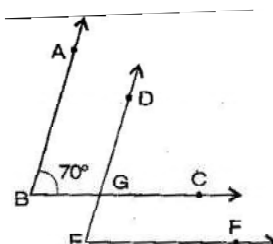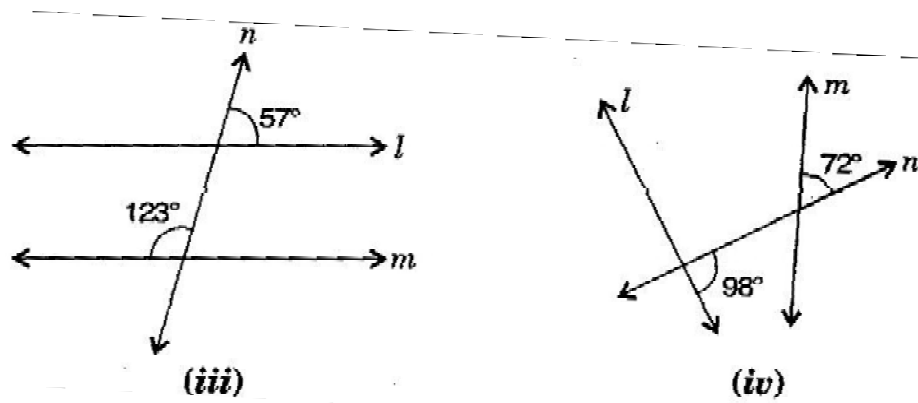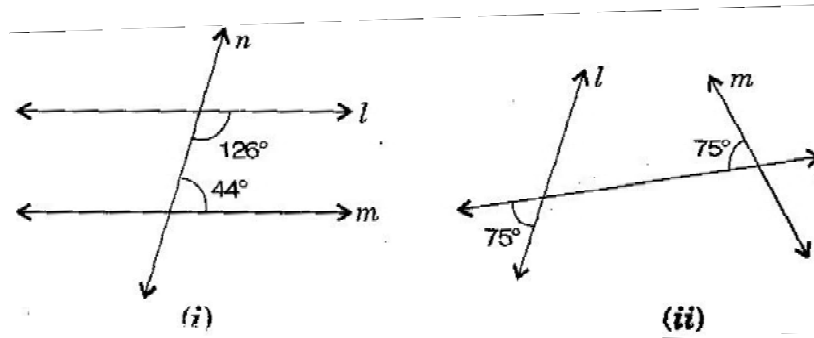6. In the given figures below, decide whether *l* is parallel to *m*.

(i)

(ii)

(iii)

(iv)

1. (i)   Given, $a \parallel b$ then $\angle 1 = \angle 5$ [Corresponding angles]

   If two parallel lines are cut by a transversal, each pair of corresponding angles are equal in measure.

   (ii)   Given, $\angle 4 = \angle 6$, then $a \parallel b$ [Alternate interior angles]

   When a transversal cuts two lines such that pairs of alternate interior angles are equal, the lines have to be parallel.

   (iii)   Given, $\angle 4 + \angle 5 = 180°$, then $a \parallel b$ [

   When a transversal cuts two lines, such that pairs of interior angles on the same side of transversal are supplementary, the lines have to be parallel.

2. (i)   The pairs of corresponding angles:

   $\angle 1, \angle 5$; $\angle 2, \angle 6$; $\angle 4, \angle 8$ and $\angle 3, \angle 7$

   (ii)   The pairs of alternate interior angles are:

   $\angle 3, \angle 5$ and $\angle 2, \angle 8$

   (iii)   The pair of interior angles on the same side of the transversal:

   $\angle 3, \angle 8$ and $\angle 2, \angle 5$

   (iv)   The vertically opposite angles are:

   $\angle 1, \angle 3$; $\angle 2, \angle 4$; $\angle 6, \angle 8$ and $\angle 5, \angle 7$

3. Given, $p \parallel q$ and cut by a transversal line.

   $\because$ $125° + e = 180°$ [Linear pair]

   $\therefore$ $e = 180° - 125° = 55°$ ....(i)

   Now $e = f = 55°$ [Vertically opposite angles]

   Also $a = f = 55°$ [Alternate interior angles]

   $a + b = 180°$ [Linear pair]

   $\Rightarrow$ $55° + b = 180°$ [From eq. (i)]

   $\Rightarrow$ $b = 180° - 55° = 125°$

   Now $a = c = 55°$ and $b = d = 125°$ [Vertically opposite angles]

   Thus, $a = 55°, b = 125°, c = 55°, d = 125°, e = 55°$ and $f = 55°$.

4. (i)   Given, $l \parallel m$ and t is transversal line.

   $\therefore$ Interior vertically opposite angle between lines l and $t = 110°$.

   $\therefore$ $110° + x = 180°$ [Supplementary angles]

   $\Rightarrow$ $x = 180° - 110° = 70°$

   (ii)   Given, $l \parallel m$ and t is transversal line.

   $x + 2x = 180$ [Interior opposite angles]

   $\Rightarrow$ $3x = 180°$ $\Rightarrow$ $x = \dfrac{180°}{3} = 60°$

(iii)   Given, $l \parallel m$ and $a \parallel b$.

        $x = 100°$ [Corresponding angles]

5. (i)   Given, AB $\parallel$ DE and BC is a transversal line and $\angle ABC = 70°$

        $\because$ $\angle ABC = \angle DGC$ [Corresponding angles]

        $\therefore$ $\angle DGC = 70°$ ....(i)

(ii)   Given, BC $\parallel$ EF and DE is a transversal line and $\angle DGC = 70°$

        $\because$ $\angle DGC = \angle DEF$ [Corresponding angles]

        $\therefore$ $\angle DEF = 70°$ [From eq. (i)]

6. (i) $126° + 44° = 170°$

        l is not parallel to m because sum of interior opposite angles should be 180°.

(ii) $75° + 75° = 150°$

        l is not parallel to m because sum of angles does not obey the property of parallel lines.

(iii) $57° + 123° = 180°$

        l is parallel to m due to supplementary angles property of parallel lines.

(iv) $98° + 72° = 170°$

        l is not parallel to m because sum of angles does not obey the property of parallel lines.