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DPM CLASSES

6th to 10th (Math's & Science), 11th & 12th (Physics, Chemistry, Math's)

BASIC NOTES (CBSE/NCERT)

LINES & ANGLES

PART -1 OUT OF 1

6^{th}, 7^{th} & 8^{th}

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-: Line and Angles :-

Q. Line :- minimum of two point are required to draw a line.

Q. Collinear point and non-collinear points :- If three or more points lie on the same line, they are called colinear points other wise they are called non-collinear points.

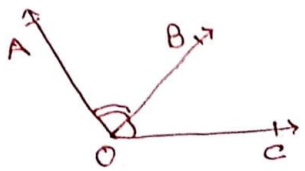
Q. Angle : Angle is formed when two rays originate from the same end point.

Q. Arms : The rays making an angle are called the arms of the angle and end point is called the vertex of the angle.

Q. Types of angles :-

- Acute Angle : $0° < x < 90°$
- Right Angle : $y = 90°$
- obtuse Angle : $90° < z < 180°$
- Straight Angle : $\delta = 180°$
- reflex Angle : $180 < t < 360°$

Q. Adjacent Angle : If they have a common vertex, a common are called Adjacent Angle.



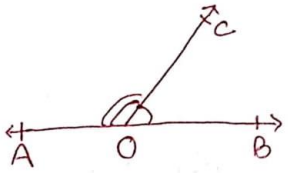
O is common vertex
OB is common arm
$\angle AOC = \angle AOB + \angle COB$

-: Lines and Angles :-

(1). Linear pair of angles : If two angles make a straight line is called linear pair angles.

$\angle AOB$ is a linear angle or straight line angle

$\angle AOC + \angle BOC = 180°$

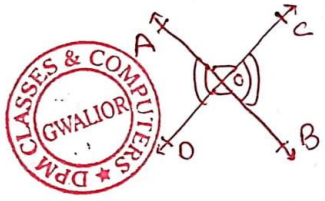


Sum of angles is 180° because straight line is 180°.

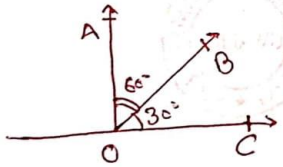
(2). Vertically opposite Angles :- If two lines intersect each other, then make angles are called vertically opposite angles.

$\angle AOC = \angle BOD$ (Vertically)

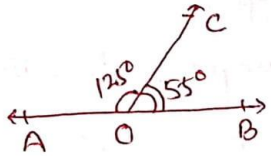
$\angle AOD = \angle BOC$ (Vertically)



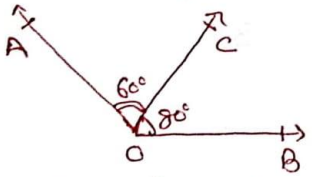
(3). Axiom 6.1 :- If a ray stand on a line, then the sum of two adjacent angles so formed is 180°. When the sum of two adjacent angles is 180°, then they are called a linear pair : Adjacent angles different angles :-



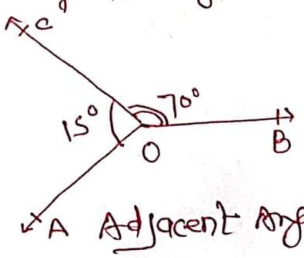
Adjacent angles or acute angles



Adjacent angles or Linear pair angles



Adjacent angles



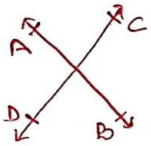
Adjacent Angles

! Lines and Angles !-

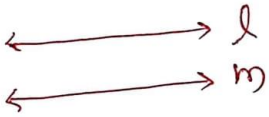
① . Axiom 6.2 : If the sum of two adjacent angles is 180° then the non-common arms of the angles form a line
Two axioms above together is called the Linear pair Axiom.

② . Intersecting lines and non-intersecting lines :-

- When two lines intersect each other then called intersecting lines.
- When two lines are not intersect each other then called non-intersecting or parallel lines. (|| used for parallel lines)



Intersecting lines



Parallel lines

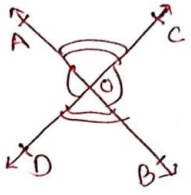
③ . pairs of angles :-

- Complementry angles : Sum of two angles are 90°
- Supplementry angles : Sum of two angles are 180°
- Linear pair of angles : Sum of two angles are 180°

Note : more than two angles are used in above pairs of angles.

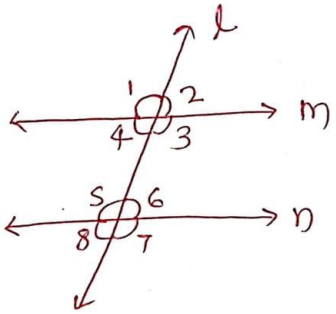
:- Lines and Angles :-

Q. Theorem 6.1 : If two lines intersect each other, then the vertically opposite angles are equal.



$\angle AOC = \angle DOB$
$\angle AOD = \angle COB$
$\angle AOB = \angle AOC + \angle COB = 180°$
$\angle COD = \angle AOD + \angle AOC = 180°$

Q. Parallel lines and a transversal :-



- Corresponding Angles :-
  $\angle 1$ and $\angle 5$
  $\angle 4$ and $\angle 8$
  $\angle 2$ and $\angle 6$
  $\angle 3$ and $\angle 7$ They are equals.

- Alternate interior angles :-
  $\angle 4$ and $\angle 6$
  $\angle 3$ and $\angle 5$ they are equals.

- Alternate Exterior angles :-
  $\angle 1$ and $\angle 7$
  $\angle 2$ and $\angle 8$ They are equals.

- Transversal Angles :-
  $\angle 4$ and $\angle 5$
  $\angle 3$ and $\angle 6$ Sum of pair equal to 180°

:- Lines and Angles :-

Q. Axiom 6.3 : If a transversal intersects two parallel lines, then each pair of corresponding angles are equal.

Q. Axiom 6.4 : If a transversal intersects two lines such that a pair of corresponding angles is equal then the two lines are parallel to each others.

Q. Theorem 6.2 : If a transversal intersect two parallel lines, then each pair of alternate interior angles is equal.

Q. Theorem 6.3 : If a transversal intersect two lines such that a pair of alternate interior angles is equal, then the two lines are parallel.

Q. Theorem 6.4 : If a transversal intersects two lines such that each pair of interior angles on the same side of the transversal is supplementry.

Q. Theorem 6.5 : If a transversal intersects two lines such that a pair of interior angles on the same side of the transversal is supplementry, then the two lines are parallel.

Q Theorem 6.6 : Lines which are parallel to the same lines are parallel to each other.

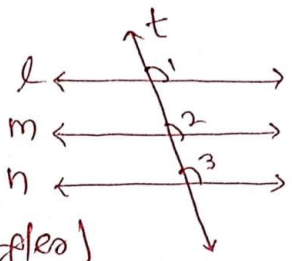
Q. Theorem 6.7 : The sum of the angles of a triangle is 180°

Q. Theorem 6.8 : If a side of a triangle is produced then the exterior angle so formed is equal to the sum of the two interior opposite angles.

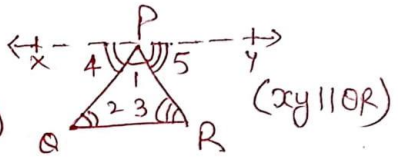
:- Lines and Angles :-

① Lines parallel to the same line :-

$l \parallel m$ $(\angle 1 = \angle 2)$
$m \parallel n$ $(\angle 2 = \angle 3)$
So, $l \parallel n$ $(\angle 1 = \angle 3)$
(By corresponding angles)



② Angle Sum property of a triangle :-



$\angle 1 + \angle 2 + \angle 3 = 180°$ (Angle Sum property of Δ)

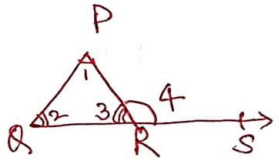
$\angle 4 + \angle 1 + \angle 5 = 180°$ (Linear pair) ----(i)

$\angle 4 = \angle 2$ (Alternate interior)
$\angle 5 = \angle 3$ (Alternate interior)

Put value of $\angle 4$ and $\angle 5$ in eq (i), we get

$\angle 2 + \angle 1 + \angle 3 = 180$

$\boxed{\angle 1 + \angle 2 + \angle 3 = 180°}$



③ Exterior Angle of triangle :-

$\angle 3 + \angle 4 = 180°$ (Linear pair) ---- (i)

$\angle 1 + \angle 2 + \angle 3 = 180°$ (Angle Sum property) ----(ii)

from eq (i) and (ii)

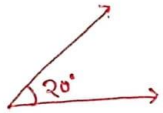
$\angle 3 + \angle 4 = \angle 1 + \angle 2 + \angle 3$

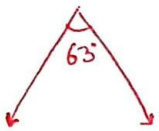
$\boxed{\angle 4 = \angle 1 + \angle 2}$

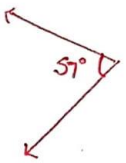
So, Exterior angles are equal to Sum of two opposite interior angles of triangle (Theorem 6.8)

:-Lined and Angles:-

Q. Find the Complement of each of the following angles:

(i) 

(ii) 

(iii) 

Sol. (i) 20°

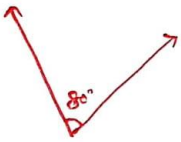
Complement = 90 - 20
= 70°

For Complentry angle always (90 - a)

[do other it self].

Q. Find the Supliment of each of the following angles.

(i) 

(ii) 

(iii) 

Sol. (i) 105°

Supliment = 180 - 105
= 75°

[do other it self]

:- Lines and Angles :-

Q. 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°

Sol. The sum of the measures of Complementary angles is 90° and that of Supplementary angles 180°

(i) 65°, 115°

Sum of angles = 65 + 115°
= 180°

Hence, these angles are Supplementary Angles.

(ii) 63°, 27°

Sum of angles = 63 + 27
= 90°

Hence, these angles are Complementary Angles.

[do other it self]

:- Lines and Angles :-

Q. Find the angles which is equal to its Complement.

Sol. Let the angle is x

Complement of this angle also x

the sum of the measure of a Complementry angles Pair is $90°$

$$x + x = 90$$
$$2x = 90$$
$$x = \frac{90}{2}$$
$$x = 45°$$

Q. Find the angle which is equal to its Supplement.

Sol. Let the angle is x

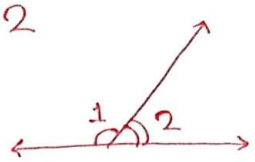
Complement of this angle also x

Sum of the measures of a Complementry angle pair is $180°$

$$x + x = 180$$
$$2x = 180$$
$$x = \frac{180}{2}$$
$$x = 90°$$

~! Lines and Angles !~

Q. 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.

Sol. $\angle 1$ 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.

Q. Can two angles be supplementary if both of them are:
(i) acute (ii) obtuse (iii) right ?

Sol. (i) No, Acute angle is always lesser than 90°

(ii) No, Obtuse angle is always greater than 90°

(iii) yes, Right angle are 90° and $90+90=180°$

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

:- Lines and Angles :-

Q. An angle is greater than 45°. Is its Complementry angle greater than 45° or Equal to 45° or less than 45°?

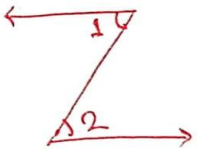
Sol. Let A and B are two angles making a Complementry angle pair and A is greater than 45°

$$A + B = 90°$$

$$B = 90 - A$$

Therefore, B will be lesser than 45°.

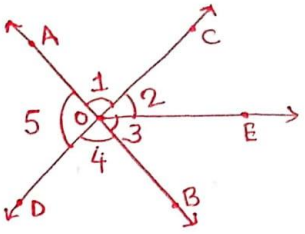
Q. In the following figure, is $\angle 1$ adjacent to $\angle 2$? give reasons.



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

:- Lines and Angles :-

Q. In the adjoining figure :



(i) Is $\angle 1$ adjacent to $\angle 2$?

(ii) Is $\angle AOC$ adjacent to $\angle AOE$?

(iii) Do $\angle BOD$ and $\angle DOA$ Supplementry ?

(iv) Do $\angle COE$ and $\angle EOD$ form a linear pair ?

(v) Is $\angle 1$ vertically opposite to $\angle 4$?

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

Sol.

(i) Yes, $\angle 1$ adjacent to $\angle 2$ because $\angle 1$ and $\angle 2$ are common vertex.

(ii) NO, $\angle AOC$ not adjacent to $\angle AOE$ because $\angle AOC$ and $\angle AOE$ are common vertex.

(iii) yes, $\angle BOD$ and $\angle DOA$ Supplementry because these angle make a Straight line (180°)

(iv) yes, $\angle COE$ and $\angle EOD$ form a linear pair because these angles make a straight line (180°)

(v) yes, $\angle 1$ vertically opposite to $\angle 4$ due to the intersection of two straight line (AB and CD)

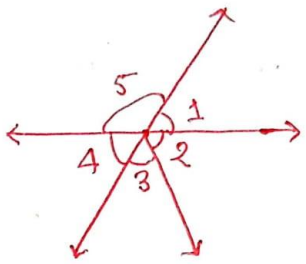
(vi) $\angle COB$ is the vertically opposite angle of $\angle 5$.

-: Lines and Angles :-

Q. Indicate which pairs of angles are :

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

Sol.



(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.

Q. Fill in the blanks :

(i) If two angles are Complementry, then the sum of their measure is ..... (Ans : 90°)

(ii) If two angles are Supplementry, then the sum of their measures is ..... (Ans : 180°)

(iii) Two angles forming a linear pair are .....
(Ans: Supplementary)

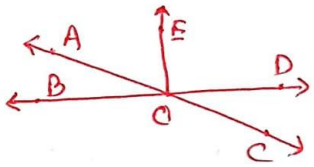
-: Lines and Angles :-

(iv) If two adjacent angles are supplementry, they form a ..... (Ans: Linear pair)

(v) If two lines intersect at a point, then the vertically opposite angles are always ..... (Ans: equal)

(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 ..... (Ans: obtuse angles)

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



(i) obtuse vertically opposite angles

(ii) Adjacent Complementry angles.

(iii) Equal Supplementry angles.

(iv) unequal Supplementry angles.

(v) Adjacent angles that do not form a linear pair.

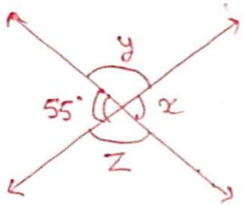
Sol. (i) $\angle AOD$, $\angle BOC$ (ii) $\angle EOA$, $\angle AOB$

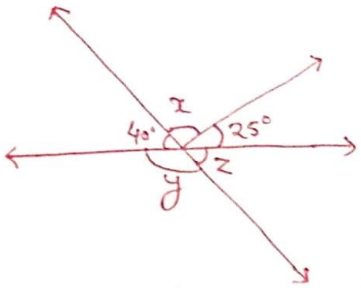
(iii) $\angle EOB$, $\angle EOD$ (iv) $\angle EOA$, $\angle EOC$

(v) $\angle AOB$ and $\angle AOE$, $\angle AOE$ and $\angle EOD$, $\angle EOD$ and $\angle COD$

Lines and angles :-

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

(i) 

(ii) 

Sol. (i) $\angle x = \angle 55^\circ$ (vertically opposite angles)

$\angle x + \angle y = 180$ (linear pair)

$55 + \angle y = 180$

$\angle y = 180 - 55$

$\angle y = 125^\circ$

$\angle z = \angle y$ (vertically opposite angles)

$\angle z = 125^\circ$

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

$\angle y + \angle z = 180$ (linear pair)

$\angle y + 40 = 180$

$\angle y = 180 - 40$

$\angle y = 140^\circ$

$40^\circ + \angle x + 25 = 180$ (angles on a straight line)

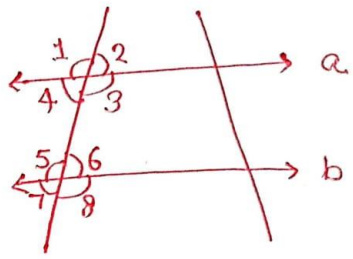
$65 + \angle x = 180$

$\angle x = 180 - 65$

$\angle x = 115^\circ$

:- Lines and Angles :-

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



(i) if a||b, then $\angle 1 = \angle 5$

(ii) If $\angle 4 = \angle 6$ then a||b

(iii) If $\angle 4 + \angle 5 = 180^\circ$, then a||b

Sol. (i) Corresponding angles property.

(ii) Alternate interior angles property.

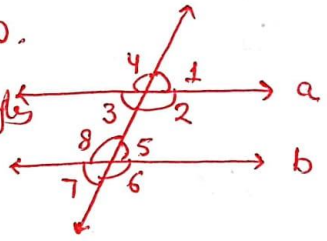
(iii) Interior angles on the same side of transversal are supplementry.

Q. 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.

Sol. (i) $\angle 1$ and $\angle 5$, $\angle 2$ and $\angle 6$, $\angle 3$ and $\angle 7$, $\angle 4$ and $\angle 8$

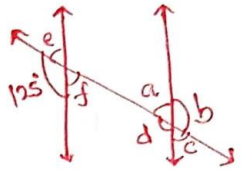
(ii) $\angle 2$ and $\angle 8$, $\angle 3$ and $\angle 5$

(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 $\angle 8$

→ Lines and Angles :-

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



Sol. $\angle d = 125°$ (Corresponding angles)

$\angle e = 180 - 125 = 55°$ (Linear pair)

$\angle f = \angle e = 55°$ (Vertically opposite angles)

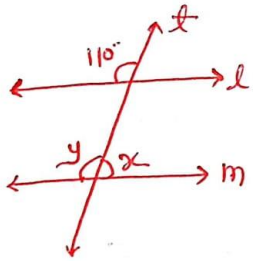
$\angle c = \angle f = 55$ (Corresponding angles)

$\angle a = \angle e = 55°$ (Corresponding angles)

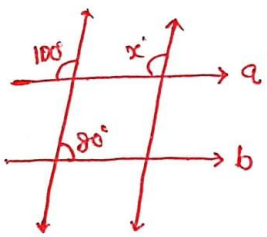
$\angle b = \angle d = 125°$ (Vertically opposite angles)

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

(i)



(ii)



Sol. (i) $\angle y = 110°$ (Corresponding angles)

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

$\angle x = 180 - 110$

$\angle x = 70°$

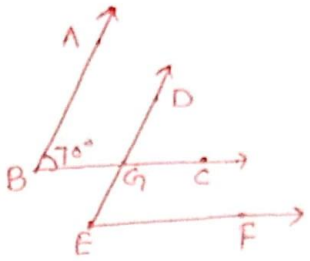
(ii) $\angle x = 100°$ (Corresponding angles)

Lines and Angles :-

Q. In the given figure, the arms of two angles are Parallel.

If $\angle ABC = 70°$, then find

(i) $\angle DGC$ (ii) $\angle DEF$



Sol. (i) AB || DG and a transversal line BC is intersecting.

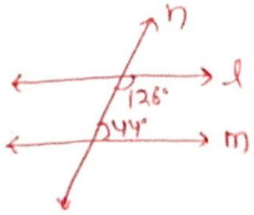
$\angle DGC = 70°$ (Corresponding angles)

(ii) BC || EF and a transversal line DE is intersecting

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

$\angle DEF = 70°$

Q. In the given figure below, decide whether l is Parallel to m.



Sol. 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 $= 126 + 44 = 170°$

As the sum of interior angles on the same side of transversal is not 180°, therefore, l is not parallel to m.

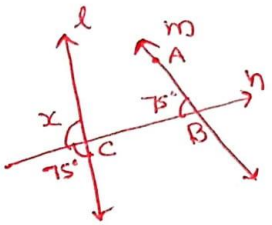
∴ Lines and Angles :-

Q. In the given figure below, decide whether l is parallel to m.

(i) $x + 75^\circ = 180^\circ$ (Linear pair)

$x = 180 - 75$

$x = 105^\circ$

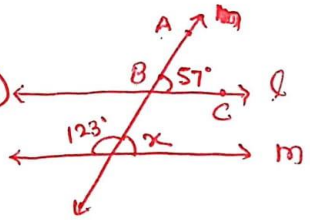


For l and m to be parallel to each other, corresponding angles ($\angle ABC$ and $\angle x$) should be equal. However, here their measure are 75° and 105° respectively, Hence, these lines are not parallel to each other.

(ii) $\angle x + 123 = 180^\circ$ (Linear pair)

$\angle x = 180 - 123$

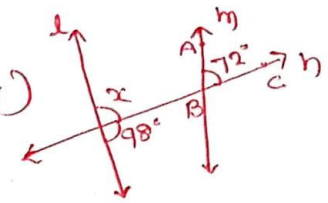
$\angle x = 57^\circ$



For l and m to be parallel to each other, corresponding angles ($\angle ABC$ and $\angle x$) should be equal. However, here their measures are 57° and 57° respectively, Hence, these lines are parallel to each other.

:- Lines and angles :-

(iii)



$98 + \angle x = 180$ (Linear pair)

$\angle x = 180 - 98$

$\angle x = 82$

For l and m to be parallel to each other, corresponding angles ($\angle ABC$ and $\angle x$) should be equal. However, here their measures are 72° and 82° respectively. Hence, these lines are not parallel to each other.