Subject: Mathematics.

Topic: Angles on parallel lines.

Class: S.S.1.

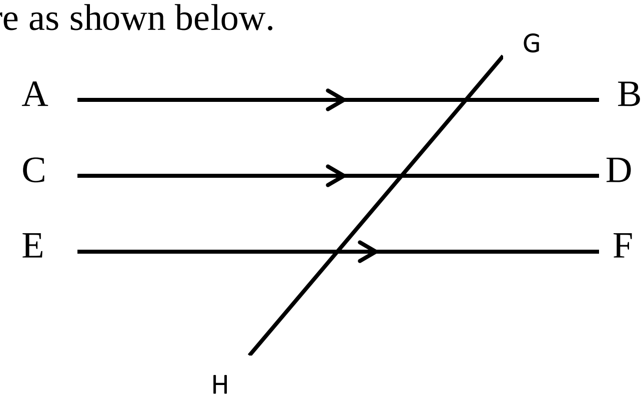
Specific objectives: By the end of this lesson the students should be able to :

i. State the relationships between the angles on parallel lines.
ii. Solve simple problems involving angles on parallel lines.

## Introduction

It is pertinent to note that parallel lines are lines that are always the same distance apart. They do not meet each other.

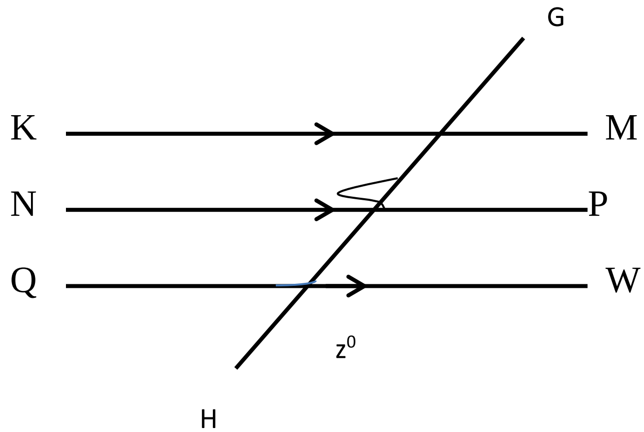
A line that intersects two or more parallel lines is called a transversal. These lines are as shown below.




From the above diagram, lines: AB, CD and EF are parallel while line GH is a transversal. Note that arrows are usually used to indicate parallel lines.

## TERMS ASSOCIATED WITH ANGLES ON PARALLEL LINES AND THEIR RELATIONSHIPS

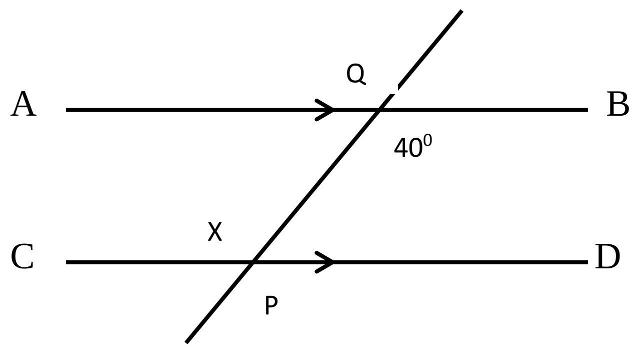
1. **Alternate Angles**: when two angles are formed on opposite sides of the transversal within two parallel lines, such angles are said to be alternate as shown in the diagram below




From the diagram, the angles marked $X^0$ and $r^0$ or $z^0$ and $Y^0$ are alternate angles respectively. Two alternate angles are equal to each other, hence we have:

i. $X^0 = r^0$ (ii) $Z^0 = y^0$

Example 1: In the diagram below, find the angle marked x.



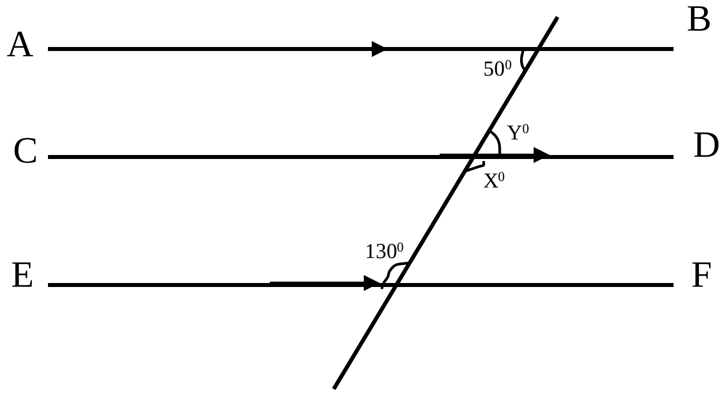

**Solution**

Angles <PQB and <QPC are alternate angles and< PQB = $40^0$ <QPC = X

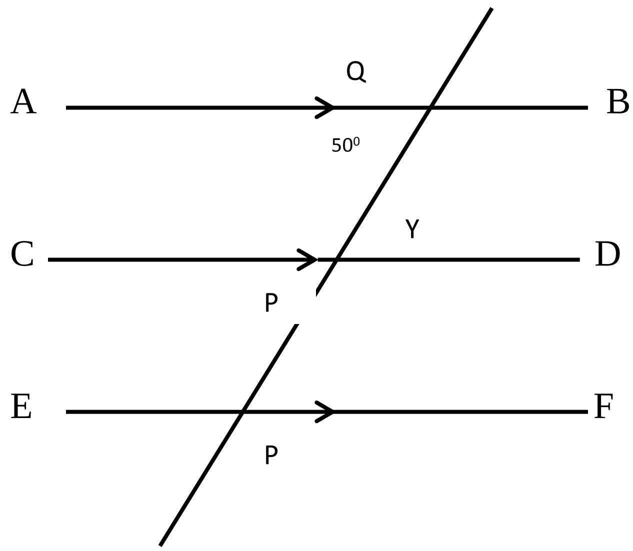
$\longrightarrow$ <QPC = <PQB (alternate angles are equal).

Hence, X = $40^0$

2. Find each of the marked angles in this diagram below



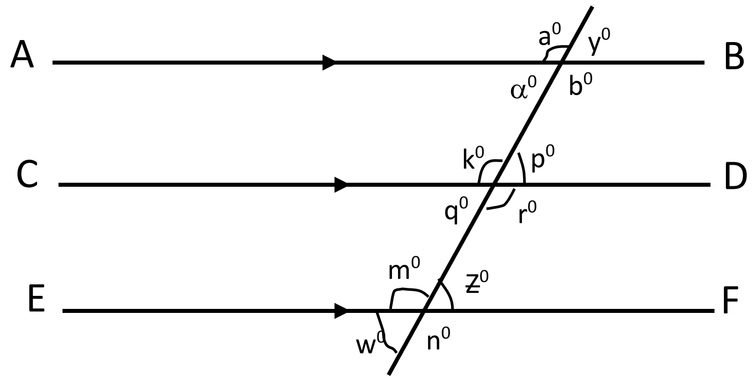
Example 2: In the diagram below, find the angle marked x.




**Solution**

(i) y= $50^0$ (alternate angles are equal) (ii) x = $130^0$ (same reason)

2. **Vertically Opposite Angles:** two angles are said to be vertically opposite if they are formed opposite each other at the point where the two lines intersect, (whether the two lines are parallel or not). Vertically opposite angles are equal.




From the diagram above, the following pairs of angles are vertically opposite.

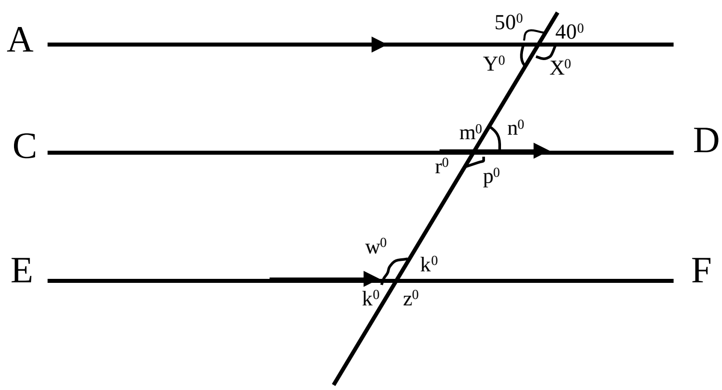
(i) $a^0$ and $b^0$ (iv) $p^0$and $q^0$
(ii) $x^0$ and $y^0$ (v) $m^0$ and $n^0$
(iii) $k^0$ and $r^0$ (vi) $w^0$ and $z^0$

since vertically opposite angles are always equal, it follows that:

(iv) $a^0 = b^0$ (iv) $p^0= q^0$
(v) $x^0 = y^0$ (v) $m^0 = n^0$
(vi) $k^0 = r^0$ (vi) $w^0 = z^0$

Example:

Find each of the marked angles in the diagram blow.




NB: Always remember that alternate angles are equal and apply it where appropriate.

From the diagram above.

(i) $x= 50^0$

(Vertically opposite angles are equal)

$y = 40^0$

(ii) ) $x= m^0$

(alternate angles are equal)

$y = n^0$

Hence, $m = 50^0$ and $n= 40^0$

Also,

(iii) $m^0 = p^0$ (Vertically opposite angles are equal)

$n^0 = r^0$

Hence, $p = 50^0$ and $r = 40^0$

(iv) $p^0 = w^0$ (Alternate angles are equal)

$r^0 = L^0$

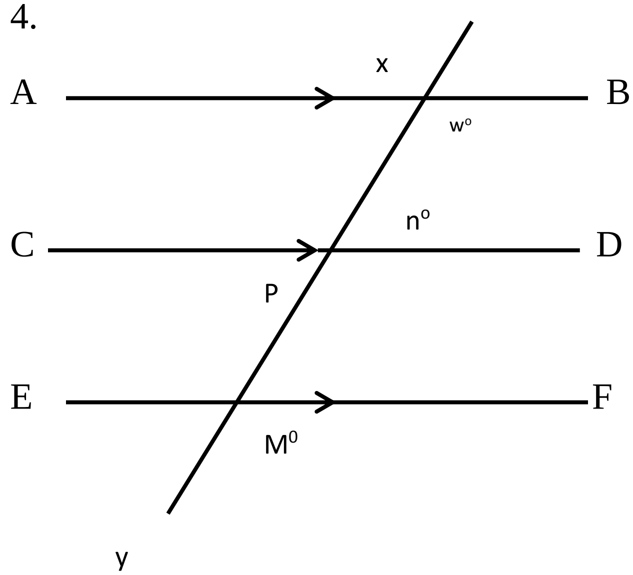
Hence, $w = 50^0$ and $L = 40^0$

(v) $w^0 = z^0$ (Vertically opposite angles are equal)

$L^0 = k^0$

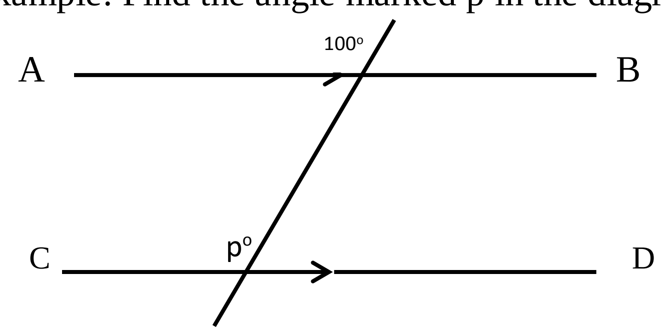
Hence, $z = 50^0$ and $k = 40^0$

3. **Corresponding Angles**: Angles on a similar position are called corresponding angles, and corresponding angles are equal.
4.




Hence, $x^{0\ v} = k^0 = y^0$ and $w^0 = n^0 = m^0$

Example: Find the angle marked p in the diagram below.



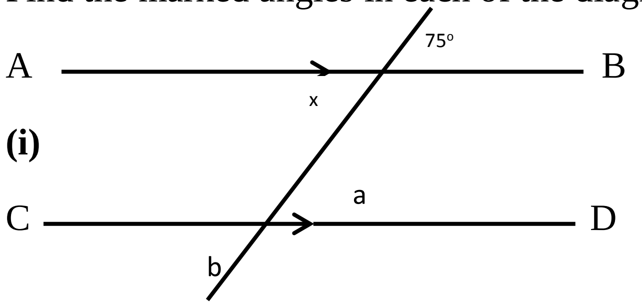
**Solution**

P = 100$^0$ (corresponding angles are equal).

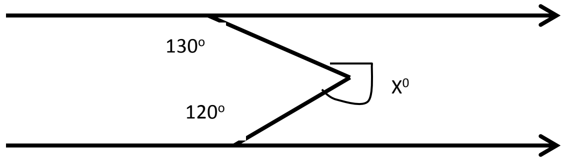
General Examples:

Find the marked angles in each of the diagram below.

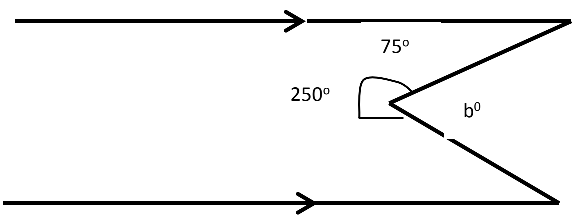
**(i)**




(ii)




(iii)



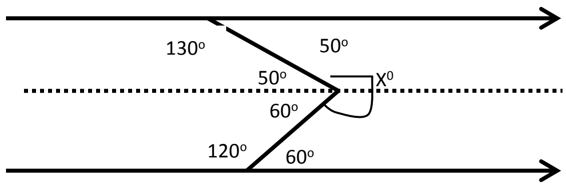

## Solution

(i) $x^0 = 75^0$ (Vertically opposite angles )

$x^0 = a^0$ (Alternate angles are equal)

Hence, $a = 75^0$ and $b = 75^0$

To solve number (ii) we re-draw the diagram, as show below.




Recall the following points:

(i) Sum of the angles on a straight line is equal to $180^0$

(ii) Sum of the angles at a point equals $360^0$

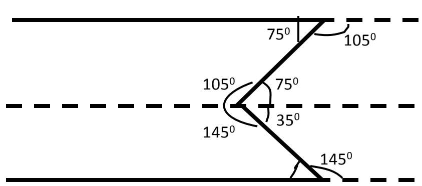
Hence, 50 + 60 + x = 360 (sum of the angles at a point)

$110 + x = 360$

$X = 360 – 110$

$X = 250^0$

(iii) Also we re-draw the diagram as shown below.

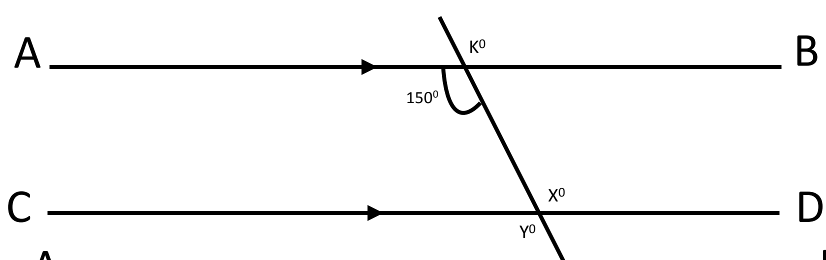



Hence, $b = 35 + 75 = 110^0$

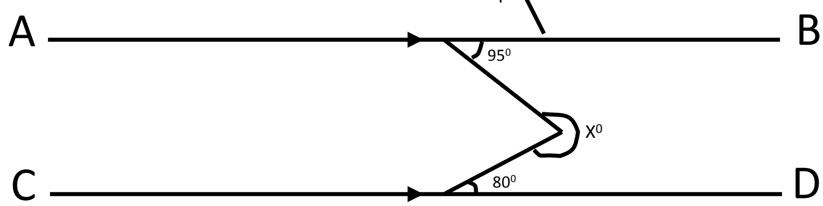
Evaluation

1. Solve for each of the following marked angles in the diagram below

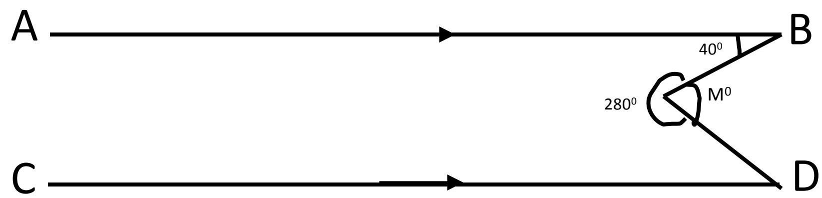
i.




ii.

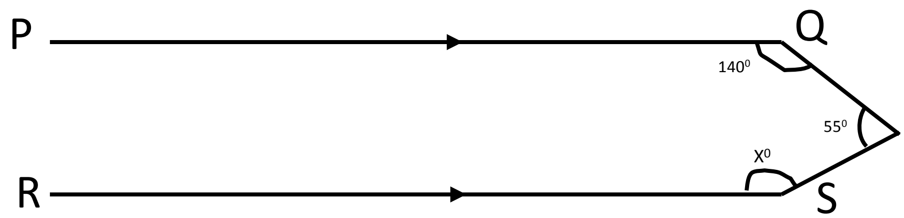


2. Find the angle marked m in the diagram below




Assignment

1. In the diagram lines PQ and RS are parallel. Find X.




2. Given that $(y-30)^0$ and $(50-4y)$ are two corresponding angles. Find the value of y.