

## 2.2 Parallel Lines & Transversals

## Old Complementary & Supplementary Angles

- Complementary Angles sum to  $90^\circ$
- Supplementary Angles sum to  $180^\circ$ .

[Example] Find the missing angle.

$$\begin{array}{l} 3x-11 \rightarrow 100^\circ \\ 2x+6 \rightarrow 80^\circ \end{array}$$

$$3x-11+2x+6=180$$

$$5x-5=180$$

$$5x-5=180$$

$$+5 = +5$$

$$\frac{5x}{5} = \frac{185}{5}$$

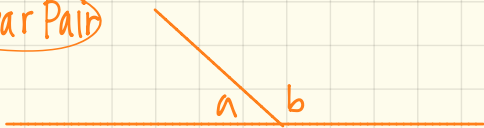
$$x = 37$$

$$3(37)-11 = 100^\circ$$

$$2(37)+6 = 80^\circ$$

Let's recall the definition of linear pair.

Linear Pair



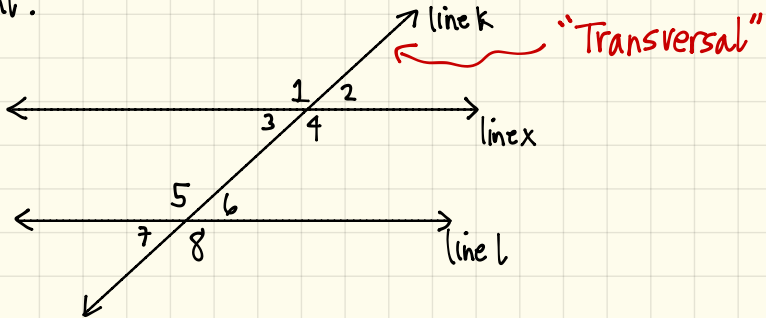
$$a+b=180$$

So,  $100^\circ$  and  $80^\circ$  are a linear pair because of the straight angle.

# Parallel Lines & Transversals

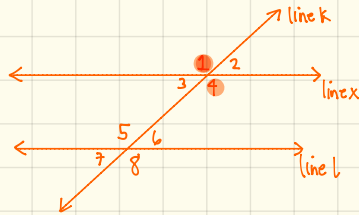
## 1 Congruent Angles

Let's consider the diagram below. Notate all the angles that are congruent.



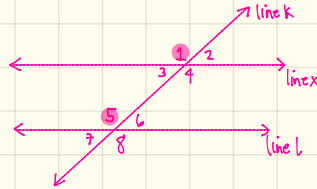
### a Vertical Angles

$$\begin{aligned} \angle 1 &= \angle 4 & \angle 2 &= \angle 3 \\ \angle 5 &= \angle 8 & \angle 6 &= \angle 7 \end{aligned}$$



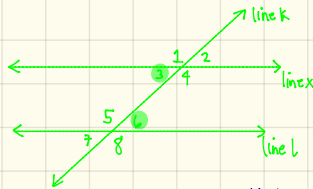
### b Corresponding Angles

$$\begin{aligned} \angle 1 &= \angle 5 & \angle 3 &= \angle 7 \\ \angle 2 &= \angle 6 & \angle 4 &= \angle 8 \end{aligned}$$



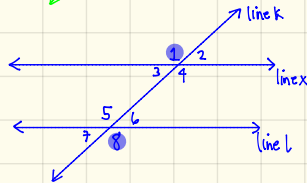
### c Alternate Interior Angles

$$\begin{aligned} \angle 3 &= \angle 6 & \angle 4 &= \angle 5 \end{aligned}$$



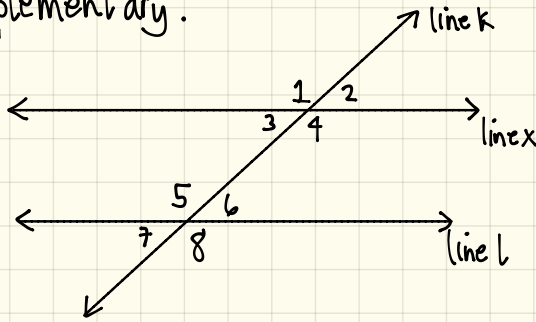
### d Alternate Exterior Angles

$$\begin{aligned} \angle 1 &= \angle 8 & \angle 2 &= \angle 7 \end{aligned}$$



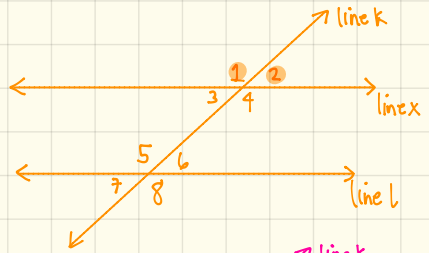
## 2 Supplementary Angles

Let's consider the diagram below. Note all the angles that are supplementary.



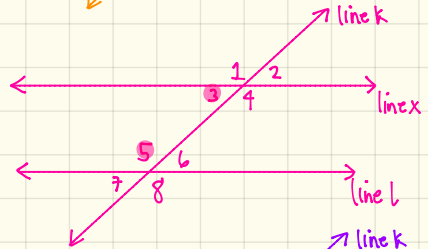
### a) Linear Pair

$$\begin{aligned} \angle 1 + \angle 2 &= 180^\circ & \angle 3 + \angle 4 &= 180^\circ \\ \angle 1 + \angle 3 &= 180^\circ & \angle 2 + \angle 4 &= 180^\circ \\ \angle 5 + \angle 6 &= 180^\circ & \angle 5 + \angle 7 &= 180^\circ \\ \angle 6 + \angle 8 &= 180^\circ & \angle 7 + \angle 8 &= 180^\circ \end{aligned}$$



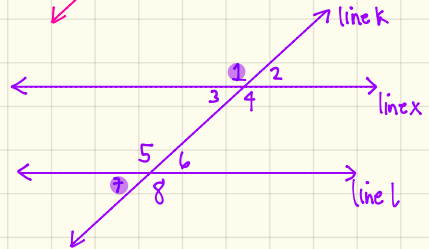
### b) Same Side Interior Angles

$$\angle 3 + \angle 5 = 180^\circ \quad \angle 4 + \angle 6 = 180^\circ$$



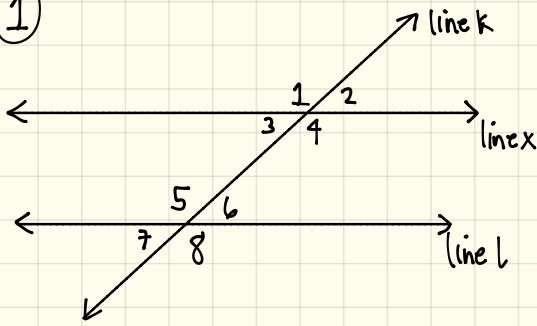
### c) Same Side Exterior Angles

$$\angle 1 + \angle 7 = 180^\circ \quad \angle 2 + \angle 8 = 180^\circ$$



[Examples] Find the missing angles.

①

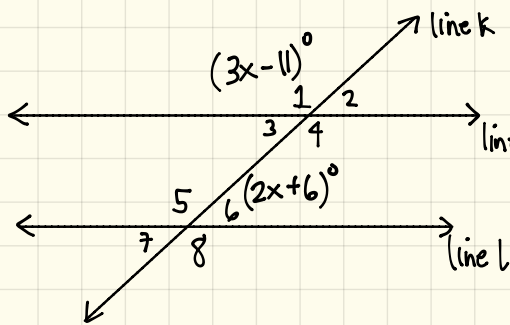


Given  $\angle 6 = 100^\circ$ .

- $\angle 1 = 80^\circ$
- $\angle 2 = 100^\circ \rightarrow$  congruent (corresponding)
- $\angle 3 = 100^\circ \rightarrow$  congruent (alternate interior)
- $\angle 4 = 80^\circ \rightarrow$  supplementary (same side interior)

- $\angle 5 = 80^\circ \rightarrow$  supplementary (linear pair)
- $\angle 6 = 100^\circ \rightarrow$  given
- $\angle 7 = 100^\circ \rightarrow$  congruent (vertical)
- $\angle 8 = 80^\circ \rightarrow$  supplementary (linear pair)

②



Given  $\angle 1 = (3x-11)^\circ$   
 $\angle 6 = (2x+6)^\circ$

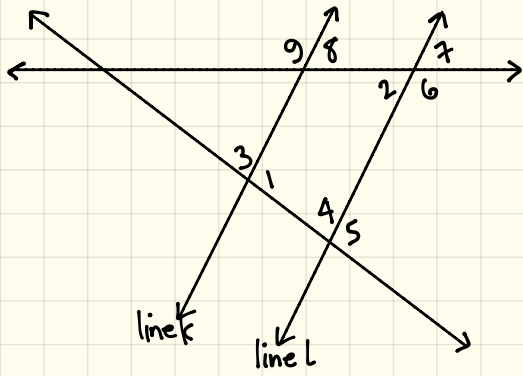
$$\begin{aligned}
 3x-11+2x+6 &= 180^\circ & 3(37)-11 &= 100^\circ \\
 5x-5 &= 180^\circ & 2(37)+6 &= 80^\circ \\
 +5 &= +5 \\
 \hline
 5x &= 185 \\
 \frac{5x}{5} &= \frac{185}{5} \\
 x &= 37
 \end{aligned}$$

Using  $\angle 1$

- $\angle 1 = 100^\circ \rightarrow$  given
- $\angle 2 = 80^\circ \rightarrow$  supplementary (linear pair)
- $\angle 3 = 80^\circ \rightarrow$  supplementary (linear pair)
- $\angle 4 = 100^\circ \rightarrow$  congruent (vertical)

- $\angle 5 = 100^\circ \rightarrow$  congruent (corresponding)
- $\angle 6 = 80^\circ \rightarrow$  given
- $\angle 7 = 80^\circ \rightarrow$  supplementary (same side)
- $\angle 8 = 100^\circ \rightarrow$  congruent (alternate ext.)

③ Given  $k \parallel l$ ,  $m \angle 1 = 78^\circ$  &  $\angle 2 = 47^\circ$ . Find the missing angles.



$\angle 1 = 78^\circ \rightarrow$  given

$\angle 2 = 47^\circ \rightarrow$  given

$\angle 3 = 102^\circ \rightarrow$  supplementary (linear pair to  $\angle 1$ )

$\angle 4 = 102^\circ \rightarrow$  supplementary (same side to  $\angle 1$ )

$\angle 5 = 78^\circ \rightarrow$  congruent (corresponding to  $\angle 1$ )

$\angle 6 = 133^\circ \rightarrow$  supplementary (linear pair to  $\angle 2$ )

$\angle 7 = 47^\circ \rightarrow$  congruent (vertical to  $\angle 2$ )

$\angle 8 = 47^\circ \rightarrow$  congruent (corresponding to  $\angle 2$ )

$\angle 9 = 133^\circ \rightarrow$  supplementary (same side to  $\angle 7$ )