Unit 7: Properties of Parallelograms

A *parallelogram* is a quadrilateral whose opposite sides are parallel.

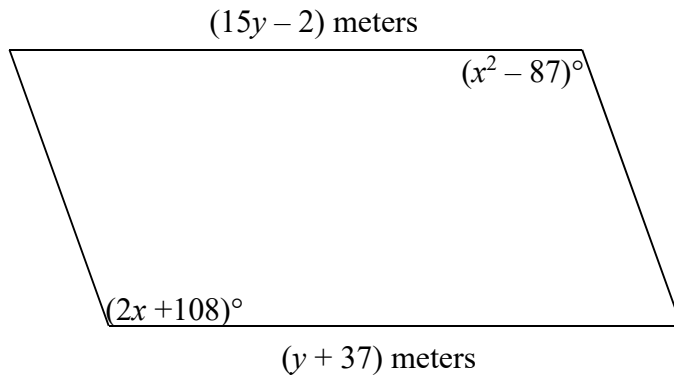The following theorems apply to all parallelograms:
- If a quadrilateral is a parallelogram, then its **opposite sides** are **congruent**.
- If a quadrilateral is a parallelogram, then its **opposite angles** are **congruent**.
- If a quadrilateral is a parallelogram, then its **consecutive (or same-side interior) angles** are supplementary.
- If a quadrilateral is a parallelogram, then its **diagonals bisect each other**.

EX 1) In parallelogram *KLMN* below, points *O, P, Q, R* are midpoints of $\overline{XN}$, $\overline{XK}$, $\overline{XL}$, and $\overline{XM}$, $\angle NKL = 61°$ and $\angle NLK = 68.3°$. Find the indicated measures.
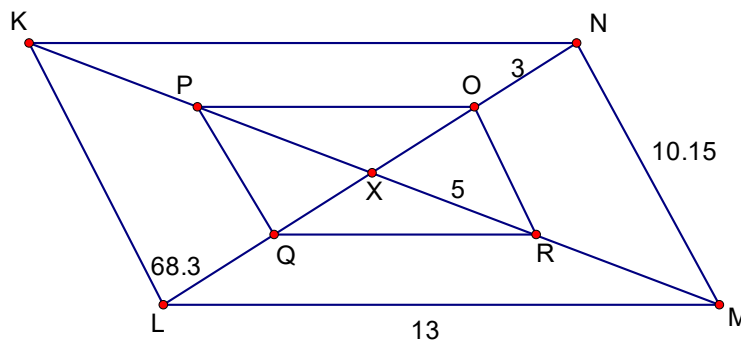
a) *KN* =	b) *PX* =	c) *KL* =
d) *XN* =	e) *LN* =	f) *KP* =
g) *KR* =	h) $m\angle MNL =$	i) $m\angle NLM =$
j) $m\angle NML =$	k) $m\angle XQP =$	l) Perimeter of *KLMN* =

EX 2) Solve for *x* and *y* in the parallelogram below.

$(15y - 2)$ meters

$(x^2 - 87)°$

$(2x + 108)°$

$(y + 37)$ meters

7-2: Properties of Parallelograms

In order to prove that a quadrilateral is a parallelogram, you can show that *both* pairs of opposite sides are parallel (since this is the definition of a parallelogram).

In addition, you can prove a quadrilateral is a parallelogram any of the following ways:

- If the **opposite sides** of a quadrilateral are **congruent**, then it is a parallelogram.
- If the **opposite angles** of a quadrilateral are **congruent**, then it is a parallelogram.
- If the **consecutive angles** of a quadrilateral are **supplementary**, then it is a parallelogram.
- If the **diagonals** of a quadrilateral **bisect each other**, then it is a parallelogram.
- If *one* pair of **opposite sides** are **parallel** and **congruent**, then the quadrilateral is a parallelogram.

3)   For each of the figures below, which **MUST** be parallelograms. If it is a parallelogram, write the reason why it is. If it is not, explain why not.

a)

10 cm

12 cm

12 cm

10 cm

b)

14 m

15 m

c)
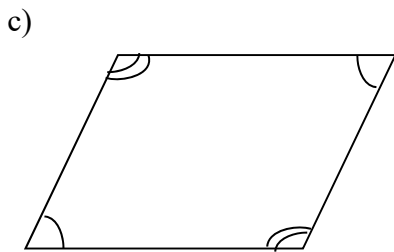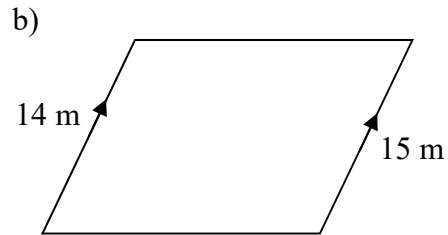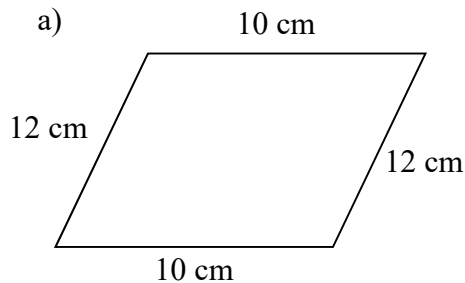
EX 4) Prove that quadrilateral *ABCD* below is a parallelogram. There are 3 different ways to attack this coordinate proof, so find one that works best for you.

- Method 1: Show that opposite sides are parallel (have the same slope).
- Method 2: Show that opposite sides are congruent (have the same length).
- Method 3: Show that *one* pair of opposite sides is congruent and parallel.