<u>Module 13b: Proofs about Parallelograms</u>

Math Practice(s):
   -Model with mathematics.
   -Attend to precision.

Learning Target(s):
   -Prove & apply properties of parallelograms.

Homework:
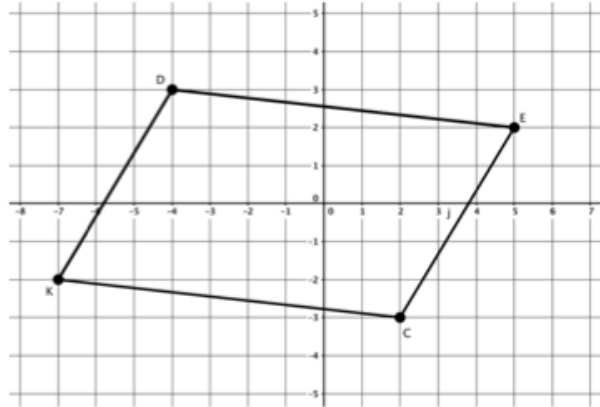   HW#15: 13b #1-9

Warm-up

1. Determine the slope of each side of parallelogram DECK shown in the coordinate plane below.

$$m_{DE} = -\frac{1}{9}$$

$$m_{EC} = \frac{5}{3}$$

$$m_{CK} = -\frac{1}{9}$$

$$m_{KD} = \frac{5}{3}$$

2. Analyze all four slopes you determined in question 1 (above). What do the slope values tell us about the sides of parallelogram DECK?

   The two sides that have the same slope are parallel.

3. Complete the following tasks using the coordinate plane provided below.

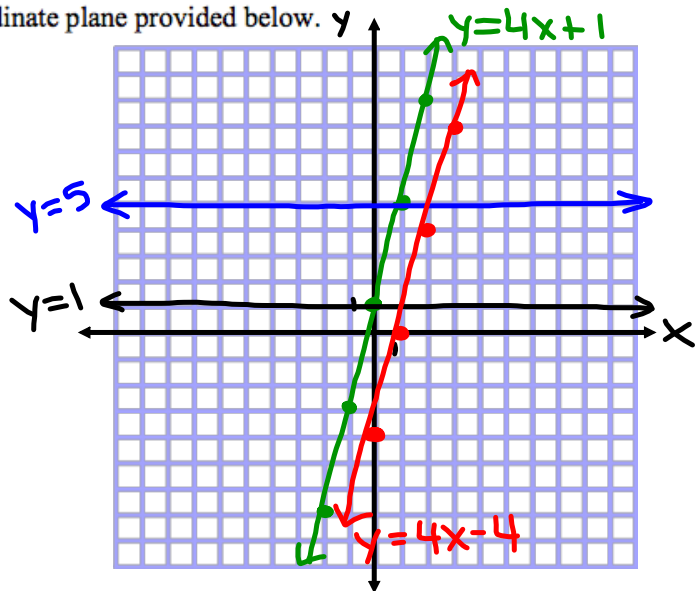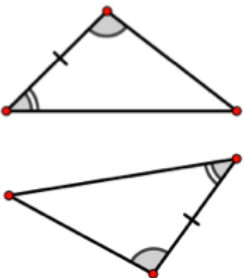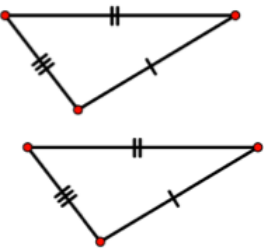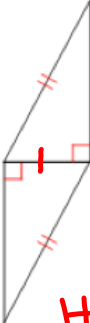   A. Graph the following lines:

   $y = 4x + 1$

   $y = 5$

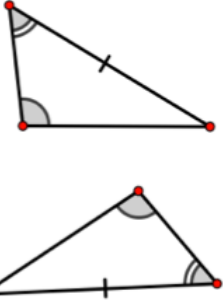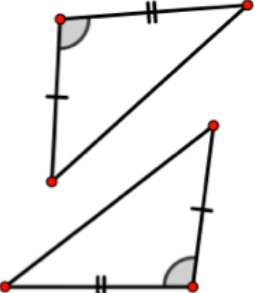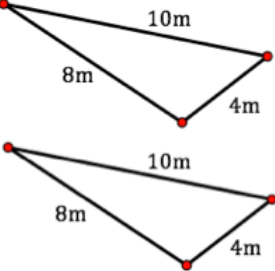   B. Show the graphs of TWO additional lines that will form a parallelogram with the two lines you already graphed. $y = 1$
   $y = 4x - 4$

   C. Determine the equation of both lines that you drew for question B (above).

   $y = 4x + 1$
   $y = 5$
   $y = 1$
   $y = 4x - 4$

First, let's recall the **Triangle Congruence Theorems.**

A.	B.	C.
ASA	**SSS**	**HL**

D.	E.	F.
AAS	**SAS**	10m, 8m, 4m / 10m, 8m, 4m **SSS**

Next, let's recall the **Parallel Postulate** and its consequences.

(erase to show)

If __2__ pairs of __||__ lines are cut by a
_____**transversal**_____,

then the _____**same-side**_____
_____**interior**_____ angles are **supp.**
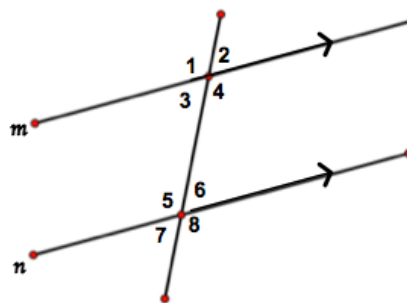
Example 1:

Given: ABCD is a parallelogram

Prove: $\overline{BC} \cong \overline{DA}$

(Opp. sides ≅)

Part	Statement	Reasons
I	· ABCD is a ▱	· Given
II	$\overline{AB} \| \overline{CD}$ & $\overline{BC} \| \overline{DA}$	· Def. of ▱
	· $\overline{BD} \cong \overline{DB}$	· Reflexive Prop.
	· ∠CBD ≅ ∠ADB ∠CDB ≅ ∠ABD	· Alt int ∠s ≅
	· △CBD ≅ △ADB	· ASA
III	· $\overline{BC} \cong \overline{DA}$	· CPCTC

Example 2:

Given: ABCD is a parallelogram

Prove: $\angle D \cong \angle B$

(Opp. $\angle$s $\cong$)

Part	Statement	Reasons
I	• ABCD is ▱	• Given
II	• $\overline{AB} \| \overline{CD}$ & $\overline{BC} \| \overline{DA}$	• Def. of ▱
	• $\overline{AC} \cong \overline{CA}$	• Reflexive Prop.
	• $\angle BCA \cong \angle DAC$ $\angle ACD \cong \angle CAB$	• Alt. Int $\angle$s $\cong$
	• $\triangle ABC \cong \triangle CDA$	• ASA
III	• $\angle D \cong \angle B$	• CPCTC

Feb 22-9:56 AM

Example 3:

Given: ABCD is a parallelogram

Prove: $\overline{CE} \cong \overline{AE}$ and $\overline{DE} \cong \overline{BE}$
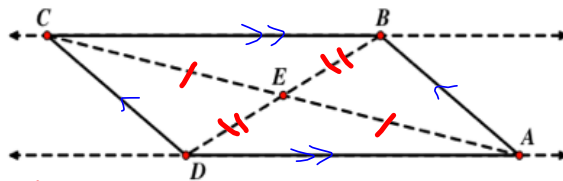
(Diagonals bisect each other)

Part	Statement	Reasons
I	· ABCD is ▱	· Given
II	· $\overline{AB} \parallel \overline{CD}$ & $\overline{BC} \parallel \overline{DA}$ · $\angle CBD \cong \angle ADB$ $\angle CDB \cong \angle ABD$ · $\overline{DB} \cong \overline{BD}$ $\overline{AC} \cong \overline{CA}$ · $\triangle BCD \cong \triangle DAB$ $\triangle ACD \cong \triangle CAB$	· Def. of ▱ · Alt. Int ∠'s $\cong$ · Reflexive Prop. · ASA
III	· $\overline{CE} \cong \overline{AE}$ & $\overline{DE} \cong \overline{BE}$	· CPCTC

Feb 22-9:56 AM

Summarizing what proved about parallelograms: (erase to show)

A parallelogram is a ___quadrilateral___ with ___2___ pairs of ___||___ sides.

Opposite sides of a parallelogram are ___≅___ .

Opposite angles of a parallelogram are ___≅___ .

Consecutive angles of a parallelogram are ___supplementary___ .

Diagonals of a parallelogram ___bisect___ each other.

Practice

1. The diagonals of parallelogram CHEK, intersect at point M. If $HK = 42\ cm$ and $CE = 45\ cm$ determine the lengths of the following segments:
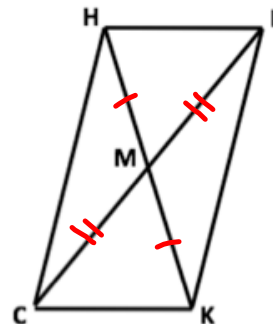
   (Diagonals of ▱ bisect each other)

   A. $KM =$ ___21 cm___ $42 \div 2$

   B. $MH =$ ___21 cm___ $42 \div 2$

   C. $ME =$ ___22.5 cm___ $45 \div 2$

   D. $CM =$ ___22.5 cm___ $45 \div 2$

2. The diagonals of parallelogram JKBH, intersect at point C. Determine the lengths of both diagonals, given following information: (Diag. bisect each other)

- $CJ = 9.5$ inches

- $CH = 3x - 1$

- $CK = 19 - 2x$
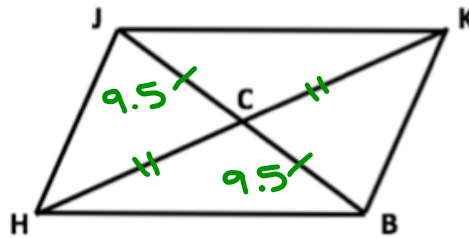
$$JC + BC = JB$$
$$2(9.5) = JB$$
$$\boxed{JB = 19 \text{ in}}$$

$$CH = CK$$
$$3x - 1 = 19 - 2x$$
$$5x = 20$$
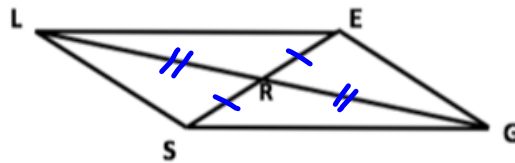$$X = 4$$

$$CH = 3(4) - 1$$
$$= 12 - 1$$
$$= 11$$
$$\boxed{HK = 22 \text{ in}}$$

3. The diagonals of parallelogram LEGS, intersect at point R. Determine the lengths of both diagonals, given following information:

- $LR = x + 9$

- $GR = \frac{3}{4}x + 11$

- $RS = 45 - 3x$

$$LR = GR$$
$$x + 9 = \frac{3}{4}X + 11$$
$$\frac{1}{4}X = 2$$
$$X = 8$$

$$LR = (8) + 9$$
$$= 17$$
$$\boxed{LG = 34 \text{ units}}$$

$$RS = 45 - 3(8)$$
$$= 45 - 24$$
$$= 21$$
$$\boxed{ES = 42 \text{ units}}$$

Feb 22-9:57 AM