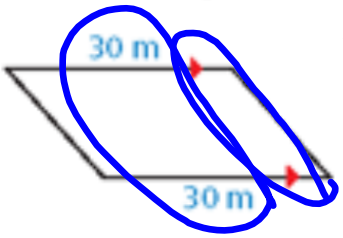
Ways to Prove a Quadrilateral Is a Parallelogram

1. Show that both pairs of opposite sides are parallel (definition)	Show slopes are same
2. Show that both pairs of opposite sides are congruent (parallelogram opposite sides converse)	show lengths are equal
3. Show that both pairs of opposite angles are congruent (parallelogram Opposite Angles Converse)	
4. Show that one pair of opposite sides are both congruent and parallel (Opposite sides parallel congruent theorem)	pick one set of sides find slope + length
5. Show that the diagonals bisect each other (parallelgoram diagonals Converse)	Show midpoint for the diagonals is the same

Proving it's a Parallelogram

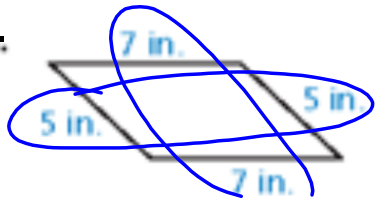
State the theorem you can use to show that the quadrilateral is a parallelogram.

4.



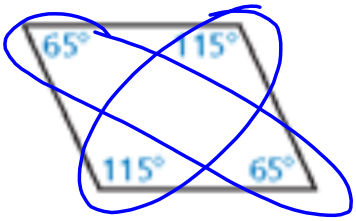
Opposite sides are parallel and congruent Theorem

5.



Parallelogram opposite sides congruent Converse

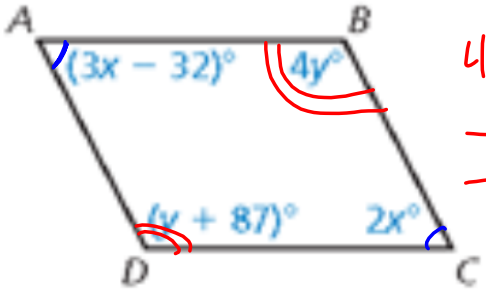
6.



Opposite angles Congruent Converse Thm

7.

For what values of x and y is quadrilateral $ABCD$ a parallelogram? Explain your reasoning.



$3x - 32 = 2x$

$-3x \quad -3x$

$-32 = -x$

$\frac{-32}{-1} = \frac{-x}{-1}$

$32 = x$

$4y = y + 87$

$-y \quad -y$

$3y = 87$

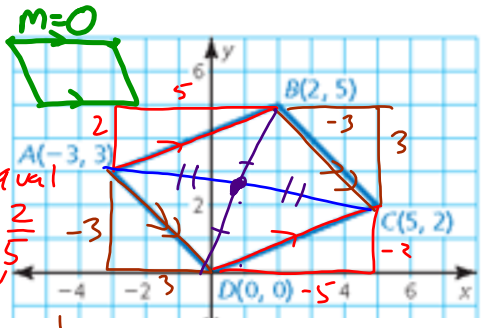
$\frac{3y}{3} = \frac{87}{3}$

$y = 29$

If $x = 32$ and $y = 29$, then Opposite angles are congruent and this is a parallelogram.

8.

Show that quadrilateral $ABCD$ is a parallelogram.



Method 1

Find opposite slopes are equal

$m_{AB} = \frac{\text{rise}}{\text{run}} = \frac{2}{5}$ $\quad m_{DC} = \frac{-2}{-5} = \frac{2}{5}$

$m_{AD} = \frac{\text{rise}}{\text{run}} = \frac{-3}{3} = -1$ $\quad m_{BC} = \frac{3}{-3} = -1$

Since opposite sides have the same slope, they are parallel and this is a parallelogram

Method 2

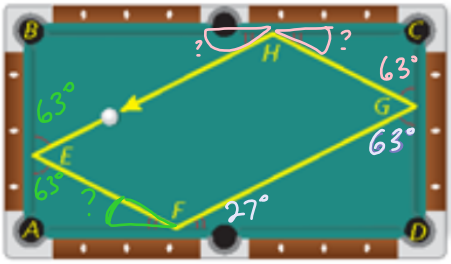
Show midpoints of diagonals are the same

$\text{Midpt}_{AC}\left(\frac{-3+5}{2}, \frac{3+2}{2}\right)$ $\quad \text{Midpt}_{BD}\left(\frac{2+0}{2}, \frac{5+0}{2}\right)$

$(1, 2.5)$ $\quad (1, 2.5)$

Since both diagonals are broken up into 2 equal parts by the same point they bisect eachother, and this is a parallelogram

9. **MODELING WITH MATHEMATICS** You shoot a pool ball, and it rolls back to where it started, as shown in the diagram. The ball bounces off each wall at the same angle at which it hits the wall.



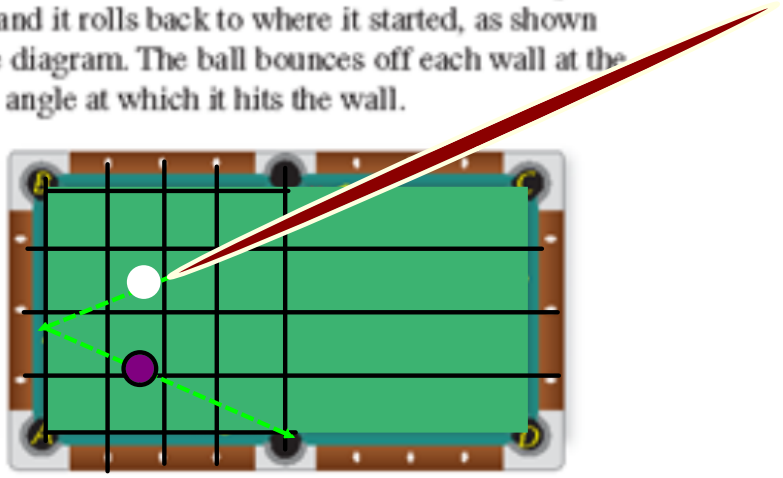
a. The ball hits the first wall at an angle of 63°. So $m\angle AEF = m\angle BEH = 63°$. What is $m\angle AFE$? Explain your reasoning. $90 = 63 + m\angle AFE \rightarrow m\angle AFE = 27°$

b. Explain why $m\angle FGD = 63°$. If $m\angle AFE = 27°$ and the ball bounces off at the same angle, then $m\angle DFG = 27°$ and $90 = 27 + m\angle FGD \rightarrow m\angle FGD = 63°$

c. What is $m\angle GHC$? $m\angle EHB$? $m\angle GHC = m\angle EHB = 27°$

d. Is quadrilateral $EFGH$ a parallelogram? Explain your reasoning. Quadrilateral EFGH is a parallelogram because $\angle E \cong \angle G$, they are the missing angle to the straight lines created by the same 2 adjacent angles and $\angle F \cong \angle H$ for the same reason. So both pairs of opposite angles are congruent $\therefore$ EFGH is a parallelogram.

9. **MODELING WITH MATHEMATICS** You shoot a pool ball, and it rolls back to where it started, as shown in the diagram. The ball bounces off each wall at the same angle at which it hits the wall.



How can you hit the cue ball so that the purple ball will go into a pocket?

Homework
Day 1: 7.2 p.372 #4,6,8,9-20, (Assigned)

Day 2: 7.3 pg. 381 # 3-16 (Assigned)

Day 3:
7.2 pg. 372 # 28-30 (Assigned)
#32,34,40,42,45 (Extra Challenge)
7.2 pg. 381 # 17-20 (Assigned)
#21-24, 29 (Extra Challenge)