- Mr. Bo
Day 4 Notes

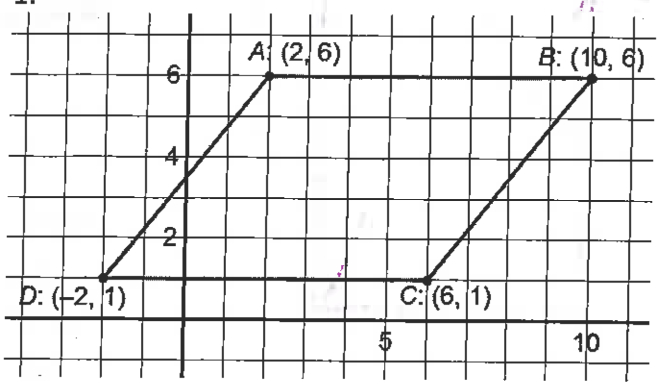
Name________________________
Date____________________

Parallelograms

Parallelograms:

A **Parallelogram** is a *quadrilateral* (4 sided shape) with 2 pairs of parallel sides.

1.



a. To prove quadrilateral ABCD is a parallelogram, you need to first show $\overline{AB} // \overline{DC}$. Based on the picture, how do you know that $\overline{AB} // \overline{DC}$? Explain your reasoning.

$\overline{AB}$ and $\overline{DC}$ are horizontal lines and horizontal lines are always parallel.

b. You will also need to show $\overline{DA} // \overline{CB}$. This can't be assumed from the picture. Why? What will you need to show as evidence that $\overline{DA} // \overline{CB}$? Explain your reasoning.

$\overline{DA} // \overline{CB}$ can't be assumed because they are not vertical or horizontal lines. they may or may not be parallel.

I can show that their slopes are equal as evidence to show they are parallel.

c. Prove quadrilateral ABCD is a parallelogram.

$\overline{AB} // \overline{DC}$ because they are both horizontal.

Slope $\overline{AD} = \dfrac{6-1}{2--2} = \dfrac{5}{4}$

Slope $\overline{CB} = \dfrac{6-1}{10-6} = \dfrac{5}{4}$

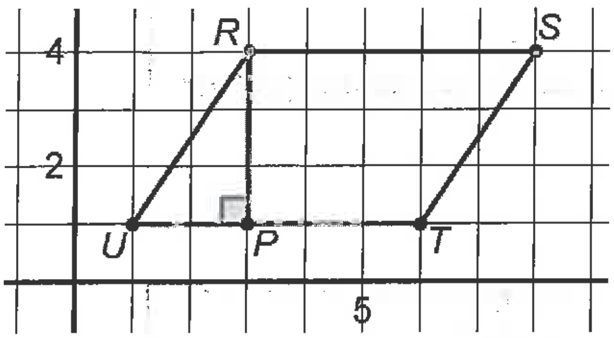
$\overline{AD} // \overline{CB}$ because they have equal slopes.

Quad. ABCD is a parallelogram because it has 2 pairs of parallel sides.

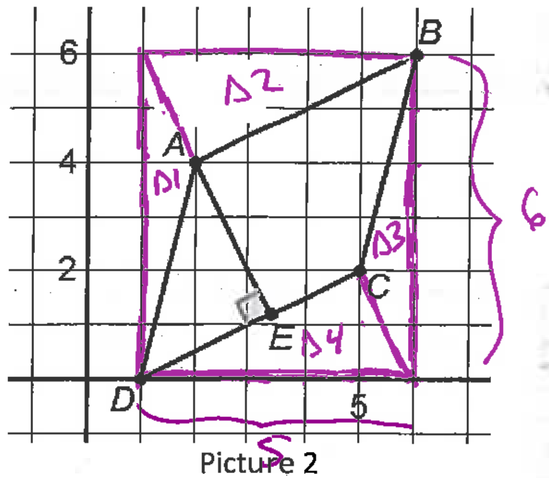
Parallelogram Perimeter and Area:

The area of a parallelogram: $A = bh$ where b is the base and h is the height.

The **height** (or *Altitude*) of a parallelogram is a segment drawn from a vertex of the parallelogram perpendicular to a point on the side opposite the vertex. Altitudes $\overline{RP}$ and $\overline{AE}$ have been drawn in each of the parallelograms pictured below.



Picture 1



Picture 2

2. Find the area of parallelograms RSTU and ABCD.

height RP = 3
base UT = 5

Area //-ogram RSTU
= (3)(5)
= 15 sq. units.

height AE is not easily found because I don't know the point E.

I'll use the box method instead.

Area box = (5)(6) = 30

Area Δ1 = $\frac{1}{2}$(6)(1) = 3

Δ2 = $\frac{1}{2}$(5)(2) = 5

Δ3 = $\frac{1}{2}$(6)(1) = 3

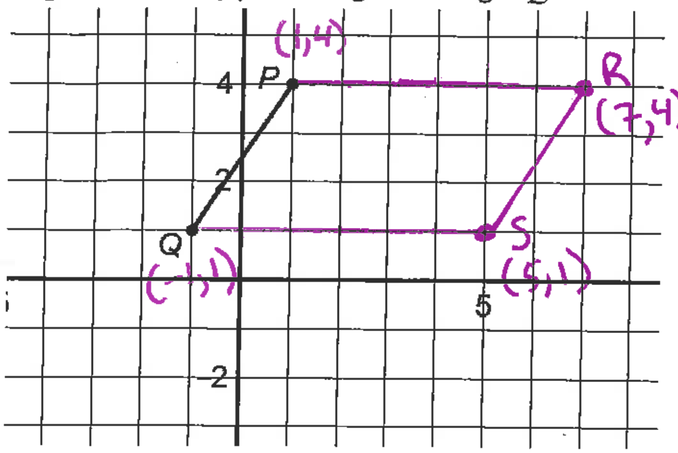
Δ4 = $\frac{1}{2}$(5)(2) = 5

Area //-ogram ABCD = 30 - (3+5+3+5)
= 14 sq. units.

Other Parallelogram Properties:

Parallelograms have a variety of other useful properties. Let's look at two of them.

3. On the grid, draw any parallelogram using $\overline{PQ}$ as one of its sides.



//-ogram PRSQ

4. How do you know your quadrilateral is a parallelogram? Explain your reasoning.

I know $\overline{PR} \parallel \overline{QS}$ because they are both horizontal lines.

I know $\overline{PQ} \parallel \overline{RS}$ because I used the slope of $\overline{PQ} = \frac{3}{2}$ to make $\overline{RS}$ have the same slope.

5. ***"The opposite sides of a parallelogram are congruent."***
Prove this parallelogram property is true using your parallelogram.

$$\left.\begin{array}{l} PR = 6 \\ QS = 6 \end{array}\right\} \overline{PR} \cong \overline{QS}$$

$$PQ = \sqrt{(1--1)^2 + (4-1)^2} = \sqrt{2^2+3^2} = \sqrt{13}$$

$$RS = \sqrt{(7-5)^2+(4-1)^2} = \sqrt{2^2+3^2} = \sqrt{13}$$

So, $\overline{PQ} \cong \overline{RS}$

the opposite sides of //-ogram PQRS are $\cong$ because they are the same length.

4. ***"The diagonals of a parallelogram bisect each other."***
Prove this property is true using your parallelogram. *(Hint: To bisect a segment means to cut through its midpoint.)*

midpoint of Diagonal $\overline{PS} = \left(\frac{1+5}{2}, \frac{4+1}{2}\right) = (3, 2.5)$

midpoint of Diagonal $\overline{RQ} = \left(\frac{7+-1}{2}, \frac{4+1}{2}\right) = (3, 2.5)$

Since $\overline{PS}$ and $\overline{RQ}$ have the same midpoint, that means that the bisect each other.