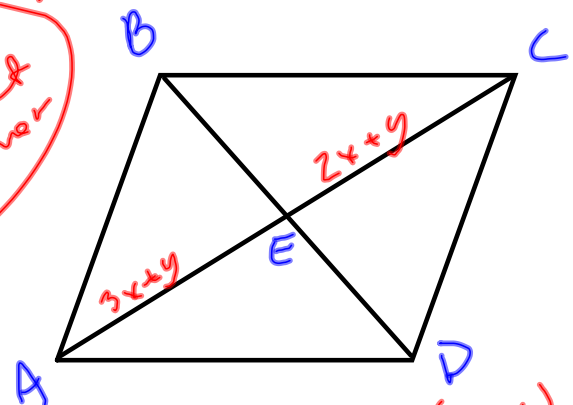


Parallelogram  
 $AE = EC$   
 diagonals bisect each other

$$AC = 4x + 10 = AE + EC$$



$$\begin{array}{r} 3x + y = 2x + y \\ -2x - y \quad -2x - y \\ \hline x = 0 \end{array}$$

$$\begin{array}{r} 4x + 10 = (3x + y) + (2x + y) \\ 4x + 10 = 5x + 2y \\ -5x \quad -5x \\ \hline -x + 10 = 2y \\ \frac{-x}{2} + 5 = y \end{array}$$

$$y = 5$$

Just do it! Draw the Quadrilateral Family Tree...

- Sheet of paper, landscape form.
- Make it big!
- Draw the boxes in the proper shape.
- Shape name inside the box.
- Label shape w/ side and angle  $\cong$  and  $\parallel$  markings.



Just do it! Draw the Quadrilateral Family Tree...

- Circle the Parallelogram family...
- Beside it write the properties of parallelograms we discovered yesterday...



Write out Theorem 6-1 as best you can from memory...state it as a conditional!

Write out Theorem 6-1 as best you can from memory...state it as a conditional

If a shape is a parallelogram

Then ...

Write out Theorem 6-1 as best you can from memory...state it as a conditional

If a shape is a parallelogram

Then opposite sides are  $\cong$ .

Now write out the converse of Theorem 6-1...

Now write out the converse of Theorem 6-1...

If both pair of opposite sides of a quadrilateral are  $\cong$   
Then ...

Now write out the converse of Theorem 6-1...

If both pair of opposite sides of a quadrilateral are  $\cong$

Then ...

Now write out the converse of Theorem 6-1...

If both pair of opposite sides of a quadrilateral are  $\cong$

Then the shape is a parallelogram.

Now write out the converse of Theorem 6-1...

If both pair of opposite sides of a quadrilateral are  $\cong$

Then the shape is a parallelogram.

Don't know what type of quadrilateral it is...  
...just know that opp sides are  $\cong$

The converse of Theorem 6-1...

Conv Thm 6-1: If both pair of opposite sides of a quadrilateral are  $\cong$

Then the shape is a parallelogram.

...and write out the converses of Theorem 6-2 & 6-3...

Conv Thm 6-1: If both pair of opposite sides of a quadrilateral are  $\cong$   
Then the shape is a parallelogram.

Conv Thm 6-2: \_\_\_\_\_  
\_\_\_\_\_

Conv Thm 6-3: \_\_\_\_\_  
\_\_\_\_\_

...and write out the converses of Theorem 6-2 & 6-3...

Conv Thm 6-1: If both pair of opposite sides of a quadrilateral are  $\cong$   
Then the shape is a parallelogram.

Conv Thm 6-2: If both pair of opposite angles of a quadrilateral are  $\cong$   
Then the shape is a parallelogram.

Conv Thm 6-3: \_\_\_\_\_  
\_\_\_\_\_

...and write out the converses of Theorem 6-2 & 6-3...

Conv Thm 6-1: If both pair of opposite sides of a quadrilateral are  $\cong$   
Then the shape is a parallelogram.

Conv Thm 6-2: If both pair of opposite angles of a quadrilateral are  $\cong$   
Then the shape is a parallelogram.

Conv Thm 6-3: If the diagonals of a quadrilateral bisect each other  
Then the shape is a parallelogram.

...and write out the converses of Theorem 6-2 & 6-3...

Conv Thm 6-1: If both pair of opposite sides of a quadrilateral are  $\cong$   
Then the shape is a parallelogram.

Conv Thm 6-2: If both pair of opposite angles of a quadrilateral are  $\cong$   
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Thm 6-1: If both pair of opposite sides of a quadrilateral are  $\cong$   
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Then the shape is a parallelogram.

Thm 6-3: If the diagonals of a quadrilateral bisect each other  
Then the shape is a parallelogram.

The converse parallelogram theorems...

Thm 6-7: If both pair of opposite sides of a quadrilateral are  $\cong$ ...

Thm 6-8: If both pair of opposite angles of a quadrilateral are  $\cong$ ...

Thm 6-5: If the diagonals of a quadrilateral bisect each other...

Then...

The converse parallelogram theorems...

Thm 6-7: If both pair of opposite sides of a quadrilateral are  $\cong$ ...

Thm 6-8: If both pair of opposite angles of a quadrilateral are  $\cong$ ...

Thm 6-5: If the diagonals of a quadrilateral bisect each other...

Then the shape is a parallelogram.

The converse parallelogram theorems...

Thm 6-7: If both pair of opposite sides of a quadrilateral are  $\cong$ ...

Thm 6-8: If both pair of opposite angles of a quadrilateral are  $\cong$ ...

Thm 6-5: If the diagonals of a quadrilateral bisect each other...

Then the shape is a parallelogram.

If we see a quadrilateral w/these characteristics,  
then we know it is a parallelogram.

Two sets of theorems about Parallelograms...

Two sets of theorems about Parallelograms...

It is a parallelogram so...

Is it a parallelogram?

Two sets of theorems about Parallelograms...

It is a parallelogram so...

Thm 6-1

Thm 6-2

Thm 6-3

...so I know...

Is it a parallelogram?

Two sets of theorems about Parallelograms...

It is a parallelogram so...

Thm 6-1

Thm 6-2

Thm 6-3

...so I know...

Is it a parallelogram?

Thm 6-7

Thm 6-8

Thm 6-5

...it is if I see these characteristics...

Two sets of theorems about Parallelograms...

It is a parallelogram so...

Is it a parallelogram?

Thm 6-1  $\leftarrow$  ~~both pair opp sides~~  $\cong$   $\rightarrow$  Thm 6-7

Thm 6-2  $\leftarrow$  ~~both pair opp angles~~  $\cong$   $\rightarrow$  Thm 6-8

Thm 6-3  $\leftarrow$  ~~both pair opp sides~~  $\cong$   $\rightarrow$  Thm 6-5

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Two sets of theorems about Parallelograms...

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Thm 6-3 ~~←--- diags bisect each other ---→~~ Thm 6-5

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Thm 6-3 ~~←--- diags bisect each other ---→~~ Thm 6-5

...so I know...

...it is if I see these characteristics...

Use regular set to justify

statements about  
parallelograms.



Two sets of theorems about Parallelograms...

It is a parallelogram so...

Is it a parallelogram?

Thm 6-1 ~~←--- both pair opp sides  $\cong$  ---→~~ Thm 6-7

Thm 6-2 ~~←--- both pair opp angles  $\cong$  ---→~~ Thm 6-8

Thm 6-3 ~~←--- diags bisect each other ---→~~ Thm 6-5

...so I know...

...it is if I see these characteristics...

Use regular set to justify  
statements about  
parallelograms.

Use converse set to prove  
a quadrilateral is a  
parallelogram.

Now, consider Thm 6-7...

Now, consider Thm 6-7...

To prove that a quad is a parallelogram using Thm 6-7,  
what do we need to demonstrate?

Now, consider Thm 6-7...

To prove that a quad is a parallelogram using Thm 6-7,  
what do we need to demonstrate?

We need to show that both pair of opposite sides are  $\cong$ .

Now, consider Thm 6-7...

To prove that a quad is a parallelogram using Thm 6-7,  
what do we need to demonstrate?

We need to show that both pair of opposite sides are  $\cong$ .

Can we get away with less? Is one set opp sides  $\cong$  sufficient?

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Can we get away with less? Is one set opp sides  $\cong$  sufficient?  
See if you can find a counter-example...

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See if you can find a counter-example...



Nope, one set opp sides  $\cong$  won't do it...

Now, consider Thm 6-7...

To prove that a quad is a parallelogram using Thm 6-7,  
what do we need to demonstrate?

We need to show that both pair of opposite sides are  $\cong$ .

Can we get away with less? Is one set opp sides  $\cong$  sufficient?  
See if you can find a counter-example...



Nope, one set opp sides  $\cong$  won't do it...  
...we need more info that just that...

Now, consider Thm 6-7...

To prove that a quad is a parallelogram using Thm 6-7,  
what do we need to demonstrate?

How about if we had one set  $\cong$  sides that we knew were parallel?

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...I can't! Let's see if we can prove it!

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See if you can find a counter-example...

...I can't! Let's see if we can prove it!

...we want to prove this is a parallelogram...

...which set of parallelogram theorems should we look at?

Now, consider Thm 6-7...

To prove that a quad is a parallelogram using Thm 6-7,  
what do we need to demonstrate?

How about if we had one set  $\cong$  sides that we knew were parallel?

See if you can find a counter-example...

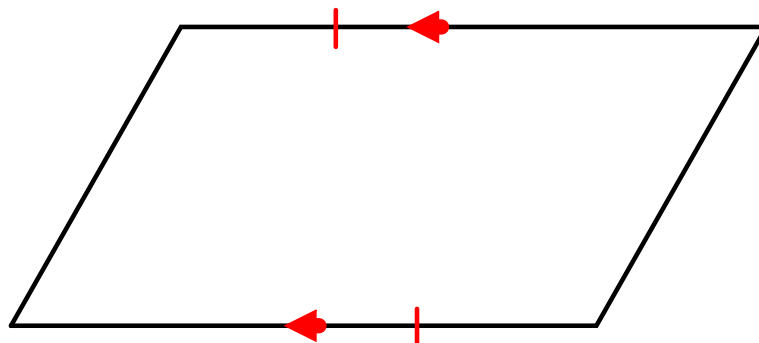
...I can't! Let's see if we can prove it!

...we want to prove this is a parallelogram...

...we need to look at the converse set of theorems.

Proving our conjecture...

Now draw a diagram and mark what we know or can easily determine...

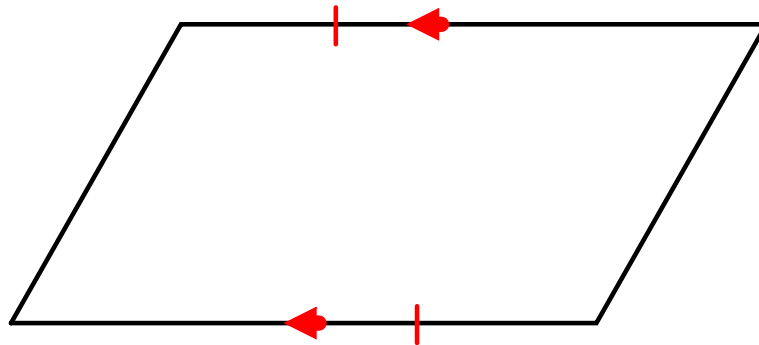




Proving our conjecture...

Now draw a diagram and mark what we know or can easily determine...

Not much to work with...

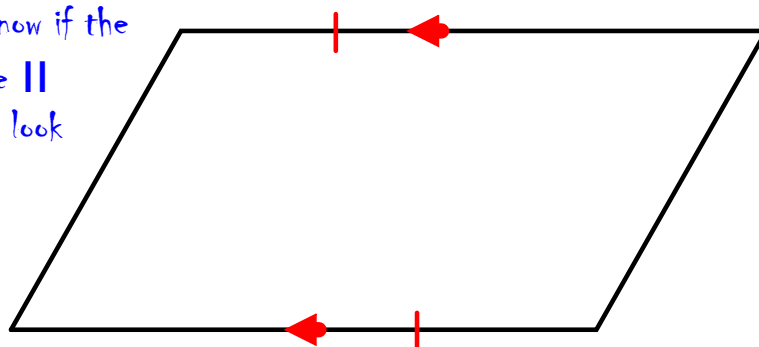


Proving our conjecture...

Now draw a diagram and mark what we know or can easily determine...

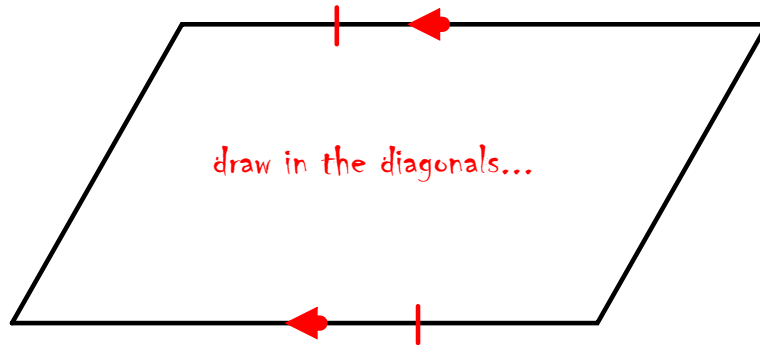
Not much to work with...

Since we don't know if the other 2 sides are  $\parallel$  maybe we should look at the diagonals.



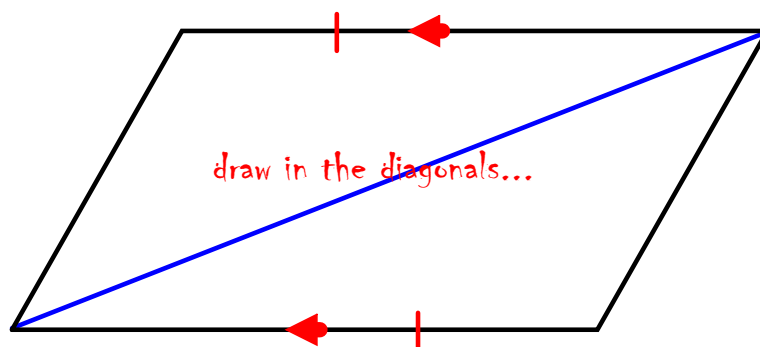
Proving our conjecture...

Now draw a diagram and mark what we know or can easily determine...



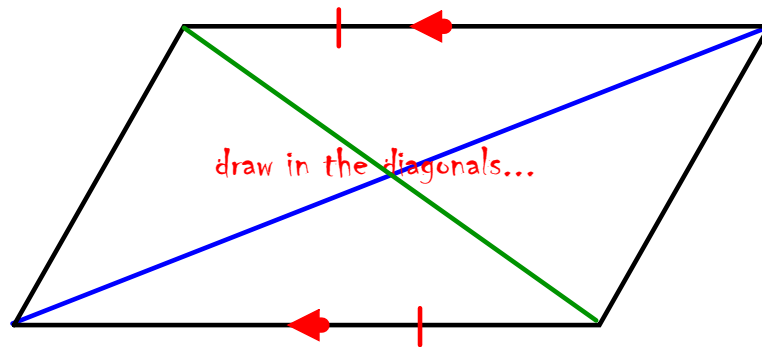
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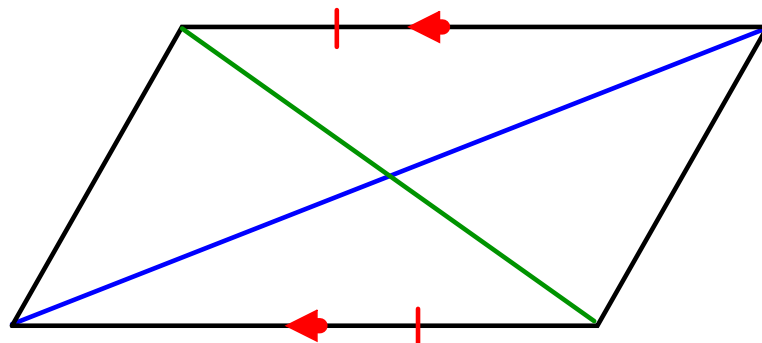
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Now draw a diagram and mark what we know or can easily determine...



Proving our conjecture...

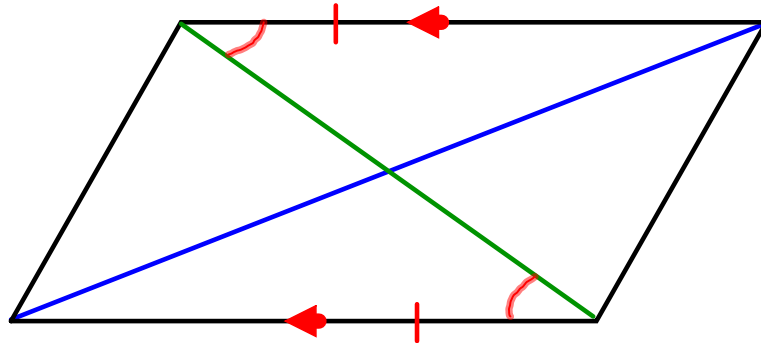
Now draw a diagram and mark what we know or can easily determine...



|| lines means alt int  $\angle$ 's  $\cong$

Proving our conjecture...

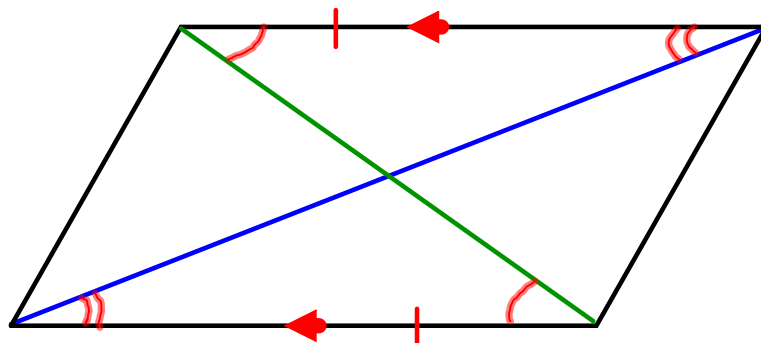
Now draw a diagram and mark what we know or can easily determine...



|| lines means alt int  $\angle$ 's  $\cong$

Proving our conjecture...

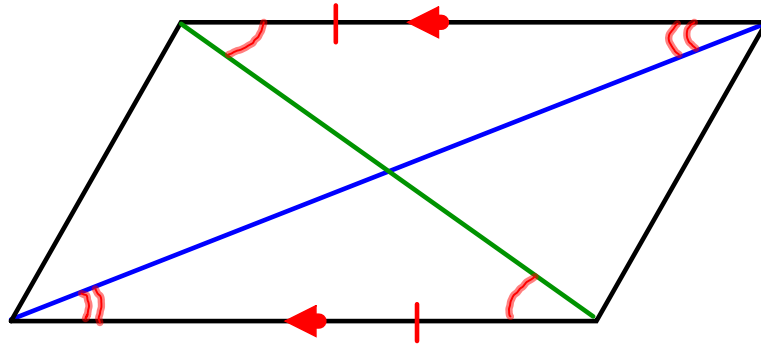
Now draw a diagram and mark what we know or can easily determine...



|| lines means alt int  $\angle$ 's  $\cong$

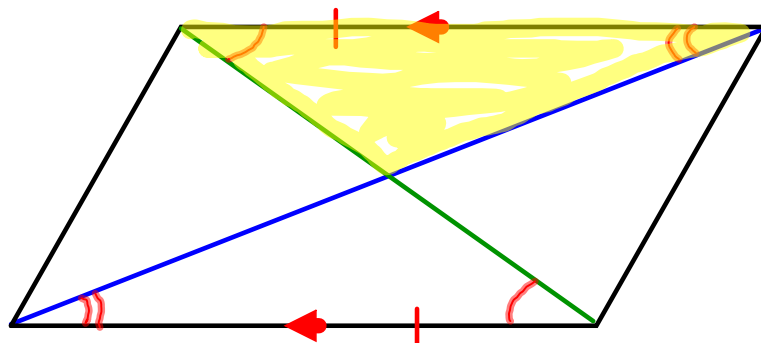
Proving our conjecture...

Now draw a diagram and mark what we know or can easily determine...



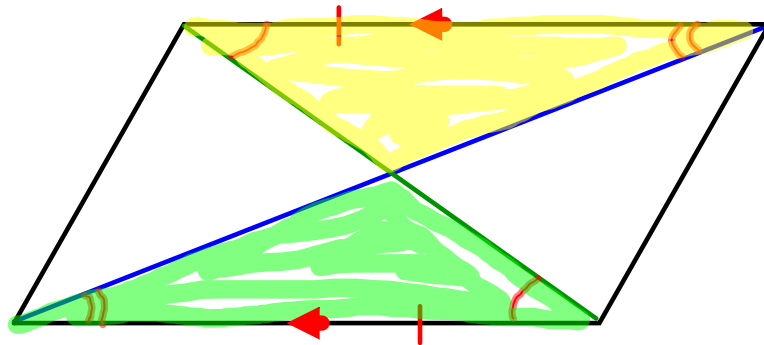
Proving our conjecture...

Now draw a diagram and mark what we know or can easily determine...



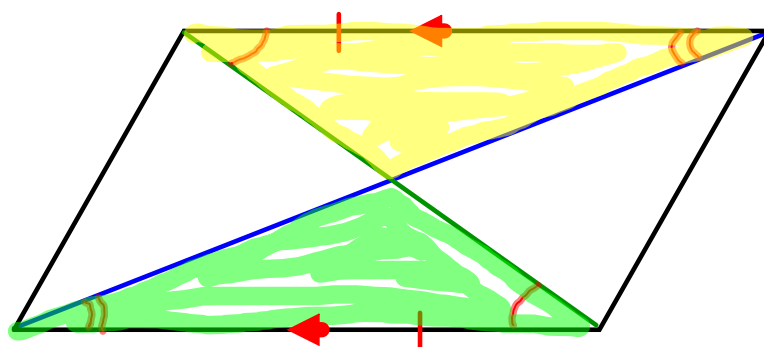
Proving our conjecture...

Now draw a diagram and mark what we know or can easily determine...



Proving our conjecture...

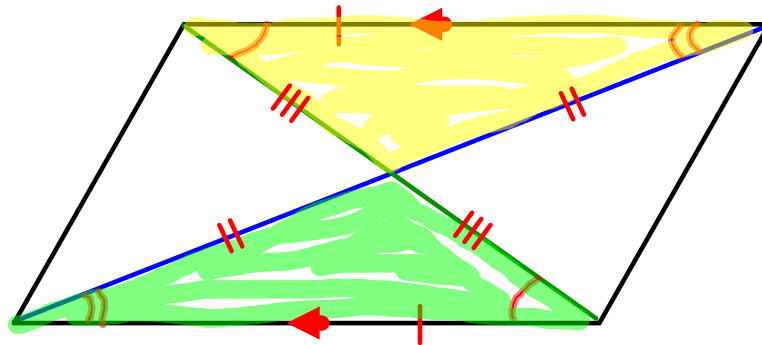
Now draw a diagram and mark what we know or can easily determine...



We can show these two  $\Delta$ 's  $\cong$ ...

Proving our conjecture...

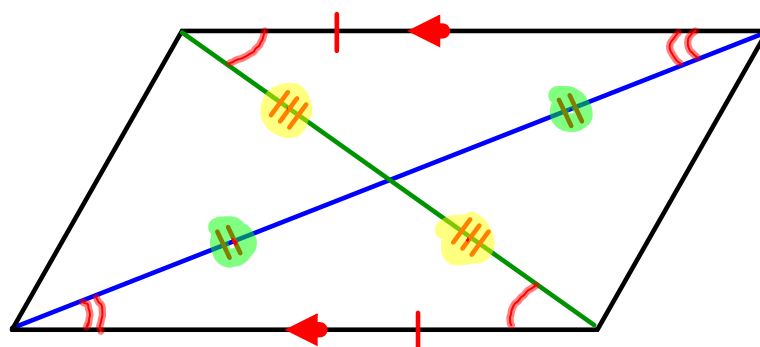
Now draw a diagram and mark what we know or can easily determine...



We can show these two  $\Delta$ 's  $\cong$  ...and CPCTC gives us...

Proving our conjecture...

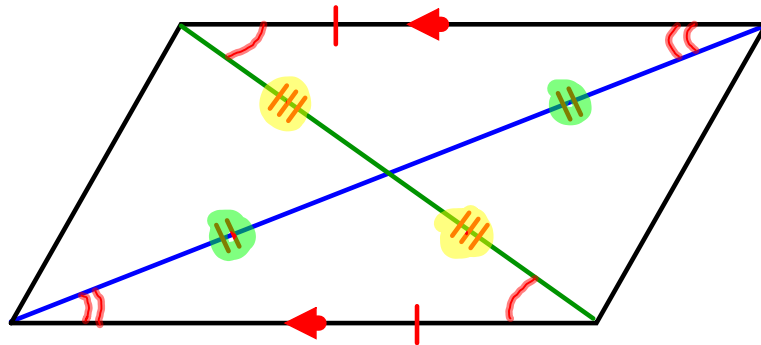
Now draw a diagram and mark what we know or can easily determine...



Hey! The diagonals bisect each other!

Proving our conjecture...

Now draw a diagram and mark what we know or can easily determine...

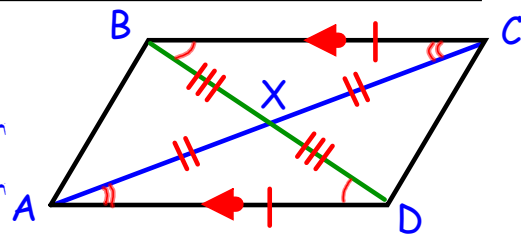


Hey! The diagonals bisect each other!

We can use Thm 6-5 to say this is a parallelogram!

Proving our conjecture...

$\overline{BC} \parallel \overline{AD}, \overline{BC} \cong \overline{AD}$	given
$\angle CBX \cong \angle ADX$	alt int angle thm
$\angle BCX \cong \angle DAX$	alt int angle thm
$\triangle CBX \cong \triangle ADX$	ASA
$\overline{AX} \cong \overline{CX}$	CPCTC
$\overline{DX} \cong \overline{BX}$	CPCTC



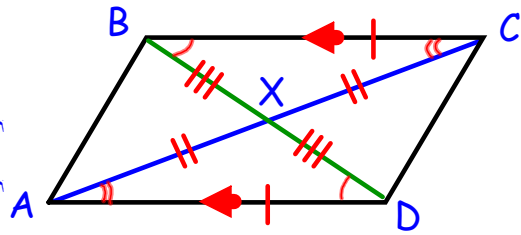
$\therefore ABCD$  is a parallelogram by Thm 6-5

QED



Proving our conjecture...

$\overline{BC} \parallel \overline{AD}, \overline{BC} \cong \overline{AD}$  given  
 $\angle CBX \cong \angle ADX$  alt int angle thm  
 $\angle BCX \cong \angle DAX$  alt int angle thm  
 $\triangle CBX \cong \triangle ADX$  ASA  
 $\overline{AX} \cong \overline{CX}$  CPCTC  
 $\overline{DX} \cong \overline{BX}$  CPCTC



$\therefore ABCD$  is a parallelogram by Thm 6-5

QED

Theorem 6-6

*This is just one way... there are others... can you find one?*

Two sets of theorems about Parallelograms...

It is a parallelogram...

Is it a parallelogram?

Thm 6-1  $\longleftrightarrow$  both pair opp sides  $\cong$   $\longleftrightarrow$  Thm 6-7

Thm 6-2  $\longleftrightarrow$  both pair opp angles  $\cong$   $\longleftrightarrow$  Thm 6-8

Thm 6-3  $\longleftrightarrow$  diags bisect each other  $\longleftrightarrow$  Thm 6-5

...so I know...

...it is if I see these characteristics...

Use regular set to justify

statements about  
parallelograms.

Use converse set to prove

a quadrilateral is a  
parallelogram.

Two sets of theorems about Parallelograms...

It is a parallelogram...

Is it a parallelogram?

Thm 6-1 ~~←--- both pair opp sides  $\cong$  ---→~~ Thm 6-7

Thm 6-2 ~~←--- both pair opp angles  $\cong$  ---→~~ Thm 6-8

Thm 6-3 ~~←--- diags bisect each other ---→~~ Thm 6-5

Thm 6-6

...so I know...

...it is if I see these characteristics...

Use regular set to justify  
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Two sets of theorems about Parallelograms...

It is a parallelogram...

Is it a parallelogram?

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Thm 6-2 ~~←--- both pair opp angles  $\cong$  ---→~~ Thm 6-8

Thm 6-3 ~~←--- diags bisect each other ---→~~ Thm 6-5

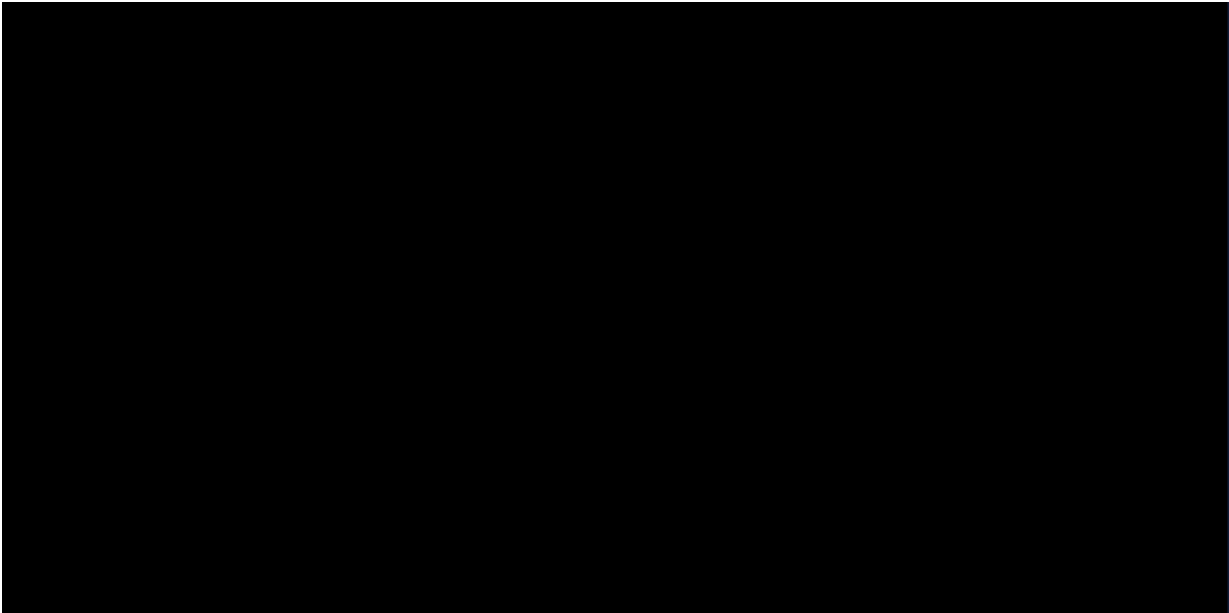
1 pair opp sides  $\parallel$  &  $\cong$  → Thm 6-6

...so I know...

...it is if I see these characteristics...

Use regular set to justify  
statements about  
parallelograms.

Use converse set to prove  
a quadrilateral is a  
parallelogram.



Questions...

Next set...

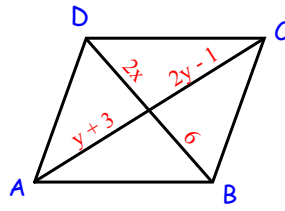
**1 x=**



ABCD is a parallelogram, find the value

$$x = ?$$

$$y = ?$$

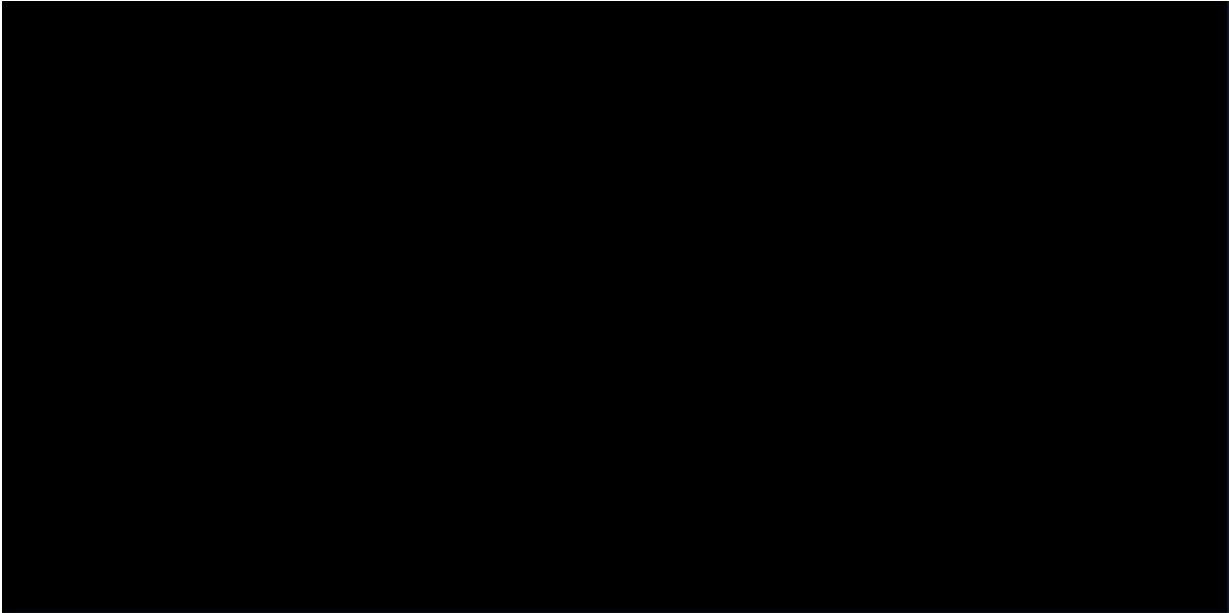


$$2x = 6$$
$$x = 3$$

$$y+3 = 2y-1$$
$$y = 4$$

...back

2



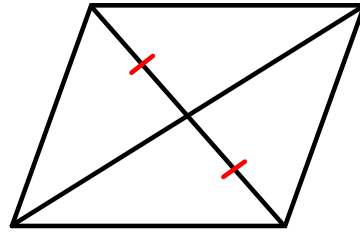
Prior set...

Is this quadrilateral a parallelogram?

1 Yes or no...

Yes

No



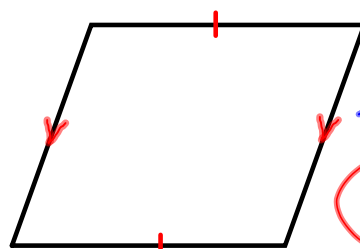
only 1 diag bisects  
the other ...

Is this quadrilateral a parallelogram?

2 Yes or no...

Yes

No



$\cong ?$   
Don't know

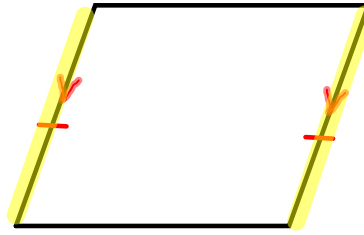
parallel ?

Is this quadrilateral a parallelogram?

### 3 Yes or no...

Yes

No



1) set sides  
both  
 $\cong$   
and  
 $\parallel$

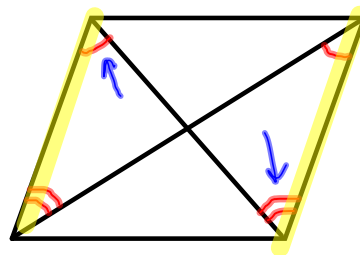
then C-C

Is this quadrilateral a parallelogram?

### 4 Yes or no...

Yes

No



the alt int  $\angle$ 's  
are not  $\cong$   
therefore sides not  $\parallel$ .

## L6.3 HW Problems

Pg 307 #1-15,  
19-29,  
33, 39, 40, 44, 45, 47

Pg 310 #1-10