This material accompanies a videotaped lesson on Inside Mathematics (www.insidemathematics.org): Decimal Place Value: Public Lesson. Austin, Texas: the Charles A. Dana Center at The University of Texas at Austin.
If you connect the blue & yellow sticks at their midpoints, any angle you put them in parallel, the it is a parallelogram.

ΔA ≅ ΔB through SAS
ΔC ≅ ΔD through SAS

KPEK: so all angles of ΔA ≅ angles of ΔB, all Ls of ΔC ≅ all Ls of ΔD
If all Ls of ΔC ≅ all Ls of ΔD, then Ls Ls are ≅, then they alternate interior angles congruent

If alternate interior angles congruent, then two sides are parallel

Game for Δs A & B but with Ls 3 & 4
The two diagonals have to cross at the same distance from the endpoints if the diagonals have to be the same length.
If you put blue stick perpendicular to any hole, in the yellow stick except endpoints & midpoint, than it will make a kite. Doesn't matter how long sticks are.
How can we construct a non-isosceles trapezoid?
I drew a lot of shapes, & defined how I arranged the sticks. However, I did not have too many observations along the way. I'll make more observations next time so that maybe, one of them might help me realize something I did wrong or lead me to the solution.
Block 1 3/8/09

Kites; trapezoid, trapezium, rhombus, heptagon, square, rectangle

1 long, 1 short

Both joined at center: 4 by each "4"

$\angle 90^\circ$ angles

Parallelogram: two joined at center, no limit on angles
Rhombus: $90^\circ$ angles in center
Square: $90^\circ$ angle in center, same length diagonals

1 joined at center:

Rhombus

Kite

Kite

Same lengths joined same distance away: $\sqrt{3^2 - 1^2} - 3 - 2 - 1$

$\frac{5 - 2}{2 - 1} = \frac{3}{1}$

$\frac{8 - 5}{7 - 6} = \frac{3}{1}$

Same slope: parallel

Same slope: parallel
rectangle:
As long as they're joined in the center, it'll be a parallelogram, and thus have equal sides.

Kite

Right angles, one side in center

Joined same distance from each side
kite: has one diagonal biseected by the other side

\[90^\circ\text{s}\]

given: \( \overline{AX} \cong \overline{CX} \)

\[ \angle AXB \cong \angle BXC \text{ (both } 90^\circ\text{: same m, } \cong) \]

\( \overline{BX} \cong \overline{BX} : \text{ reflexive prop} \)

\( \triangle ABX \cong \triangle CBX : \text{ SAS} \)

\( \overline{AC} \cong \overline{CB} \)

\( \overline{AX} \cong \overline{CX} \text{ (given)} \)

\( \angle AYO \cong \angle CXD \text{ (both } 90^\circ\text{: same m, } \cong) \)

\( \overline{XD} \cong \overline{XD} : \text{ reflexive prop} \)

\( \triangle AYO \cong \triangle CXD : \text{ SAS} \)

\( \overline{AC} \cong \overline{CD} \)

\( \triangle ABCD \text{ is a kite: 2 consecutive pairs of } \cong \text{ side} \)
How am I going to prove that lines are parallel?

Is there another way to make a trapezoid?

Why doesn't the kite maker just mass-produce?!
I need well diagrams, explanations, figuring it out

I could improve documenting all my process from my first that. Keeping track of all my discoveries, relevant or not, drawing more pic, doing more thinking on paper to make them more organized.
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When you make a cross with 90° using a long a short stick you cannot create a rectangle. The short stick has to be aligned with the long stick through the center hole and at a 90° angle. But the short sticks length prevents a rectangle from being made and instead a parallelogram.
Why can't you make a trapezoid with 1 long stick & 1 short stick?

Something I thought I did well on was constructing the different types of quadrilaterals to see which shapes worked and which ones didn't. Something I think I could improve by giving more info on the page with the figures.
If the diagonals bisect each other
and the diagonals are congruent
and the diagonals are perpendicular

Then the quadrilateral is a square.

Statement | Reason
---|---
1. $\triangle DEC \cong \triangle BEA$ | 1) given
2. $\triangle AED \cong \triangle CEB$ | 2) given
3. $DB \perp CA$ | 3) given
4. $AC = DB$ | 4) given
5. $\angle EAB \cong \angle ECD$ | 5) CPCTC
6. $AB \parallel DC$ | 6) alternate interiors
7. $\triangle AED \cong \triangle CEB$ | 7) SAS
8. $\angle ADE \cong \angle CBD$ | 8) CPCTC
9. $AD \parallel BC$ | 9) alternate interiors
10. $\overline{AB} \parallel \overline{CD} \parallel \overline{DA}$ | 10) CPCTC
11. $\angle ABC, m\angle DAB$ | 11) all 4 are isosceles triangles
12. $m \angle BCD, m \angle ABC = 90^\circ$ | 12) $o, 9, 10, 11$
13. $ABCD$ is a square | 13)
Parallelogram: a quad. w/ 2 pairs of parallel sides

- diagonals bisect each other
- diagonals are not perpendicular
- diagonals are different lengths

\[ \text{Diagram of parallelogram with labeled sides and angles.} \]

<table>
<thead>
<tr>
<th>Statement</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) bisect each other</td>
<td>1) given</td>
</tr>
<tr>
<td>2) 2 pairs of parallel sides</td>
<td>2) diagonals bisect each other</td>
</tr>
<tr>
<td>3) diagonals are different lengths</td>
<td>3) not a square, rectangle</td>
</tr>
<tr>
<td>4) diagonals are not \perp\</td>
<td>4) not a kite, rhombus</td>
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</tbody>
</table>

\[ \text{Proof of parallelogram properties.} \]

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1) \angle CED = \angle AEB</td>
<td>1) given</td>
</tr>
<tr>
<td>2) \angle AED = \angle BEC</td>
<td>2) given</td>
</tr>
<tr>
<td>3) AE = EC</td>
<td>3) given</td>
</tr>
<tr>
<td>4) FE = EB</td>
<td>4) given</td>
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<td>\text{Statement}</td>
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<tr>
<td>1) \triangle CED = \triangle AEB</td>
<td>1) SAS</td>
</tr>
<tr>
<td>2) \angle DCE = \angle BAE</td>
<td>2) CPCTC</td>
</tr>
<tr>
<td>3) AB \parallel DC</td>
<td>3) Alternate interior</td>
</tr>
<tr>
<td>4) \angle BAC = \angle DEA</td>
<td>4) SAS</td>
</tr>
<tr>
<td>5) \angle EAD = \angle BCF</td>
<td>5) CPCTC</td>
</tr>
<tr>
<td>6) AD \parallel BC</td>
<td>6) Alternate interior</td>
</tr>
</tbody>
</table>
QUADRILATERALS

QUADRILATERAL: a POLYGON with exactly four sides.

VARIous TYPES OF QUADRILATERALS

Trapezium: a quadrilateral in which no pair of sides is parallel. (Trapezium in British usage means trapezoid.)

Trapezoid: a quadrilateral in which one and only one pair of sides is parallel.

Isosceles Trapezoid: a trapezoid in which the nonparallel sides are equal in length.

Parallelogram: a quadrilateral in which both pairs of opposite sides are parallel. The opposite sides of a parallelogram are equal, and the opposite angles are equal.

Rhombus: a parallelogram in which two adjacent sides are equal. Since a rhombus is a parallelogram, opposite sides are equal. Therefore, all four sides of a rhombus are equal.

Rectangle: a parallelogram in which one angle equals 90°. Since a rectangle is a parallelogram, opposite angles are equal, and adjacent angles are supplementary (total 180°). Therefore, every angle of a rectangle equals 90°.

Square: a rectangle in which two adjacent sides are equal. Since a square is a rectangle, which is a parallelogram, opposite sides are equal. Therefore, all four sides of a square are equal.

Kite-shaped Quadrilateral: a convex quadrilateral in which two pairs of adjacent sides are equal, but opposite sides are not parallel. (In a convex polygon, every interior angle is less than 180°.)

Deltoid: a concave quadrilateral in which two pairs of adjacent sides are equal, but opposite sides are not parallel. (In a concave polygon, at least one interior angle is greater than 180°.)