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Nov 30, 2015

Nov 26, 2013

Nov 6, 2012

Nov 27, 2017

Exploring Parallel Lines

GOAL

Identify relationships among the measures of angles formed by intersecting lines.

EXPLORE the Math

A sports equipment manufacturer builds portable basketball systems, like those shown here. These systems can be adjusted to different heights.

transversal

When the adjusting arm is moved, the measures of the angles formed with the backboard and the supporting post change. The adjusting arm forms a transversal.

transversal

When a system is adjusted, the backboard stays perpendicular to the ground and parallel to the supporting post.

? When a transversal intersects two parallel lines, how are the angle measures related?

Can you make a conjecture based on the first example?

When a transversal cuts two parallel lines, their corresponding angles are equal.

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? When a transversal intersects two parallel lines, how are the angle measures related?

Sample solution

I measured the angle formed by the backboard and the lower adjusting arm. I also measured the angle facing the same direction, formed by the lower adjusting arm and the post. In the first diagram, these angles both measured 132°. In the second diagram, they both measured 70°.

I imagined these angles as forming an F. I conjectured that any angles determined by two parallel lines and a transversal that formed an F would be equal. I drew a sketch of what these angles would look like.

I constructed parallel line segments AB and CD and a transversal using dynamic geometry software. I measured one set of angles that formed an F. Then I moved the transversal to form several different sets of angles and measured the angles. I noticed that no matter how I angled the transversal, the F angles were always equal.

Example 1: (notes)

$\angle ABC = 40.8^\circ$
 $\angle DCE = 40.8^\circ$

$\angle ABC = 75.4^\circ$
 $\angle DCE = 75.4^\circ$

$\angle ABC = 106.9^\circ$
 $\angle DCE = 106.9^\circ$

Next, I changed the angle of the parallel line segments and the distance between the parallel line segments. The F angles were still equal.

Example 2: (notes)

$\angle ABC = 125.2^\circ$
 $\angle DCE = 125.2^\circ$

$\angle ABC = 129.3^\circ$
 $\angle DCE = 129.3^\circ$

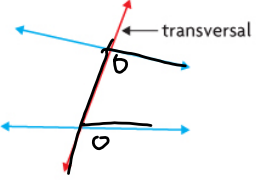
$\angle ABC = 47.5^\circ$
 $\angle DCE = 47.5^\circ$

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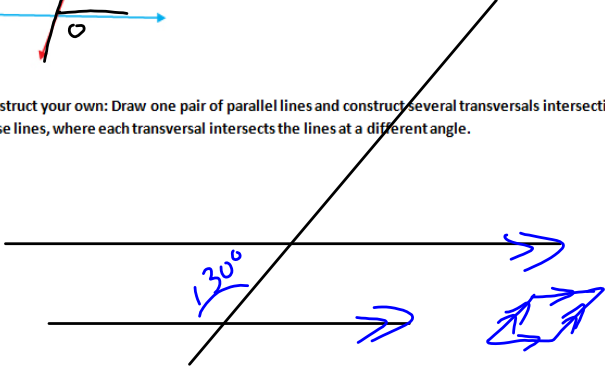
Transversal

transversal

A line that intersects two or more other lines at distinct points.



Construct your own: Draw one pair of parallel lines and construct several transversals intersecting these lines, where each transversal intersects the lines at a different angle.



Whats the difference between the two figures below?

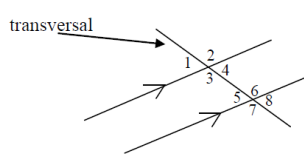


Figure 1

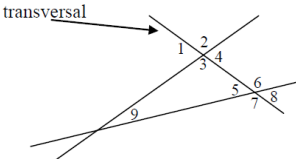


Figure 2

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Reflecting Pg 70

A. Use the relationships you observed to predict the measures of as many of the angles a to g in this diagram as you can. Explain each of your predictions.

B. Jonathan made the following conjecture: "When a transversal intersects two parallel lines, the **corresponding angles** are always equal." Do you agree or disagree? Explain, using examples.

C. Did you discover any counterexamples for Jonathan's conjecture? What does this imply?

D. Sarah says that the **converse** of Jonathan's conjecture is also true: "When a transversal intersects two lines and creates corresponding angles that are equal, the two lines are parallel." Do you agree or disagree? Explain.

E. Do your conjectures about angle measures hold when a transversal intersects a pair of non-parallel lines? Use diagrams to justify your decision.

Answers

A. Explanation:

- $\angle a = 40^\circ$
- $\angle b = 140^\circ$
- $\angle c = 40^\circ$
- $\angle d = \angle a = 40^\circ$
- $\angle e = \angle b = 140^\circ$
- $\angle f = 140^\circ$
- $\angle g = 40^\circ$

Supplementary angles: $180^\circ - 140^\circ$

Vertically opposite angles

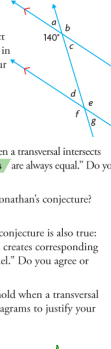
Vertically opposite angles

Angles on the same side of the transversal, facing the same direction, are equal.

Angles on the same side of the transversal, facing the same direction, are equal.

Vertically opposite angles

Vertically opposite angles



interior angles

Any angles formed by a transversal and two parallel lines that lie inside the parallel lines.

$a, b, c,$ and d are interior angles.

exterior angles

Any angles formed by a transversal and two parallel lines that lie outside the parallel lines.

$e, f, g,$ and h are exterior angles.

corresponding angles

One interior angle and one exterior angle that are non-adjacent and on the same side of a transversal.

converse

A statement that is formed by switching the premise and the conclusion of another statement.

co-interior angles

$140^\circ + d = 180^\circ$

corresponding angles equal

alternate interior angles

Attachments

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