

Core Concept

Counterexample

To show that a conjecture is true, you must show that it is true for all cases. You can show that a conjecture is false, however, by finding just one *counterexample*. A **counterexample** is a specific case for which the conjecture is false.

Why only one counterexample?

- Even numbers are not divisible by 3.
 - Is the statement true or false? _____
 - If it is false give one counterexample to justify your answer:

The statement is false because _____ is even and it is _____.

- If a polygon is a square then it has 4 sides.
 - Is the conditional statement true or false? _____
 - Can you find a counterexample? Why?
- Write the converse of the statement and determine its truth value.
- If the converse is false, find a counterexample:

Core Concept

Deductive Reasoning

Deductive reasoning uses facts, definitions, accepted properties, and the laws of logic to form a logical argument. This is different from *inductive reasoning*, which uses specific examples and patterns to form a conjecture.

Law of Syllogism

If hypothesis p , then conclusion q .
 If hypothesis q , then conclusion r .
 If hypothesis p , then conclusion r .



If these statements are true,



then this statement is true.

This pattern can continue for longer chains of logic.

- Assume the following conditional statements are true.
 If the school day is Friday, then Drake students will get out before 2 pm.
 If Drake students get out before 2 pm, then Drake students are happy.
 Use the Law of Syllogism to write a conditional statement:

- The following conditional statements are true:
 If the polygon is a rectangle then the polygon has four sides.
 If the polygon has four sides, then it is a quadrilateral.
 Use the Law of Syllogism to write a conditional statement:

- Use the Law of Syllogism to make a conclusion:

a) If it's sunny Saturday, then I'll go to the beach. If I go to the beach, then I'll lay in the sun. If I lay in the sun, I'll get a sunburn.	b) If you want to be independent, then you should have your own car. If you have your own car, then you must pay for the insurance. If you must pay for the insurance, then you will need a job.	c) Write your own set of three conditional statements that follow this pattern and then state the conclusion. (silly ones are encouraged)
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- Determine if each statement is True or False. If the statement is false, prove that it is false by providing a counterexample. You can draw a picture of the counterexample if that is easier.

a) If it is a weekend day, then it is Saturday.	b) If $\angle A \cong \angle B$, then $m\angle A = m\angle B$	c) If I have 25 cents, then I have two dimes and a nickel.
d) If two angles are supplementary, then they are adjacent.	e) If points A , B , and C are coplanar, then they are colinear.	f) If two angles share a common vertex then they are adjacent.
g) If a number is even and greater than 10, then it is divisible by 4.	h) If an obtuse angle is bisected the two angles formed are acute.	i) If a shape has four sides, then it is a square.
j) Everyone that goes to Drake high is under 6 feet tall.	k) Every person in your family likes ice cream. ☺	l) Every student in our geometry class has a dog.

- Can you prove that something is true by finding many examples of that fact being true? For example, if you ask five people in our geometry class if they have a dog, and they do, does that mean every student in our class has a dog?
- How many counterexamples does it take to disprove a statement? For example, how many Drake students over 6 feet tall do you have to find to prove that problem 2j is false?
- Each conditional statement is true. Write the **contrapositive** of each statement and determine its truth value.

a) If you are studying in the library, then you cannot be loud.	b) If the animal is a frog, then it is an amphibian.	c) If a shape has four sides, then it is not a triangle.
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- Each conditional statement is true. Write the **converse** of each statement and determine its truth value.

a) If a shape has four sides, then it is not a triangle.	b) If two angles add to 180° then they are supplementary.	c) If you are studying geometry, then you are studying math.	d) If two segments have the same length, then the two segments are congruent.
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- Use your knowledge about linear pairs and vertical angles to write and solve an equation for (b) and (c). **Also find the measure of each angle.**

If two angles are vertical angles then they are _____.		
If two angles form a linear pair then sum of their measures is _____.		

Algebra Review:

- Multiply each of the following:

a) $(3x - 4)(2x - 5)$	b) $(2x - 3)(2x + 3)$	c) $(x - 2)(x - 2)$
d) $\left(\frac{7}{3}x - \frac{1}{2}\right)\left(\frac{1}{3}x + \frac{5}{2}\right)$	e) $(x^2 + 3)(x^2 - 5)$	f) $(3x^2 - 4)(2x^2 + 5)$

- Factor each of the following:

a) $2x^2 + 6x + 3$	b) $4x^2 + 11x + 6$	c) $6x^2 + 11x + 4$
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