

Induction and Deduction

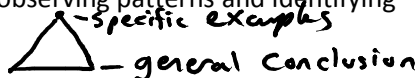
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Learning Competencies

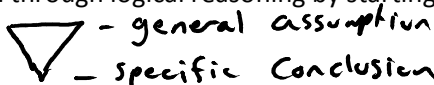
- 1.1 Vocabulary
- 1.2 Understanding how to use evidence and inductive Reasoning to make conjectures
- 1.3 Understanding how to strengthen an argument with evidence
- 1.4 Invalidating conjectures with more evidence

Vocabulary

Inductive Reasoning: Drawing a general conclusion by observing patterns and identifying properties in specific examples.



Deductive Reasoning: Drawing a specific conclusion through logical reasoning by starting with general assumptions that are known to be valid.



Conjectures: A testable expression that is based on available evidence but is not yet proven.

Counterexample: An example that invalidates a conjecture.

Proof: An argument that shows a statement to be true in all cases. (No counterexamples exists)

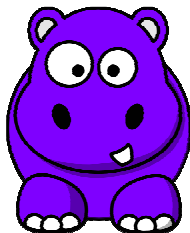
Generalization: A principle, statement, or idea that has general application.

Making a Conjecture

In order to make a conjecture you must first collect evidence to provide support and then use inductive logic to link your testable statement with the evidence.

Testable Statement

Parkland is home to the very rare but cuddly miniature purple hippopotamus. They are commonly found in Mr. Horncastles room.



Untestable Statement

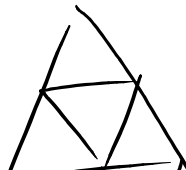
Parkland is home to the very rare but cuddly miniature invisible hippopotamus. They are commonly found in Mr. Horncastles room.

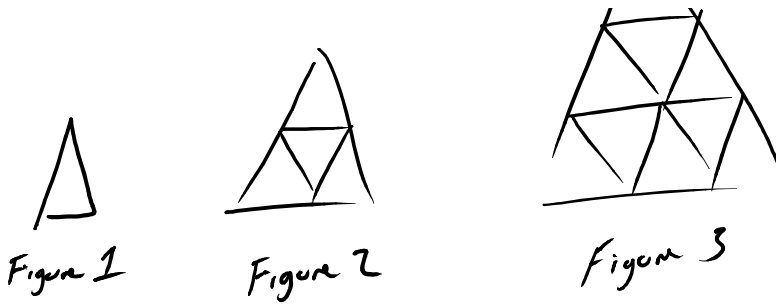


Evidence

Neither of these statements are supported by evidence. This makes both these statements very weak. In order to make a better statement we need to first collect evidence and use that evidence to form and support our statements.

How many Triangles will be in the next two figures?





In order to figure out how many triangles are going to be in the next figures we simply need to look at the evidence and then use inductive logic to make a conjecture in order to predict what will come next.

	Fig 1	Fig 2	Fig 3	Fig 4	Figure 5	$(\text{Fig}\#) \times (\text{Fig}\#)$
# Δ	1	4	9	16	25	

What will be the number of triangles in Figure 10? Can you make a formula to calculate this from the figure number?

$$10^2 = \underline{\underline{100}}$$

Our Inductive Process

When we make conjectures or predictions based on evidence, we need to find patterns or trends.

You try Average rainfall in Victoria (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	150	27	133	139	49	12	19	4	40	248	167	113
2014	250	45	132	90	69	50	43	29	54	155	136	160
2013	280	57	92	70	43	55	25	5	40	58	351	146
2012	181	116	214	76	37	80	53	8	73	155	116	210
2011	138	69	75	62	43	43	16	76	31	100	177	197

Search this data to find trends in our rainfall and make a conjecture about our cities precipitation.

using the data for the last five years

- Jan. gets the most rain
- It rains the least in May $\rightarrow$ Aug

How many pieces of data do we need in order to make a strong conjecture?

Evidence: Yesterday I saw a cow facing north in a field. Later that day it rained.

My conjecture is: Cows always point north when it's about to rain.



Bad conjecture
- Not enough evidence



Bad con-
- Not enough
evidence

The more evidence the better, but for our purposes you should always have at least three pieces of data.

You Try

Collect evidence and then make a conjecture about the product (Multiply) of two odd integers.

$$(1) \times (-5) = -5$$

$$(-7) \times (-3) = 21$$

$$(11) \times (13) = 143$$

The product of odd integers will always be odd.

Make a conjecture about the difference between consecutive perfect squares

$$4 - 1 = 3$$

$$9 - 4 = 5$$

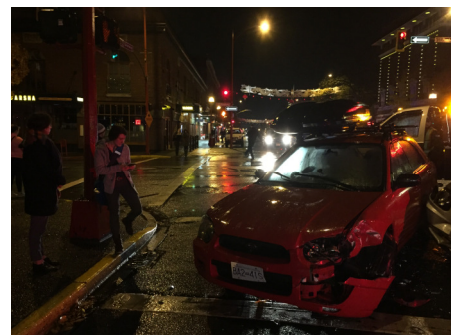
$$16 - 9 = 7$$

The product will be
odd

$$\Rightarrow \begin{aligned} (2)^2 - (1)^2 &= 3 \\ (3)^2 - (2)^2 &= 5 \\ (4)^2 - (3)^2 &= 7 \end{aligned}$$

The product will be the
sum of the perfect squares

Apply to life: We use inductive logic all the time. If you walk into a classroom only to find every student's bag at the front of the class and all the desks aligned in rows what might you conclude you are doing in class? If you go to your friend's house only to find no cars in the driveway and the lights all off in the house what might you conclude? Look at these pictures of an accident and see if you can conclude what might have happened? What was the cause of the accident? Who was at fault? Was anyone injured? What can you discover based on this photographic evidence?



Summary

A statement based on inductive reasoning is only as good as the current evidence. The best we can say about this statement is that the evidence supports it. We can know for certain if the statement will always be true. As we gather more evidence we may need revise and alter our conjectures to include them.

Work on Homework problems page 13: 1-22 odd