

TOPIC: INDUCTIVE AND DEDUCTIVE REASONING

Intro to Inductive Reasoning

◆ **Inductive Reasoning:** process of using *specific* examples to draw general _____ (**conjectures/hypotheses**).

► To write a conjecture, look for a _____. Then, use the conjecture to make predictions.

EXAMPLE

For the following examples, find the pattern and use it to write your conjecture. Then, apply the conjecture to make a prediction about what happens next.

(A) Mira does her laundry once a week. For the last three weeks, she did it on Saturday. What day will she do her laundry next week?

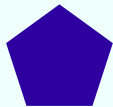
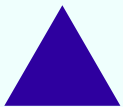


Conjecture: Mira does her laundry on _____.

(B) 1, 2, 4, 8, 16, ____

Conjecture: Each number is _____ the _____ number.

(C)



Conjecture: Each shape has _____ than the previous shape.

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PRACTICE

Find the next two numbers in the pattern.

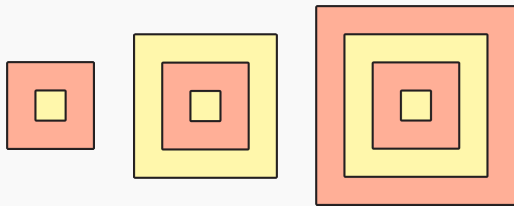
(A) 84, 72, 60, 48, ____, ____, ...

(B) $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1, \frac{5}{4}, \text{____}, \text{____}, \dots$

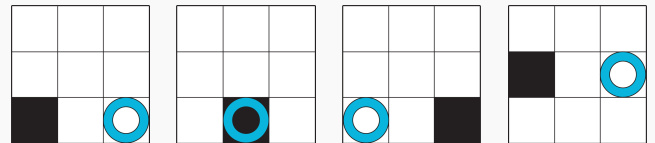
PRACTICE

Use inductive reasoning to find the next figure in the pattern.

(A)



(B)



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EXAMPLE

Use inductive reasoning to find the next equation in the pattern.

$$1 = 1^2$$

$$1 + 3 = 2^2$$

$$1 + 3 + 5 = 3^2$$

$$1 + 3 + 5 + 7 = 4^2$$

EXAMPLE

Pick any number. Multiply the number by 6. Add 12 to the product. Divide the result by 3.
Subtract 4 from the quotient. Make a conjecture about the original number and the final number.

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Counterexamples and Limitations to Inductive Reasoning

◆ Recall: Inductive reasoning involves forming conjectures. Two problems can happen with conjectures:

Multiple Possible Conjectures	Wrong Conjecture
1, 2, 4, __ Conjecture 1: Conjecture 2:	$2^2 = 4$ $3^2 = 9$ $4^2 = 16$ Conjecture: If you square a number, you get a larger value.

◆ To _____ a conjecture, you need to provide at least one **counterexample** that goes against the conjecture.

EXAMPLE Find a counterexample for the following conjectures.

(A) All fractions are less than 1.

(B) All letters are consonants.

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EXAMPLE

Find two possible conjectures for how to find the next number in the pattern that lead to different next values. Then find the subsequent value for each conjecture.

3, 5, 7, ...

Conjecture 1:

Conjecture 2:

EXAMPLE

Find a counterexample for each of the following conjectures.

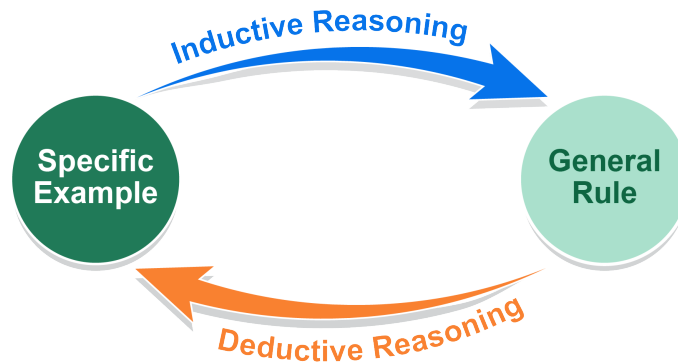
(A) No students are teachers.

(B) Dividing a smaller number by a larger number always results in an answer less than 1.

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Deductive Reasoning

- ◆ Recall: **Inductive Reasoning** is the process of using *specific* examples to draw conclusions about *general* rules.
- ▶ **Deductive Reasoning** is the process of using *general* rules to draw conclusions about *specific* examples.



EXAMPLE

For the following examples, use deductive reasoning by applying the general rule to the specific case.

- (A) A school district cancels school for the day if there is more than 5 inches of snow on the ground by morning. There is 7 inches of snow on the ground this morning. Will school be canceled?

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- (B) The area of a rectangle can be found using the formula $A = lw$. Find the area of a rectangle with a length (l) of 2 and a width (w) of 5.

- ◆ Conclusions drawn from deductive reasoning are always _____ as long as the *general rule* is true.

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PRACTICE

Classify the following as either inductive or deductive reasoning.

(A) All students must pass calculus I before they can be enrolled in calculus II. Maria is enrolled in calculus II. Thus, we conclude Maria passed calculus I

[INDUCTIVE | DEDUCTIVE]

(B) All students must pass calculus I before they can be enrolled in calculus II. Maria is enrolled in calculus II. Thus, we conclude Maria passed calculus I

[INDUCTIVE | DEDUCTIVE]

EXAMPLE

Use deductive reasoning to answer the following questions.

(A) The formula for the area of a circle is $A = \pi r^2$. A circle has a radius of $r = 3$. Find the area of that circle.

(B) In the sequence of numbers, the n^{th} term is $2n - 1$. Find the 5th term.

(C) All whales breathe oxygen. Dall's porpoises are whales. Do Dall's porpoises breathe oxygen?

EXAMPLE

Andy, Brad, Carl, Dolly, and Elle are seated in a row of five chairs numbered 1 (left-most) to 5 (right-most). Determine where each person is seated.

Clues:

- Dolly sits to the right of Carl.
- Andy is not sitting at either end.
- Elle sits next to Andy.
- Brad sits between Carl and Andy.
- Carl is not sitting in Seat #1.

