

Section 1.6

Reasoning to Solve Problems

Learning Targets:

- 1) Recognizing the difference between inductive and deductive reasoning.
- 2) Using **inductive reasoning** to solve brain teasers and other problems.
- 3) Using **deductive reasoning** to solve brain teasers and other problems.

Using **inductive reasoning** to solve problems often involves solving a simpler problem, observing patterns, and drawing a logical conclusion from your observations.

Using **deductive reasoning** to solve problems involves using known facts or assumptions in an argument that is then used to draw a logical conclusion.

Classify each of the following as either **inductive** or **deductive** reasoning.

All reptiles have scales.
Iguanas are reptiles.
Therefore, iguanas have
scales.

Deductive

The unknown term in this pattern is "64"

1, 4, 16, _____, 256, 1024

Inductive

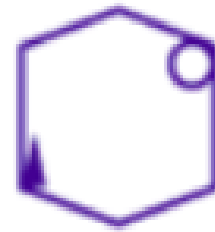
Every multiple of 6 has a factor of 3.

24 is a multiple of 6.

Therefore, 24 has a factor of 3.

Deductive

The figure that comes next in this pattern is



Inductive

Example #1: Using a pattern ***(inductive)***

Determine the missing term in the sequence of numbers.

2, 5, 9, _____, 20, 27

Explain your reasoning.

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⁺³ ⁺⁴ ⁺⁵ ⁺⁶ ⁺⁷
Explain your reasoning.

Example #1: Using a pattern *(inductive)*

Determine the missing term in the sequence of numbers.

2, 5, 9, 14, 20, 27

+3 +4 +5 +6 +7

Explain your reasoning.

The differences between the terms are increasing by 1

Example #2: Logic puzzle (*deductive*)

Sadie, Tristan, Ursula and Vance all live on the same street. One is a firefighter, one is a doctor, one is a lawyer and one is a travel agent.

- Vance and Ursula each lunch with the lawyer
- Sadie and Tristan carpool with the firefighter
- Ursula watches tennis on television with the firefighter and the lawyer

Who is the *firefighter*?

Solution: Use a process of elimination (who can't be the firefighter?)

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Based on this statement, neither Sadie nor Tristan is the firefighter.

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Based on this statement, neither Sadie nor Tristan is the firefighter.

Based on this statement, Ursula is not the firefighter.

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Who is the *firefighter*?

Solution: Use a process of elimination (who can't be the firefighter?)

Based on this statement, neither Sadie nor Tristan is the firefighter.

Based on this statement, Ursula is not the firefighter.

Therefore, Vance must be the firefighter.

Example #3 - Brain Teaser

- A set of nine cards, numbered from 1 to 9, is divided between two bags.
- The sum of the cards in the red bag is twice the sum of the cards in the white bag.
- The red bag contains four cards.

Which bag contains the number 6? Explain.

Total of all 9 cards:

$$1+2+3+4+5+6+7+8+9 = 45$$

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Small sum = 15 ← white bag (5 cards)

Total of all 9 cards:

$$1+2+3+4+5+6+7+8+9 = 45$$

We have to split 45 into two numbers where one is twice as big as the other:

$$45 = 30 + 15$$

Large sum = 30 ← red bag (4 cards)

$$6+7+8+9 = 30$$

Small sum = 15 ← white bag (5 cards)

$$1+2+3+4+5 = 15$$

**Therefore, the 6 must
be in the red bag.**

Example #4 - Brain Teaser

What number is found in the ones digit of 3^{100} ?

$$\begin{aligned}3^0 &= 1 \\3^1 &= 3 \\3^2 &= 9 \\3^3 &= 27\end{aligned}$$

$$\begin{aligned}3^4 &= 81 \\3^5 &= 243 \\3^6 &= 729 \\3^7 &= 2187\end{aligned}$$

$$3^{100} \leftarrow \text{multiple of 4}$$

$$3^0 = \underline{1} \quad 3^4 = \underline{81}$$

$\therefore 3^{100}$ has a "1" in the ones digit.

Check your understanding:

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#1, 2, 3, 6 - 10, 13 - 16, 19, 20