

## INDUCTIVE AND DEDUCTIVE REASONING

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When you make a conclusion based on a pattern, you are using **inductive reasoning**. Many times inductive reasoning is used to generalize patterns. You can also make a conclusion based on facts, using logic. This is called **deductive reasoning**. Proofs in algebra or geometry use deductive reasoning.

### Examples

#### Example 1 (from algebra)

Determine the value of  $(x^2)^{1/2}$  when  $x = 10$ .

Method 1

Trying different values of  $x$  yields:

$(1^2)^{1/2} = 1$ ,  $(2^2)^{1/2} = 2$ ,  $(3^2)^{1/2} = 3$  and based on this pattern,  $(10^2)^{1/2} = 10$

Method 2

Since

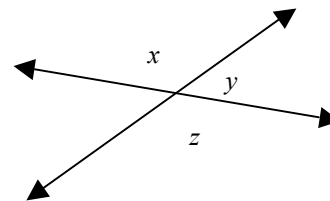
$(x^a)^b = x^{ab}$ , then  $(x^2)^{1/2} = x^{2 \cdot (1/2)} = x^1 = x$ .

If  $(x^2)^{1/2} = x$ , when  $x = 10$ ,  $(10^2)^{1/2} = 10$ .

Method 1 is looking at a computational pattern and is inductive reasoning. Method 2 uses the properties of exponents and is deductive reasoning.

#### Example 2 (from geometry)

In the diagram at right of two intersecting lines, determine the relationship between  $\angle x$  and  $\angle z$  (vertical angles).



Method 1

Drawing several different sets of intersecting lines and using a protractor to measure the size of the vertical angles, the angles appear to have the same measurement. Therefore,  $\angle x \cong \angle z$ .

Method 2

Since  $\angle x$  and  $\angle y$  make a straight line,  $m\angle x + m\angle y = 180^\circ$ . Also,  $\angle y$  and  $\angle z$  make a straight line so  $m\angle y + m\angle z = 180^\circ$ . Therefore using the transitive property of equality,  $m\angle x + m\angle y = m\angle y + m\angle z$ . Subtracting  $m\angle y$  from both sides of the equation yields  $m\angle x = m\angle z$ . Thus by the definition of congruent angles,  $\angle x \cong \angle z$ .

Method 1 is based on an observed pattern and is inductive reasoning. Method 2 uses logic through statements and reasons and is deductive reasoning.

## Problems

Refer to the following problems in your CPM *Geometry Connections* textbook. In each case, determine if you are using inductive reasoning or deductive reasoning.

- |                      |                  |
|----------------------|------------------|
| 1. 1-19 through 1-24 | 2. 1-30 and 1-31 |
| 3. 1-33              | 4. 2-67          |
| 5. 2-106             | 6. 2-114         |
| 7. 3-21              | 8. 3-44          |
| 9. 3-87              | 10. 4-59         |
| 11. 6-8              | 12. 6-35         |
| 13. 6-69             | 14. 7-47         |
| 15. 7-85             | 16. 7-91 (a)     |
| 17. 7-91 (c)         | 18. 8-7 (a)      |
| 19. 8-7 (c)          | 20. 8-13         |
| 21. 8-14             |                  |

## Answers

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|------------------------|---------------|---------------|
| 1. inductive           | 2. deductive  | 3. deductive  |
| 4. inductive           | 5. inductive  | 6. deductive  |
| 7. deductive but wrong | 8. inductive  | 9. deductive  |
| 10. inductive          | 11. deductive | 12. deductive |
| 13. inductive          | 14. deductive | 15. deductive |
| 16. inductive          | 17. deductive | 18. inductive |
| 19. deductive          | 20. inductive | 21. inductive |