2.3 Apply Deductive Reasoning

deductive reasoning - using facts, definitions, accepted properties, and the laws of logic to form a logical argument; used to show a conjecture is true or false

inductive reasoning - using specific examples and patterns to form a conjecture

KEY CONCEPT *For Your Notebook*

Laws of Logic

Law of Detachment

If the hypothesis of a true conditional statement is true, then the conclusion is also true.

Law of Syllogism

If hypothesis p, then conclusion q.
If hypothesis q, then conclusion r. ← If these statements are true,
If hypothesis p, then conclusion r. ← then this statement is true.

Ex 1: Use the Law of Detachment to make a valid conclusion in the true situation.

(a) If two segments have the same length, then they are congruent. You know that BC = XY. $\overline{BC} \cong \overline{XY}$

(b) If Nathan is enrolled at Metro High School, then Nathan has ID number. Nathan is enrolled at Metro High School.

Nathan has an ID number.

(c) If two angles are right, then they are congruent. $\angle BEF$ and $\angle FEC$ are right angles. $\angle BEF \cong \angle FEC$

Ex 2: If possible use the Law of Syllogism to write a new conditional statement that follows from the pair of true statements.

(a) If $y^3 = 8$, then $y = 2$. If $y = 2$, then $3y + 4 = 10$.

If $y^3 = 8$, then $3y + 4 = 10$.

(b) If $x^2 > 25$, then $x^2 > 20$. If $x > 5$, then $x^2 > 25$.

If $x > 5$, then $x^2 > 20$.

(c) If the radius of a circle is 4 ft, then the diameter is 8 ft. If the radius of a circle is 4 ft, then its area is 16π ft^2.

Not possible.

Ex 3: What conclusion can you make about the product of an even integer and any other integer?

Even · Odd

$2m(2n+1)$

$\stackrel{=}{2}(2mn+m)$

even

Even · Even

$2m \cdot 2n$

$4mn$

$\stackrel{=}{2}(2mn)$

even

Even · Any integer = EVEN

Ex 4: What conclusion can you make about the product of two odd numbers?

Odd · Odd

$(2m+1)(2n+1)$

$4mn + 2m + 2n + 1$

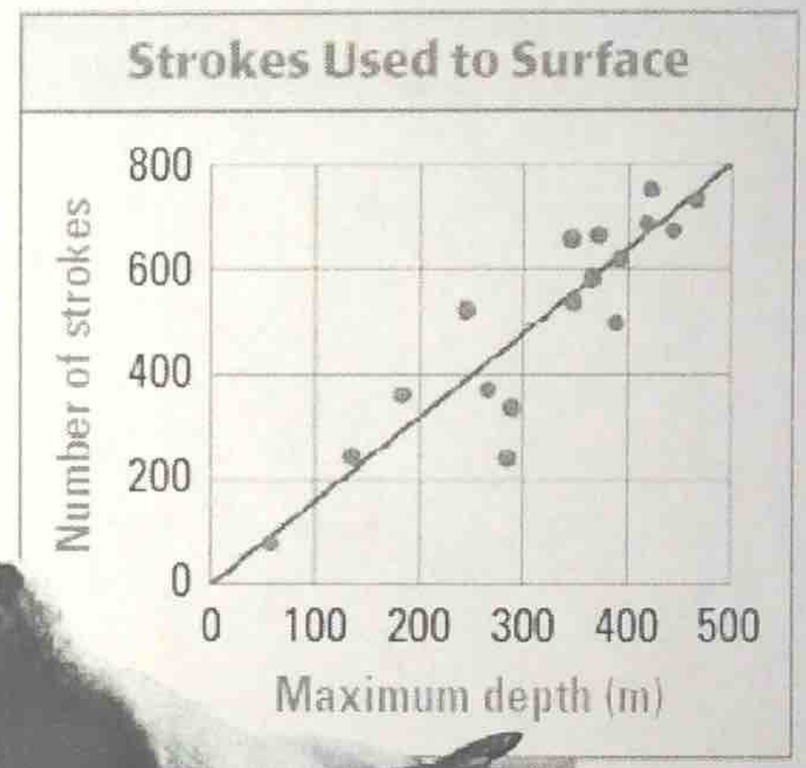
$2(2mn + m + n) + 1$

$2(x) + 1$

odd · odd = ODD

Ex 5: Tell whether the statement is the result of **inductive reasoning** or **deductive reasoning**. Explain your choice.

(a) The northern elephant seal requires more strokes to surface the deeper it dives.



Inductive reasoning because it is based on a pattern in the data.

(b) The northern elephant seal uses more strokes to surface from 250 meters than from 60 meters.

Deductive reasoning, because we are comparing values that are given on the graph.

2.3 Logic Puzzles

MATERIALS • graph paper • pencils

QUESTION How can reasoning be used to solve a logic puzzle?

EXPLORE Solve a logic puzzle

Using the clues below, you can determine an important mathematical contribution and interesting fact about each of five mathematicians.

Copy the chart onto your graph paper. Use the chart to keep track of the information given in Clues 1–7. Place an X in a box to indicate a definite "no." Place an O in a box to indicate a definite "yes."

Clue 1 Pythagoras had his contribution named after him. He was known to avoid eating beans.

Clue 2 Albert Einstein considered Emmy Noether to be one of the greatest mathematicians and used her work to show the theory of relativity.

Clue 3 Anaxagoras was the first to theorize that the moon's light is actually the sun's light being reflected.

Clue 4 Julio Rey Pastor wrote a book at age 17.

Clue 5 The mathematician who is fluent in Latin contributed to the study of differential calculus.

Clue 6 The mathematician who did work with *n*-dimensional geometry was not the piano player.

Clue 7 The person who first used perspective drawing to make scenery for plays was not Maria Agnesi or Julio Rey Pastor.

	n-dimensional geometry	Differential calculus	Math for theory of relativity	Perspective drawing	Pythagorean Theorem	Did not eat beans	Studied moonlight	Wrote a math book at 17	Fluent in Latin	Played piano
Maria Agnesi	X	O	X	X	X	X	X	X	O	X
Anaxagoras	X	X	X	O	X	X	O	X	X	X
Emmy Noether	X	X	O	X	X	X	X	X	X	O
Julio Rey Pastor	O	X	X	X	X	X	X	O	X	X
Pythagoras	X	X	X	X	O	O	X	X	X	X
Did not eat beans	X	X	X	X	O					
Studied moonlight	X	X	X	O	X					
Wrote a math book at 17	O	X	X	X	X					
Fluent in Latin	X	O	X	X	X					
Played piano	X	X	O	X	X					