2.3 Apply Deductive Reasoning

Goal • Form logical arguments using deductive reasoning.

Deductive reasoning- Uses facts, definitions, accepted properties, and the laws of logic to from a logical argument

*Remember *inductive reasoning* we formed "conjectures"

Laws of Logic

Law of Detachment
(Direct Argument)

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

Law of Syllogism
(Chain Rule)

If p, then q.
If q, then r.
If p, then r.

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.

EXAMPLE 1 Use the Law of Detachment

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 $BC = XY$.

b. Mary goes to the movies every Friday and Saturday night. Today is Friday.

EXAMPLE 2 Use the Law of Syllogism

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

a. If Rick takes chemistry this year, then Jesse will be Rick's lab partner.

If Jesse is Rick's lab partner, then Rick will get an A in chemistry.

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

If $x > 5$, then $x^2 > 25$.

c. If a polygon is regular, then all angles in the interior of the polygon are congruent.

If a polygon is regular, then all of its sides are congruent.

syllogism.

hypothesis. You cannot use the Law of Syllogism to write a new conditional statement.

Animated Geometry at classzone.com

In Geometry, you will frequently use inductive reasoning to make conjectures. You will also be using deductive reasoning to show that conjectures are true or false. You will need to know which type of reasoning is being used.

EXAMPLE 3 Use inductive and deductive reasoning

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

Solution

STEP 1 **Look** for a pattern in several examples. Use inductive reasoning to make a conjecture.

$(-2)(2) = -4$, $(-1)(2) = -2$, $2(2) = 4$, $3(2) = 6$,

$(-2)(-4) = 8$, $(-1)(-4) = 4$, $2(-4) = -8$, $3(-4) = -12$

Conjecture Even integer • Any integer = Even integer

STEP 2 **Let** n and m each be any integer. Use deductive reasoning to show the conjecture is true.

$2n$ is an even integer because any integer multiplied by 2 is even.

$2nm$ represents the product of an even integer and any integer m.

$2nm$ is the product of 2 and an integer nm. So, $2nm$ is an even integer.

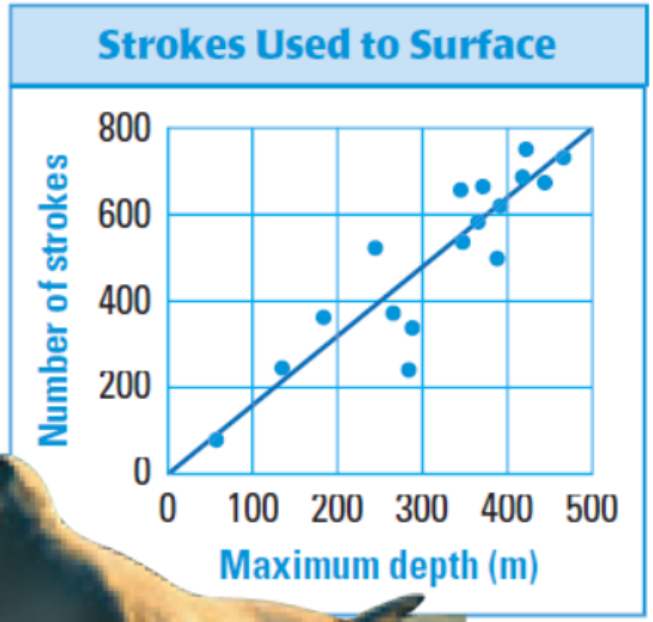
▶ The product of an even integer and any integer is an even integer.

EXAMPLE 4 Reasoning from a graph

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.

b. The northern elephant seal uses more strokes to surface from 60 feet than from 250 feet.



Solution

[redacted]

More examples:

1. Your coach has told you that if you miss more than one practice during the week, you will not be allowed to play on Saturday. You missed practice yesterday and today. What will happen?
missed practice yesterday and today. What will happen?

2. If Nathan is enrolled at Tech H.S., then Nathan has an ID #. Nathan is enrolled at Tech H.S. What can you conclude?
Nathan is enrolled at Tech H.S. What can you conclude?

3. If two angles are right angles, then they are congruent. Angle C and angle D are right angles. What can you conclude?

4. If Joe takes Geometry this year, then he will take Algebra 2 next year. If Joe takes Algebra 2 next year, then he will graduate. What can you conclude?
What can you conclude?

Assignment:

p. 90 (1-13, 16-19, 21-38 all)