5 Projecting Conjectures: Deductive Reasoning, Part 2 (1.4)

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Day 5: Proving conjectures: Deductive reasoning, Part 2 (1.4)

When we make a conclusion based on statements that we accept as TRUE we are using deductive reasoning. In proofs using deductive reasoning, we use expressions (e.g., for a number, even number, odd number, consecutive numbers, etc.) and algebra.

x $2x$ $2x+1$

Statements that we know are true:

Any integer multiplied by 2 is an even number.

-This means that *2x* or *2*(any combination of variables and coefficients) will **always** be even.

If you add 1 to any even integer you will get an odd number.

-This means that *2x+1* or *2*(any combination of variables and coefficients)+1 will **always** be odd.

Consecutive numbers follow each other in numerical order

-This means that *x, x +1, x+2, x+3* are 4 numbers that come one after the other numerically.

- consecutive even numbers: *2x, 2x+2, 2x+4, 2x+6*
- consecutive odd numbers *2x+1, 2x+3, 2x+5, 2x+7*

Finishing a Proof:

If proving an answer is...	**.. it should look like ....**
Even	2(any combination of variable terms)
Odd	2(any combination of variable terms) +1
Divisible by 3	3(any combination of variable terms)
Divisible by 4	4(any combination of variable terms)
etc.	etc.

Example 1: Use deductive reasoning to prove that the sum (+) of an odd number and an even number is always odd.

$2x+1$ $\quad 2(\ldots)+1$

Let $2x+1$ be an odd number

Let $2y$ be an even number

$$(\underbrace{2x+1}_{odd})+(\underbrace{2y}_{even})$$
$$=2x+2y+1$$
$$=2(x+y)+1 \quad \text{odd.}$$

Example 2: Prove that the square of an even integer is always even

Let $2x$ be an even #
↳ $2(\ldots)$

$(2x)^2$
$= 2^2 \cdot x^2$
$= 4x^2 = 2(2x^2)$ even

Example 3: Prove that the result of the number trick below is always the number you start with.

Let x be any #

- Choose a number
- Add 2 → $x+2$
- Multiply by 3 → $3(x+2) = 3x+6$
- Subtract 6 → $3x+6-6 = 3x$
- Subtract your original number → $3x - 1x = 2x$
- Divide by 2 → $\frac{\cancel{2}x}{\cancel{2}} = x$

Example 4: The ~~sum~~ add of a two-digit number and its reversal is a multiple of 11

Recall: $83 = 8(10) + 3$

Let xy be a 2-digit # ↳ $10(x)+y$
Let yx be its reversal. ↳ $10(y)+x$

Prove: $\boxed{10x} + \boxed{y} + \boxed{10y} + x$

$= 10x + x + 10y + y$
$= 11x + 11y$
$= 11(x+y)$ multiple of 11.

Assignment: Deductive Reasoning Worksheet

median

$x + x+1 + x+2 + x+3 + x+4$

$= 5x + 10$

$= 5(x+2)$

$\cancel{2} + 3 + \cancel{4} + \cancel{5} + \cancel{6} = 20$
$= 3(4)$ ✓