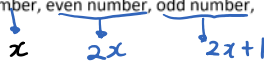


5 Projecting Conjectures: Deductive Reasoning, Part 2 (1.4)

January 3, 2020 5:58 PM

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.



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**.

$\hookrightarrow 2x+1$

$2(\dots)+1$

Let $2x+1$ be an odd number

Let $2y$ be an even number

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

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

Let $2x$ be an even #
 \downarrow
 $2(\dots)$

$$\begin{aligned} (2x)^2 &= 2^2 \cdot x^2 \\ &= 4x^2 = 2(2x^2) \text{ even} \end{aligned}$$

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 $x+2$
- Add 2 $\rightarrow x+2$
- Multiply by 3 $\rightarrow 3(x+2) = 3x+6$
- Subtract 6 $\rightarrow 3x+6-6 = 3x$
- Subtract your original number $\rightarrow 3x-x = 2x$
- Divide by 2 $\rightarrow \frac{2x}{2} = x$

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

Recall: $33 = 3(10) + 3$

Let xy be a 2-digit #
 \downarrow
 $10x+y$

Let yx be its reversal.
 \downarrow
 $10y+x$

Prove: $(10x+y) + (10y+x)$

$$\begin{aligned} &= (10x+x) + (10y+y) \\ &= 11x + 11y \\ &= 11(x+y) \text{ multiple of } 11. \end{aligned}$$

Assignment: Deductive Reasoning Worksheet

median

$$\begin{aligned} &x + x+1 + (x+2) + x+3 + x+4 \\ &= 5x + 10 \\ &= 5(x+2) \\ &\underline{\hspace{1.5cm}} \\ &7 + 8 + 9 + 10 + 11 + 12 = 20 \\ &= 3(4) \checkmark \end{aligned}$$