## Lesson 21: Odd and Even Numbers

* Let’s explore even and odd numbers.

### 21.1: Math Talk: Evens and Odds

Evaluate mentally.

### 21.2: Always Even, Never Odd

Here are some statements about the sums and products of numbers. For each statement:

* decide whether it is *always* true, true for *some* numbers but not others, or *never* true
* use examples to explain your reasoning

1. Sums:
   1. The sum of 2 even numbers is even.
   2. The sum of an even number and an odd number is odd.
   3. The sum of 2 odd numbers is odd.
2. Products:
   1. The product of 2 even numbers is even.
   2. The product of an even number and an odd number is odd.
   3. The product of 2 odd numbers is odd.

### 21.3: Even + Odd = Odd

How do we know that the sum of an even number and an odd number *must* be odd? Examine this proof and answer the questions throughout.

Let represent an even number, represent an odd number, and represent the sum .

1. What does it mean for a number to be even? Odd?

* Assume that is even, then we will look for a reason the original statement cannot be true. Since and are even, we can write them as 2 times an integer. Let and for some integers and .

1. Can this always be done? To convince yourself, write 4 different even numbers. What is the value for for each of your numbers when you set them equal to ?

* Then we know that and .
* Divide both sides by 2 to get that .
* Rewrite the equation to get .
* Since and are integers, then must be an integer as well.

1. Is the difference of 2 integers always an integer? Select 4 pairs of integers and subtract them to convince yourself that their difference is always an integer.
2. What does the equation  tell us about ? What does that mean about ?
3. Look back at the original description of . What is wrong with what we have discovered?

The logic for everything in the proof works, so the only thing that could’ve gone wrong was our assumption that is even. Therefore, must be odd.



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