

$$1 + 2 = 3$$

(generalized)

*Math Club 3/19/2012*

# Definition

**We should all know that  $1+2=3$ .**

**A *polite* number is a number that can be written as a sum of positive consecutive numbers.**

**For example,  $4+5+6+7$  is 22, so 22 is a polite number.**

**Through a few challenges, we will know everything there is to know about polite numbers by the end of this powerpoint.**

# Challenge 1

**Show that 3 is a polite number.**

# Challenge 2

**Show that 9 is a polite number.**

# Challenge 3

**Is 4 a polite number?**

# Challenge 4

**Find all polite numbers  $\leq 10$ .**

# Challenge 5

**Show that all odd numbers are polite.**

# Challenge 6

**Show that any number divisible by 3 is polite.**



# Challenge 7

**Prove that any number divisible by 7 is polite.**

# Challenge 8

Let  $d$  be some odd number  $\geq 3$ .

Prove that for any  $d$ , infinitely many multiples of  $d$  are polite.

(in other words, above a certain point, all multiples of  $d$  are polite)

# Challenge 9

**Challenge 8 is too weak.**

**Let  $d$  be some odd number  $\geq 3$ .**

**Prove that for any  $d$ , ALL multiples of  $d$  are polite numbers.**

# Challenge 10

**All numbers with an odd factor are polite.**

**What numbers are left?**

# Final Challenge (11)

**Show that a power of two cannot be polite.**