

Modeling Integers

Introduction: From the point of view of arithmetic, the whole numbers have two serious deficiencies, namely, while we can add or multiply any two whole numbers and get a whole number, we cannot in general subtract any two whole numbers or divide any two whole numbers. With the introduction of the set of fractions we resolved one of these deficiencies--we can now divide any two whole numbers (in fact any two fractions) unless the divisor is zero. The question of subtraction remains. The expansion of the whole number system to the system of integers is designed to resolve this problem.

The chip model of the integers is based on the idea of positive numbers representing assets and negative numbers representing debts. In the model, a black chip represents one unit of an asset (1) while a red chip represents one unit of debt (-1). Thus, if I have one black chip and one red chip I have the same amount (0) as if I have no chips at all. Said otherwise, in the chip model one red cancels one black.

Equipment: Red and black chips

1. What integer is represented by three red chips? _____
What integer is represented three red and two black chips? _____
2. 3 red chips and 4 black chips is equivalent to _____ black chips.
3. How many different ways are there to represent 5 with red and black chips?
Display three different representations of 5.
4. As with whole numbers, we may want to think of addition as meaning "combine and count". In this setting, set up the problems below in the chip model and use cancellation to arrive at the correct sum: