Clock Arithmetic

Kyle King

October 6, 2014

Topic: Modular Arithmetic

Connection to Core Curriculum: CCSS.Math.Content.HSA.CED.A.4 Create equations that describe numbers or relationships.

Overview: Students will experiment with an applet and formulate conjectures about modular arithmetic. This will enable students to work with various cryptography ciphers.

Objectives: Students will

- Discover how modular arithmetic works
- Formulate a general equation for modular arithmetic

Materials Needed: Computer and attached task sheet for each student

Technology: Clock arithmetic applet from Shodor.

Role of Technology: The technology facilitates exploration of various clock (modulous) sizes and helps students see how modular arithmetic works.

Web Reference: http://www.shodor.org/interactivate/activities/ClockArithmetic/

Activity Plan: Each student will get out his/her computer. The attached task sheet will be handed out as students are turning their computer on. Each student will be ask to work on their task sheet independently. The teacher will walk around the room answering any questions and monitoring the student learning. After the students have been working on their task sheet for approximately 10 minutes, the students will be asked to discuss their answers with their partner. After they have been given approximately 7 minutes to discuss, the whole class will talk about their answers. The students will then be given the conventional way to write modular arithmetic which is $a \equiv b(modm)$ where m is the "clock size", b is the "calculated time" and a is the number of elapsed hours. The teacher will note the following:

Given $a, b, m \in \mathbb{Z} \ni m \geq 1$, "$a \equiv b(modm)$" is read "$a$ is congruent to b modulo m" or "a is congruent to b mod m."

The definition for *congruence* among integers: Given $a, b, m \in \mathbb{Z} \ni m \geq 1$, $(a \equiv b(modm) \iff m|a-b)$

Included documents: See attached Task Sheet labeled "Clock Arithmetic Task Sheet"

References: Shodor. *Clock Arithmetic*. Applet retrieved from http://www.shodor.org/interactivate/activities/ClockArithmetic/