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Goals:

Name: \_\_\_\_\_

- To choose and produce a project with original work rooted in the course material. The perspective of the project is to create something that you can use, or share with other teachers, that is a “plug and play” lesson and activity for use in a classroom.
- To use creativity, ingenuity, and imagination to create a bridge between the material in Chapter 4 and something tangible and real world.
- To bring to life ideas from mathematics, find a creative way to illustrate to a new learner of the topic that the ideas they are learning are not restricted to literal uses, rather, they are abstractible and can be creatively applied to unforeseen and unexpected applications.

Weekly deliverables will be expected and graded to help you keep pace for completion. The quality of your work is expected to be at a high level of effort and nothing short of a finished useable classroom ready “unit/activity” is acceptable.

You may work either alone, or in groups of two.

### Project 1

Make a working physical 12-hr clock arithmetic converter that will convert any counting number less than 100 into that number modulo 12. You should be able to manipulate/input/configure the 12-hr clock arithmetic converter device and at the end of the routine, it should clearly indicate the resulting number modulo 12.

The device should not only complete the task, but should provide an intuitive and physical understanding of what happens when you modulo a number by 12. The purpose of the device is to provide a tangible and meaningful relationship between what a student of yours already understands (clocks) and illustrates the connection to modular arithmetic.

For further extension of this project:

You could create a way to adapt your device to arithmetic modulo 4 or some other number of your choosing.

You can also have a way to track the number of cycles a number modulo 12 might occur as it arrives at its correct modulo 12 value.

Feel free to make any other extensions of this project that you wish.

### Deliverables:

Depending on what the emphasis of your project is (on the actual complete fabrication of the device vs “using off the shelf” parts/devices, you will need to be clear with the instructor what the scope of your project will be.

- Create a physical 12-hr clock arithmetic converter that a student can pick up and utilize (if they were first given instruction on how to properly use it) to perform 12-hr clock arithmetic (number conversion modulo 12 and addition and subtraction modulo 12)
- Create a 1-2 page fully complete activity that you would hand out with the device for a 5<sup>th</sup> grade student to use. This is to be a stand-alone 5-15 minute activity that a teacher could hand out to their class along with the device, to help the student understand the ideas behind the activity. This would be the handout you would give to the student.
- All projects will need a short, concise explanation of their device, how to use it, and what the connections are to the mathematics behind it. This would be the handout for the teacher.
- All projects also need to provide a concise student friendly explanation of the mathematics that is being illustrated. i.e. a short lesson plan that would be given before the activity.

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- A slideshow/photo montage of the construction process for the project is also required.
  - All material should be presented in a thoughtful, intuitive, and USEFUL way.

## Project 2

Make a game that uses a base 3 number system of banking (monopoly, life, etc) where players follow an interesting narrative and set of rules that consist of a fun/engaging system of turns that creates a monetary set of additions and subtractions to their wealth. There is a mandatory rule that players may not possess three or more of any single monetary manipulative. There should be a clear end goal that ends the game.

The length of the game should be targeted last either 10-15 minutes or be capable of being played in 10-15 minute rounds (like hearts/spades/three thirteen/etc). The purpose would be to use this game as a one off 10-15 minute event or to be played over several days (as separate 10-15 minute events).

The manipulatives do not need to resemble money or represent money, you could be collecting eggs, three eggs in a carton, nine cartons in a box, 27 boxes in a truck...etc.

### Deliverables:

Depending on what the emphasis of your project is (on the actual complete fabrication of the game vs “using off the shelf” parts/devices/games, you will need to be clear with the instructor what the scope of your project will be.

- Create a working game that your students can play (if they were first given instruction on how to properly play it)
- Create a 1-2 page fully complete activity sheet that you would hand out with the game for a 5<sup>th</sup> grade student to use. This is to be a stand-alone 10-15 minute activity that a teacher could hand out to their class along with the game, to help the understand and learn the rules, help the students keep score, show examples on play, and understand the ideas behind the activity. This would be the handout you would give to the student.
- All projects will need a short, concise explanation of their game, how to use it, and what the connections are to the mathematics behind it. This would be the handout you would give to the teacher.
- All projects also need to provide a concise student friendly explanation of the mathematics that is being illustrated. i.e. a short lesson plan that would be given before the activity.
- A slideshow/photo montage of the construction process for the project is also required.
- All material should be presented in a thoughtful, intuitive, and USEFUL way.

## Project 3

Make a DIY tutorial on beginning weaving using a binary concept of Warp and Weft. You would provide a guided, intuitive, and relatively achievable way of producing a simple loom. The loom should be able to display patterns of thread that represent a binary representation of numbers (if the Warp is showing vs not showing) up to at least the number thirty one and be capable of creating patterns textiles longer than 12 inches.

A set of patterns will need to accompany this DIY tutorial.

- 1) A pattern that repeatedly counts from 0-31 in a binary representation.
- 2) A pattern that sequentially displays the first 31 terms in the Fibonacci Sequence where each number is first modulo 31 and then represented in base two on your loom pattern.
- 3) An existing pattern capable of being produced on your loom that has some sort of mathematical significance.

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4) Any geometric pattern of your choosing which is capable of being produced on your loom. You must provide at least 1 physical textile that was produced on your loom with a minimum length of 12 inches.

### Deliverables:

Depending on what the emphasis of your project is (on the actual complete fabrication of the game vs “using off the shelf” parts/devices/loom, you will need to be clear with the instructor what the scope of your project will be.

- Create a usable DIY tutorial in either an accessible electronic format (public accessible website, video posted to YouTube, or file on a memory stick, OR a physical folder with the tutorial and patterns on paper) OR some combination of the two.
- Your target audience is that of an inexperienced uninformed adult with interest in following your tutorial.
- All projects will need an accompanying document that is a short, concise explanation of the anatomy of the loom, how to use it, and what the connections are to the mathematics behind it. This should be informative, useful, and interesting.
- All projects also need to provide a concise student friendly explanation of the mathematics that is being illustrated. i.e. a short lesson plan or handout that would be given to a student (if completing the tutorial was to be their class assignment) before they attempted your DIY tutorial.
- A slideshow/photo montage of the construction process for the project is also required.
- All material should be presented in a thoughtful, intuitive, and USEFUL way.

### Project 4

Please create your own project and get it approved by me. Your proposal should be similar in content and presentation to the three proposed projects. It should be ready to hand out to another student in this class and make clear the scope of the project and be clear what is to be produced or delivered.

If you get this approved, you will complete your own project and submit it with the rest of the class.