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| **Lesson Title : Encryption with Algebra 2**  | **Unit #: 1** | **Lesson #: 2** | **Activity #: 1** |
| **Activity Title: Encrypting with Inverse Functions**  |

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| **Estimated Lesson Duration:** | **8 Days**  |
| **Estimated Activity Duration:** | **6 Days (50 minute periods)** |

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| **Setting:** | **Classroom**  |

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| **Activity Objectives:** |

I can…

1. Recognize and find inverse functions for linear, exponential, power, log, quadratic, and rational functions
2. Develop methods of encrypting messages using functions and their inverses

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| **Activity Guiding Questions:** |

1. How can high school math students reliably encrypt information with their current knowledge?
2. What is double encryption?

| **Next Generation Science Standards (NGSS)**  |
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| **Science and Engineering Practices (Check all that apply)**  | **Crosscutting Concepts (Check all that apply)** |
| [ ]  Asking questions (for science) and defining problems (for engineering) | [ ]  Patterns |
| [ ]  Developing and using models | [ ]  Cause and effect |
| [ ]  Planning and carrying out investigations | [ ]  Scale, proportion, and quantity |
| [ ]  Analyzing and interpreting data | [ ]  Systems and system models |
| [ ]  Using mathematics and computational thinking | [ ]  Energy and matter: Flows, cycles, and conservation |
| [ ]  Constructing explanations (for science) and designing solutions (for engineering) | [ ]  Structure and function.  |
| [ ]  Engaging in argument from evidence | [ ]  Stability and change.  |
| [ ]  Obtaining, evaluating, and communicating information  |  |

| **Ohio’s Learning Standards for Science (OLS)** |
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| **Expectations for Learning - Cognitive Demands (Check all that apply)** |
| [ ]  Designing Technological/Engineering Solutions Using Science concepts **(T)** |
| [ ]  Demonstrating Science Knowledge **(D)** |
| [ ]  Interpreting and Communicating Science Concepts **(C)** |
| [ ]  Recalling Accurate Science **(R)** |

| **Ohio’s Learning Standards for Math (OLS) and/or** **Common Core State Standards -- Mathematics (CCSS)** |
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| **Standards for Mathematical Practice (Check all that apply)** |
| [x]  Make sense of problems and persevere in solving them | [ ]  Useappropriate tools strategically |
| [x]  Reason abstractly and quantitatively | [ ]  Attendto precision |
| [ ]  Construct viable arguments and critique the reasoning of others | [ ]  Look for and make use of structure |
| [x]  Model with mathematics | [x]  Look for and express regularity in repeated reasoning |

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| **Unit Academic Standards (NGSS, OLS and/or CCSS):** |

**F-IFB5** Interpret functions that arise in applications in terms of the context: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes

**F-BFA1b** Write a function that describes a relationship between two quantities: Combine standard function types using arithmetic operations.

**F-BF3-4a** Build new functions from existing functions

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| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies) |

Powerpoint explaining double encryption with simple example

Notes sheet on inverse operations and functions

Worksheet on inverse functions and operations

Directions page with challenge (constraints/criteria included)

Cardstock for students to present their encryption methods

Rubric for grading sales pitch

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| **Teacher Advance Preparation:** |

Read through all materials and check answer key to worksheet

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| **Activity Procedures:** |

1. Go through a simple double encryption using addition for encryption and subtraction for decryption (example in powerpoint)
2. Use this to transition to inverse operations and then inverse functions
3. Do a lesson on inverse functions
4. Have students complete a worksheet finding inverse functions
5. Have students break up into their teams and spend 2 class periods creating their encryption systems and presenting them to the teacher who will check them to see if they meet the criteria

**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

Inverse function worksheet

**Summative Assessments:** These are optional; there may be summative assessments at the end of a set of Activities or only at the end of the entire Unit.

Sales pitch to teacher on their chosen encryption methods (may happen more than once if a critique is given during their explanation that they have to go back and fix)

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| **Differentiation:** Describe how you modified parts of the Lesson to support the needs of different learners.Refer to Activity Template for details. |

Accommodations:

1. Provide a template/organizer that mirrors the example so that there is a clear example to work off of
2. Allow the choice of an oral pitch or a written pitch to explain encryption system

Extension

1. Must show how the best way to break each of your encryptions
2. Find a function that needs at least two decryption steps

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson. |

This activity did not go as well as I would have hoped, because students were still struggling with the concept of encryption and cybersecurity and that prevented them from focusing on the math. Each group was still able to develop an encryption system, but because we were running out of time, they only developed one method, instead of as many methods as they could think of. With better attendance earlier in the year, and experience with CBL prior to this unit, I think all of these challenges would be more easily overcome. In terms of content, it all tied well and covered a lot of ground in Algebra II. Students really enjoyed sharing their encryption systems through an impromptu competition to try and break each other’s systems, prior to do their final iterations of improving their system and presenting their system. Student presentations were also not as comprehensive or neat as I would have expected, so I think providing a sample would be important if I were to do this unit again – I just didn’t want to give too much guidance so that they had the opportunity to be creative. Also, when students present I would make each group choose a different medium (only one poster, only 1 video, only PowerPoint, etc).