**Cryptography 101**

Description:

Write a mathematical analysis paper describing how you encode and decode messages using the techniques learned in class. Then encode the message using both the shift cipher and matrix method and describe what method would be best given time constraints, vulnerability, and ease of decoding.

Publisher: Envision Schools

Author: Brandon Barrette

Duration: 5 weeks

Grouping: Individual

Purpose: Student Assessment

Work Products: Final Mathematical Analysis Paper

Instruction Level: Beginner

Grade Levels: Grade 9, Grade 10

Standards: Common Core Standards for Mathematics (2010)

Category: Mathematics > Algebra and Functions; Mathematics > Problem Solving; Mathematics > Mathematical Reasoning

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**Directions**

Essential Questions

How is cryptography used in the real world?

Background Context

*Over the past few weeks, we have been learning various methods to encode and decode messages. You have learned about shift ciphers and matrix encoding and the advantages and disadvantages of each. You have also learned some historical context of cryptography.*

Task Prompt

You are preparing your application to the Central Intelligence Agency Undergraduate Internship Program. In the application, you are asked to answer the following scenario in a 2-3 page paper.

**“A terrorist organization has taken control of the Bay Area power grid. They are communicating in code and a recent transmission has been intercepted by the CIA. Your job is to crack the code and deliver the message encoded to the local CIA director. You speedy assistance is required to stop the terrorists from further harm.”**

Write a mathematical analysis paper describing how you encode and decode messages using the techniques learned in class. Then encode the message using both the shift cipher and matrix method and describe what method would be best given time constraints, vulnerability, and ease of decoding.

Task Requirements

You will write a 2-3 page mathematical paper that fulfills the following criteria:

* Give some historical context of cryptography.
* Describe the shift cipher, how it works, and encode your message.
* Describe matrix encoding, how it works, and encode your message.
* Describe which encoding method you would use and why, keeping in mind time constraints, vulnerability to hacking, and ease of decoding. Describe how the CIA director would decode the message.
* Describe connections to skills used in Algebra 1 throughout the year.
* Reflect on your process as a learner.
* Academic formatting
* Academic heading
  + 12 pt Times New Roman
  + double spaced
  + Edited and proofread
  + Correct citations for all references
  + 2-3 pages

You must refer to the Problem Solving Application Portfolio Rubric, as it communicates the specific expectations for proficiency. Use it as your guide at every stage of the drafting process. You will also use it when giving feedback to each other.

How will you be assessed?

* *Problem Solving Strategies*
* *Reasoning and Proof*
* *Connections*
* *Communication and Representation*

How will we get there?

**I can use problem solving strategies.**

* I can use some given restraints to encode a message.
* I can create a model using a shift cipher to encode a given message.
* I can create a model using matrices to encode a given message.

**I can use reasoning and proof to justify my work.**

* I can select the appropriate coding strategy and explain my reasoning.
* I can construct a logical, correct, and complete method to encode messages.
* I can move between real world contexts and mathematical abstractions.

**I can make connections.**

* I can explain relevant connections to similar problems.
* I can connect to previous knowledge in Algebra 1.

**I can create representations to communicate my ideas.**

* I can use multiple representations (shift ciphers and matrices) to enhance the understanding of my audience.
* I can use precise definitions with accurate representations.

**I can reflect on my work.**

* I can clearly state my learning goals and purpose for the artifact.
* I can thoroughly explain the process and decision making, including leadership skills.
* I can explain how this artifact impacted me and my growth as a mathematician.