CCSS Advanced Algebra 3 AA3: Cipher Project Name _____

Part 1: What is a Cipher?

Sometimes people want to send messages secretly and securely because the information is confidential or important. One way to do that is by using a Cipher. Please watch the video about the Caesar Cipher:
https://www.khanacademy.org/computing/computer-science/cryptography/crypt/v/caesar-cipher

When you finish the video, you can play around with the Caesar Cipher on khanacademy.
Move to Part 2 when you've got a feel for the cipher.

Part 2: Caesar Cipher

The Caesar Cipher can also be thought of as an "Addition Cipher," because a constant shift is added to the position of each letter. The letters are encoded as numbers alphabetically: A = 1, B = 2, C = 3, ..., Z = 26

We can use function notation to describe the Caesar Cipher. Namely, if x represents a letter in the original message, and f(x) represents the corresponding letter in the encrypted message, then $f(x) = x + 3$.
Here's a simple example using the Caesar Cipher:

Caesar ----------> Fdhvdu

3 1 5 19 1 18 ----------> 6 4 8 22 4 21

Salad ----------> Vdodg

19 1 12 1 4 ----------> 22 4 15 4 7

So if you want to order Caesar Salad on the DL, just order Fdhvdu Vdodg instead. Sounds tasty!

If you order Fdhvdu Vdodg at a restaurant, most servers will not know what you are talking about.

1. If you tell the server that your cipher is $f(x) = x + 3$, where x is the original letter position and $f(x)$ is the encrypted letter position, what will your server do to decode the cipher?

2. Write the function that your server will use to decode your message. What is the relation between your decoding function and your cipher?

Part 3: Caesar Cipher Practice

3. Encode this message using the Caesar Cipher from the previous slide:

Portland, Oregon

4. Decode this encrypted message:

FOHYHODQG KLJK VFKRRO

Part 4: Multiplication Ciphers

Multiplication Ciphers are similar to the Caesar Cipher, but instead of adding to the letter position, you multiply. For example, if $f(x) = 5x$, then the position of each letter is multiplied by 5.

APPLE ---> 1 16 16 12 5 ---> 5 80 80 60 25 ---> 5 2 2 8 25 ---> EBBHY

5. a. How did I change the middle set of letter positions into the final set? Why did we have to do that extra step?

b. CAUTION: Not every number works as a multiplier for this cipher. Can you think of a number that doesn't work?

Part 5: Project

For your Cipher Project, choose a quote or phrase to encrypt. Write the original quote, the encrypted quote, the cipher, and the decoding function for each task. You may use the same quote for all three tasks. Your quote must be sufficiently long and varied to demonstrate that you know how to use each cipher on any word.

6. Encrypt your quote using an addition cipher that is different than the Caesar Cipher

7. Encrypt your quote using a multiplication cipher that is invertible.

8. Encrypt your quote using a multiplication cipher that is not invertible. Explain why your cipher is not invertible. Use an example in your explanation.

Grading Rubric

7 = All parts are complete, thorough, and correct. All three ciphers are used correctly. Cipher and inverse are given for each task. Explanations demonstrate a deep understanding. Quote is sufficiently long and varied.

6 = All parts are complete, thorough, and correct. The three ciphers are used mostly correctly. Cipher and inverse are given for each task. Explanations demonstrate understanding. Quote is sufficiently long and varied.

5 = All parts are complete and correct. The three ciphers are used mostly correctly. Cipher and inverse are given for most tasks. Explanations demonstrate a shallow understanding. Quote is sufficiently long and varied.

4 = All parts are complete and correct. The Caesar cipher is used correctly. Cipher and inverse are given for most tasks. Quote is 20 characters or longer.

3 or lower = One or more part is incomplete, or the ciphers are not used correctly, or the quote is less than 20 characters.