



Math and the Cryptic Missive

Integration of Algebra, Geometry and Cryptology

1. Run (execute) the program “CIPHER”.
2. Read the opening screen. Press to proceed to the next screen.
3. In the “CipherSolvers” menu, press or to proceed to “Day 1: Strange Message”.
4. Read the next six pages, make notes as needed. Press to proceed to the next screen and press to go back a screen.
5. Use a Caesar shift of 13 letters to decrypt this message,

Gur oynpx oveq va gur obbx bs Cbr

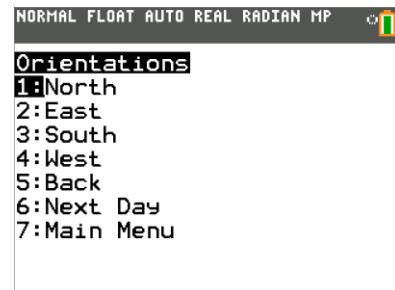
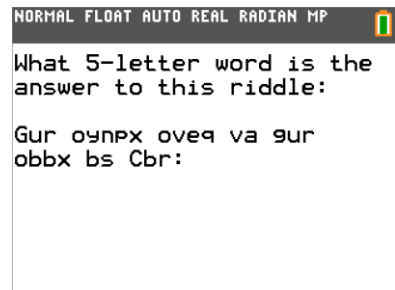
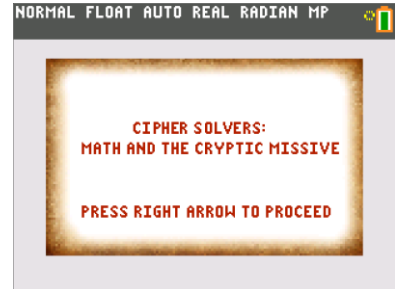
then type the 5-letter word that answers this riddle. Press .
(Hint: Make sure your calculator is in A-lock (alpha lock) by pressing then to type.)

6. Read the next four pages, make notes as needed.
7. At the “Orientations” menu, the options are based upon the clues that you read. Each option shows one orientation of the template and the four numbers it highlights. Choose three orientations based on the clues you read and write them below.

- a. Write the letter and the number assigned to it for the first orientation. Then press to proceed.

- b. Write the letter and the number assigned to it for the second orientation. Then press to proceed.

- c. Write the letter and the number assigned to it for the third orientation. Then press to proceed.





8. Once you have done three different directions, select “6: Next Day”. Read the next four pages and make notes as needed.
- What word can be formed using the letters **A T M H** ?
 - In the correct order, the letters of the word correspond to x_1 , y_1 , x_2 , and y_2 , respectively. Using the answers found in part 7a, write the two ordered pairs below:
 - Using the answers found in part 7b, write the two ordered pairs below:
 - Using the answers found in part 7c, write the two ordered pairs below:
 - Plot the three pairs of points on the CipherSolver_Graph_Paper supplied by your teacher.
9. Determine the equation of the line for each set of points.
(Note: Each person in your group should work on one equation, but a different equation, using the ordered pairs listed in 8b, 8c, or 8d.) Show your work below.



10. Write the three equations found by the members of your group below. You will be prompted to enter these into the calculator.


Y1 = _____

Y2 = _____

Y3 = _____

Graph each of the three lines on the graph paper. Do they contain the three pairs of points?

11. What do these three lines form?

Press  to proceed.


12. Determine the vertices of the triangle created by these lines.

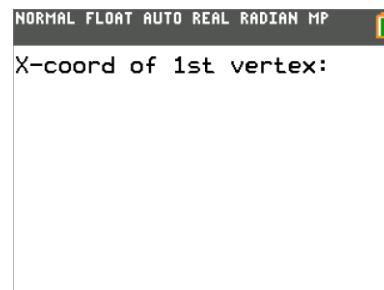
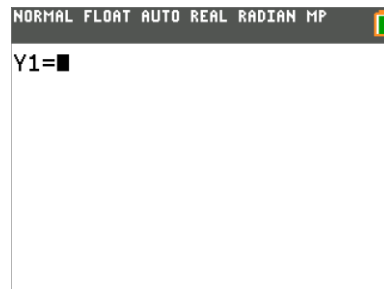
(Note: Each person in the group will algebraically determine the ordered pair for just one vertex, but a different vertex.) Show your work below.

13. Write the ordered pairs for the three vertices found by the members of your group below.

Check these ordered pairs on your graph paper.

14. For the “Day 2b: Triangle?” menu, select “1: Input vertices”. Then type in the coordinates as asked using your answers from 13.

The vertices are then shown on the graph. Press  to proceed.





15. Read the five pages, make notes as needed. The last page asks you to do the following:
Determine the equations of the lines perpendicular to each of the three sides of the triangle that pass through these midpoints of the sides. (Each person in the group does a different one of these).

Show your work below.

a. (20, 12)


b. (8, 16)

c. (16, 4)

- d. Write the three equations found by the members of your group below.

Y4 = _____ Y5 = _____ Y6 = _____

- e. Graph these three equations on your graph paper.

16. Press  to proceed to the "Day 3: Let's Dig!" menu.

Select "1: Input Equations". You will be prompted to enter the equations listed in 15d above.



17. Determine the coordinates where each pair of lines intersects. Use algebra to do so and show your work below. Each person in the group will find the intersection point of two different lines.



18. Write the coordinates of the points of intersection found by the members of your group below. Express them in two ways: as an exact fraction and rounded to the nearest thousandth:

Y4 \cap Y5 _____

Y5 \cap Y6 _____

Y4 \cap Y6 _____

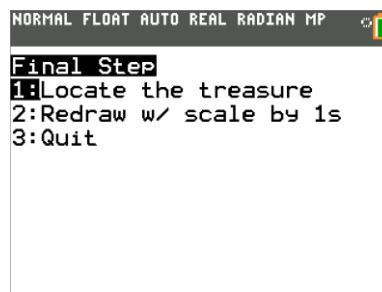
Look at these ordered pairs on your graph paper. Do they seem correct?

19. Press \blacktriangleright to proceed to the “Final Step” menu.

Select “1: Locate the treasure”. The three equations are displayed. Press \blacktriangleright to proceed.

Each person in the group will choose a different number: 1, 2, or 3. The point of intersection of the two lines chosen will be displayed as a decimal. Compare the calculator answer to your answer in 18 above. Press \blacktriangleright to proceed.

What did you discover?



20. Press \blacktriangleright to proceed to the “CipherSolvers” menu. Select “5: Day 4: Encryption Demo and read the page. Press \blacktriangleright to proceed to the “Day 4” Encryption Demo” menu.

a. Select “1: Encrypt”. Type an encryption key: any 4- to 12-digit number and press $\boxed{\text{enter}}$. Write it below.

b. Type your message.

Note: you may want to use A-lock (alpha lock) by pressing $\boxed{2\text{nd}}$ then $\boxed{\text{alpha}}$. To obtain a space, it is the alpha symbol above the zero key. When finished typing your message, press $\boxed{\text{enter}}$.

Write it below.

c. After a few seconds, your encrypted message will be displayed. Write it below (Note: it may contain numbers, spaces, or other characters, not just letters).



21. Press to proceed to the “Day 4: Encryption Demo” menu. Select “2: Decrypt”.
- Type the exact encrypted message from 20c. Press .
 - Type the encryption key from 20a. Press .
 - After a few seconds, the decrypted (original) message will be displayed, but only for 5 seconds! So watch closely.
 - Do another encrypted message, if you like.
 - When finished, at the “Day 4: Encryption Demo” menu, select “4: Quit” This will remove all images, clear the ‘y =’ menu, and place your calculator back to its default settings.