

# Secret Codes With the Rail Fence Cipher Method

by Laurie Burton, Western Oregon University, Monmouth, Oregon burton@wou.edu



This activity connects counting and basic whole number grouping and division skills.

**Materials Needed:** Student pages, graph paper

## The Cipher Method

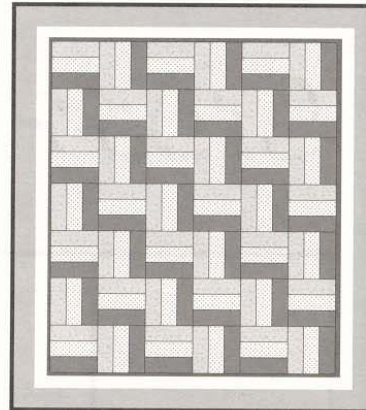
The Rail Fence cipher is a form of *Transposition Encryption* where the secret message is written in a zigzag pattern on more than one line. Each line is referred to as a rail.

For instance, the message (the plaintext or secret message) on two rails looks like this

T I I A E A P E  
H S S N X M L

and, writing the first line followed by the second line, becomes the secret code (the ciphertext):

T I I A E A P E H S S N X M L



Rail fence quilt piece

To decode the message you must split the message in two pieces and re-write in a zigzag pattern. Kids will need to figure out what to do about two-rail fences with an odd number of letters (put the number of letters in the quotient plus the remainder of 1 letter in the top row and the second “half” of the letters in the second row).

Kids will have to think about what to do with the “extra letters” in general. In a three-rail message with 11 letters, for example, the message might look like this:

T C J P H O U S E W M

To decode the message, you must split the message in three pieces.  $11 \div 3 = 3 \text{ R}2$ . In this case the remainder of two is shared in the top two lines.

T		C		J		P	
	H		O		U		S
		E		W		M	

## Encryption Tips for Kids

It is easier to write in a zigzag pattern in a table. Kids can use graph paper.

## References

*Invitation to Cryptology*, Thomas H. Barr, Prentice Hall, 2002

Reference for quilt piece at: <http://quiltingpassion.com/gallery/americana/>

## Answers

The messages on the next page are: “My favorite subject is math.” and, “You are a great friend Ralph.”

## STUDENT PAGE

**Sitting on a Fence: Zigzag Secret Codes**

Ralph loves secret messages! Today Ralph's friend Griselda told Ralph about a new secret message method called the Rail Fence Method. Griselda showed Ralph how to make a secret message with two rails. Griselda writes her message in a zigzag pattern on two lines. Each line is called a *rail*.

C	N	O	R	A	T	I	M	S	A	E
	A	Y	U	E	D	H	S	E	S	G

Griselda shows Ralph that he can now create his secret message by writing the letters from the top line followed by the letters from the second line like this:

C N O R A T I M S A E A Y U E D H S E S G

Wow! That doesn't look like the same message at all! Ralph counts the letters. There are 21!

- How do you divide 21 letters into two rows to decode the secret message? Look carefully... which row has the most letters?
- Ralph creates a message for Griselda. He is so excited! Ralph uses two rails (he writes his message on two lines). What is Ralph's secret message?

M F V R T S B E T S A H Y A O I E U J C I M T

You can use this table to write out the message. Count the letters first and skip spaces to make the zigzag pattern. Don't forget to skip the first space on the second line!


Ralph's secret message is: \_\_\_\_\_

- Griselda loves playing secret codes with Ralph! She wants to make up a secret message that is really hard for Ralph to decipher! Griselda writes her message using four rails! Can you help Ralph figure out Griselda's secret message? How many spaces do you need to skip between the letters? Where should you start on the second line, the third line, the fourth line?

Y R R F N L O E E R D P U A A I R H A G T E A


- This is a great game! Won't you join in on the fun! Make up secret messages for your friends! You can use graph paper to write your message (don't let anyone see!).

You can make it easier for your friends by telling them how many rails you used and you can make it harder for them by not telling them how many rails you used!