

Chapter 1: Caesar Ciphers

(Text page 4)

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C

Caesar cipher with shift of 3

1. a. Encrypt "keep this secret" with a shift of 3.

plaintext:	k	e	e	p		t	h	i	s		s	e	c	r	e	t	
ciphertext:																	

b. Encrypt your teacher's name with a shift of 3.

plaintext:																	
ciphertext:																	

2. Decrypt the answers to the following riddles. They were encrypted using a Caesar cipher with a shift of 3.

a. **Riddle:** What do you call a sleeping bull?

Answer:

plaintext:																	
ciphertext:	D		E	X	O	O	G	R	C	H	U						

b. **Riddle:** What's the difference between a teacher and a train?

Answer:

plaintext:																	
ciphertext:	W	K	H		W	H	D	F	K	H	U		V	D	B	V	

"Q	R		J	X	P		D	O	O	R	Z	H	G."		W	K	H

W	U	D	L	Q		V	D	B	V		"F	K	H	Z		F	K	H	Z."

Name _____ Date _____

(Text page 5)

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D

Caesar cipher with shift of 4

3. Decrypt the following note Evie wrote to Abby. She used a Caesar cipher with a shift of 4 like the one above.

plaintext:																									
ciphertext:	W	S	V	V	C.	P	I	X'	W	Y	W	I													

G	M	T	L	I	V	W	J	V	S	Q	R	S	A	S	R.										

4. Use a shift of 3 or 4 to encrypt someone's name. It could be someone in your class or school or someone your class has learned about. (You'll use this to play Cipher Tag.)

plaintext:																									
ciphertext:																									

(Text pages 6-7)

5. a. Encrypt "private information" using a cipher wheel with a shift of 5. (Shift the inner wheel five letters counterclockwise.)

plaintext:	p	r	i	v	a	t	e		i	n	f	o	r	m	a	t	i	o	n
ciphertext:																			

- b. Encrypt your school's name using a cipher wheel with a shift of 8.

plaintext:																			
ciphertext:																			

Use your cipher wheel to decrypt the answers to the following riddles:

6. **Riddle:** What do you call a dog at the beach?
Answer (shifted 4):

plaintext:																			
ciphertext:	E		L	S	X		H	S	K										

7. **Riddle:** Three birds were sitting on a fence. A hunter shot one. How many were left?
Answer (shifted 8):

plaintext:																			
ciphertext:	V	W	V	M.		B	P	M		W	B	P	M	Z	A				
	N	T	M	E		I	E	I	G.										

Name _____ Date _____

(Text page 7)

8. **Riddle:** What animal keeps the best time?

Answer (shifted 10):

plaintext:																			
ciphertext:	K		G	K	D	M	R	N	Y	Q									

9. Write your own riddle and encrypt the answer. Put your riddle on the board or on a sheet of paper that can be shared with the class later on. (Tell the shift.)

Riddle: _____

Answer:

plaintext:																			
ciphertext:																			

Chapter 2: Sending Messages with Numbers

(Text page 10)

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

1. a. **Riddle:** What kind of cookies do birds like?

Answer:

plaintext:																									
ciphertext:	2	7	14	2	14	11	0	19	4					2	7	8	17	15							

b. **Riddle:** What always ends everything?

Answer:

plaintext:																									
ciphertext:	19	7	4			11	4	19	19	4	17			6											

Return to Text

2. a. Encrypt using the cipher strip at the top of the page.

plaintext:	J	a	m	e	s		B	o	n	d															
ciphertext:																									

b. Encrypt using this cipher strip that is shifted 3.

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	0	1	2

plaintext:	J	a	m	e	s		B	o	n	d															
ciphertext:																									

c. Describe how you can use arithmetic to get your answer to 2b from your answer to 2a.

(Text page 11)

3. Encrypt the following with the given shift:

a. shift 4

plaintext:	L	i	n	c	o	l	n
numbers:							
shifted numbers:							

b. shift 5

plaintext:	L	u	k	e
numbers:				
shifted numbers:				

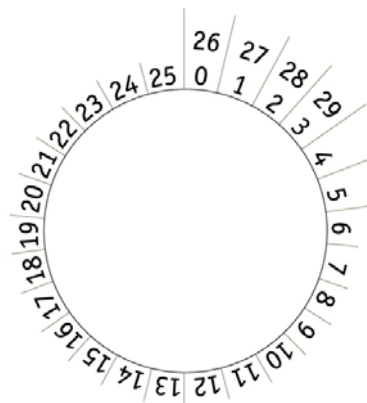
c. shift 3 (What is different about encrypting the letter x?)

plaintext:	e	x	p	e	r	i	m	e	n	t
numbers:										
shifted numbers:										

*****Return to Text*****

4. What numbers between 0 and 25 are equivalent on the circle to the following numbers?

- a. 28 _____
- b. 29 _____
- c. 30 _____
- d. 34 _____
- e. 36 _____
- f. 52 _____



5. Describe an arithmetic pattern that tells how to match a number greater than 25 with an equivalent number between 0 and 25.

6. Encrypt each word by adding the given amount. Your numbers should end up between 0 and 25.

a. add 4

plaintext:	x	-	r	a	y
numbers:					
shifted numbers:					

b. add 10

plaintext:	c	r	y	p	t	o	g	r	a	p	h	y
numbers:												
shifted numbers:												

(Text page 12)

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Cipher strip (no shift)

7. Jenny encrypted this name by adding 3. Decrypt to find the name.

↑	plaintext:																								
	numbers:																								
	shifted numbers:	14	11	14	3	10																			

8. **Riddle:** Why doesn't a bike stand up by itself?

Answer (encrypted by adding 3):

↑	plaintext:																								
	numbers:																								
	shifted numbers:	11	22	'	21		22	25	17		22	11	20	7	6										

9. **Riddle:** What do you call a monkey who loves to eat potato chips?

Answer (encrypted by adding 5):

↑	plaintext:																								
	numbers:																								
	shifted numbers:	5		7	12	13	20		17	19	18	15													

10. **Riddle:** What is a witch's favorite subject?

Answer (encrypted by adding 7):

↑	plaintext:																								
	numbers:																								
	shifted numbers:	25	22	11	18	18	15	20	13																

11. **Challenge.** This is a name that was encrypted by adding 3.

a. Decrypt by subtracting.

↑	plaintext:																								
	numbers:																								
	shifted numbers:	22	11	15	15	1																			

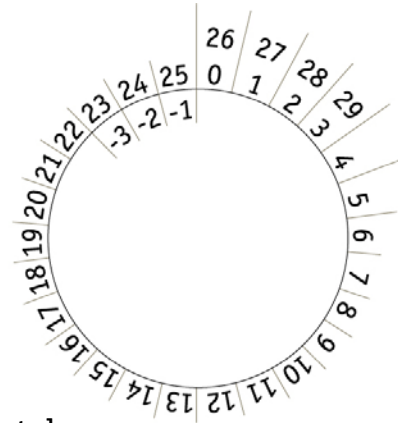
b. What happens to the 1? What can you do to fix the problem?

Name _____

(Text page 13)

12. What numbers between 0 and 25 are equivalent on the circle to the following numbers?

- a. 26 _____ b. 28 _____ c. -1 _____
 d. -2 _____ e. -4 _____ f. -10 _____



13. Describe an arithmetic pattern that tells how to match a number less than 0 with an equivalent number between 0 and 25.

14. Decrypt by subtracting. Replace negative numbers with equivalent numbers between 0 and 25.

<p>a. subtract 3</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="width: 15px; text-align: center;">↑</td> <td style="padding: 2px;">plaintext:</td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> <tr> <td></td> <td style="padding: 2px;">numbers:</td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> <tr> <td></td> <td style="padding: 2px;">shifted numbers:</td> <td style="text-align: center;">18</td> <td style="text-align: center;">11</td> <td style="text-align: center;">2</td> <td style="text-align: center;">2</td> <td style="text-align: center;">3</td> </tr> </table>	↑	plaintext:							numbers:							shifted numbers:	18	11	2	2	3	<p>b. subtract 10</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="width: 15px; text-align: center;">↑</td> <td style="padding: 2px;">plaintext:</td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> <tr> <td></td> <td style="padding: 2px;">numbers:</td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> <tr> <td></td> <td style="padding: 2px;">shifted numbers:</td> <td style="text-align: center;">3</td> <td style="text-align: center;">10</td> <td style="text-align: center;">7</td> <td style="text-align: center;">18</td> </tr> </table>	↑	plaintext:						numbers:						shifted numbers:	3	10	7	18	<p>c. subtract 15</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="width: 15px; text-align: center;">↑</td> <td style="padding: 2px;">plaintext:</td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> <tr> <td></td> <td style="padding: 2px;">numbers:</td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> <tr> <td></td> <td style="padding: 2px;">shifted numbers:</td> <td style="text-align: center;">7</td> <td style="text-align: center;">4</td> <td style="text-align: center;">13</td> </tr> </table>	↑	plaintext:					numbers:					shifted numbers:	7	4	13
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	numbers:																																																							
	shifted numbers:	7	4	13																																																				

15. **Riddle:** What do you call a chair that plays guitar?

Answer (encrypted by adding 10):

↑	plaintext:																		
	numbers:																		
	shifted numbers:	10	1	24	12	20	14	1											

16. **Riddle:** How do you make a witch itch?

Answer (encrypted by adding 20):

↑	plaintext:																		
	numbers:																		
	shifted numbers:	13	20	4	24	20	16	20	18	1	24	11	16						

(Text page 16)

17. a. To decrypt the riddle in Question 15, you could subtract 10. What number could you add to get the same answer as subtracting 10?

b. Here is the answer to the riddle in Question 15. Decrypt it again, adding or subtracting as necessary to avoid negative numbers and numbers greater than 25.

↑	plaintext:																
	numbers:																
	shifted numbers:	10		1	24	12	20	14	1								

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18. a. Suppose that you encrypted a message by adding 9. Tell two different ways you could decrypt it.

b. This message was encrypted by adding 9. Decrypt by adding or subtracting to avoid negative numbers and numbers greater than 25.

5	13		16	9	4	13		14	23	3	22	12		9			

1	16	23	0	2	11	3	2	.									

The Cryptoclub: Using Mathematics to Make and Break Secret Codes

Name _____ Date _____

(Text page 16)

19. a. Suppose that you encrypted a message by adding 5. Tell two different ways you could decrypt it.

b. In general, suppose that you encrypted a message by adding an amount n . Tell two different ways you could decrypt it.

For Questions 20–23, add or subtract as necessary to make your calculations simplest.

20. **Riddle:** Imagine that you're trapped in a haunted house with a ghost chasing you. What should you do?

Answer (encrypted by adding 10):

plaintext:																			
numbers:																			
shifted numbers:	2	3	24	25		18	22	10	16	18	23	18	23	16					

21. **Riddle:** Why must a doctor control his temper?

Answer (encrypted by adding 11):

plaintext:																			
numbers:																			
shifted numbers:	12	15	13	11	5	3	15		18	15		14	25	15	3	24	'	4	

7	11	24	4		4	25		22	25	3	15		18	19	3		0	11	4	19	15	24	4	3

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Name _____ Date _____

(Text page 17)

22. **Riddle:** What is the meaning of the word “coincide”?

Answer (encrypted by adding 7):

plaintext:																			
numbers:																			
shifted numbers:	3	14	7	0		19	21	25	0		22	11	21	22	18	11		10	21

	3	14	11	20		15	0		24	7	15	20	25						

23. Abby was learning about life on the frontier. “Peter,” she said, “Where is the frontier?” Decrypt Peter’s reply (encrypted by adding 13).

plaintext:																							
numbers:																							
shifted numbers:	6	20	13	6	'	5		13		5	21	24	24	11		3	7	17	5	6	21	1	0.

	11	1	7		1	0	24	11		20	13	8	17		13		24	17	18	6		17	13	4

	13	0	16		13		4	21	19	20	6		17	13	4	.								

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Here are some blank tables for you to make your own messages.

Now let's practice our skills

[Click here if you dare to enter Treasure Hunt Game](#)

