

# **Blackline Masters**

to accompany

# **The Cryptoclub**

## **Using Mathematics to Make and Break Secret Codes**

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Name \_\_\_\_\_ Date \_\_\_\_\_

## Three-Row Tables

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








Name \_\_\_\_\_ Date \_\_\_\_\_

## Two-Row Tables

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











Name \_\_\_\_\_ Date \_\_\_\_\_

## Cipher Tables

Here are extra tables to use when encrypting and decrypting other messages.

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

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

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

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

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

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

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

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

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

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

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

Name \_\_\_\_\_ Date \_\_\_\_\_

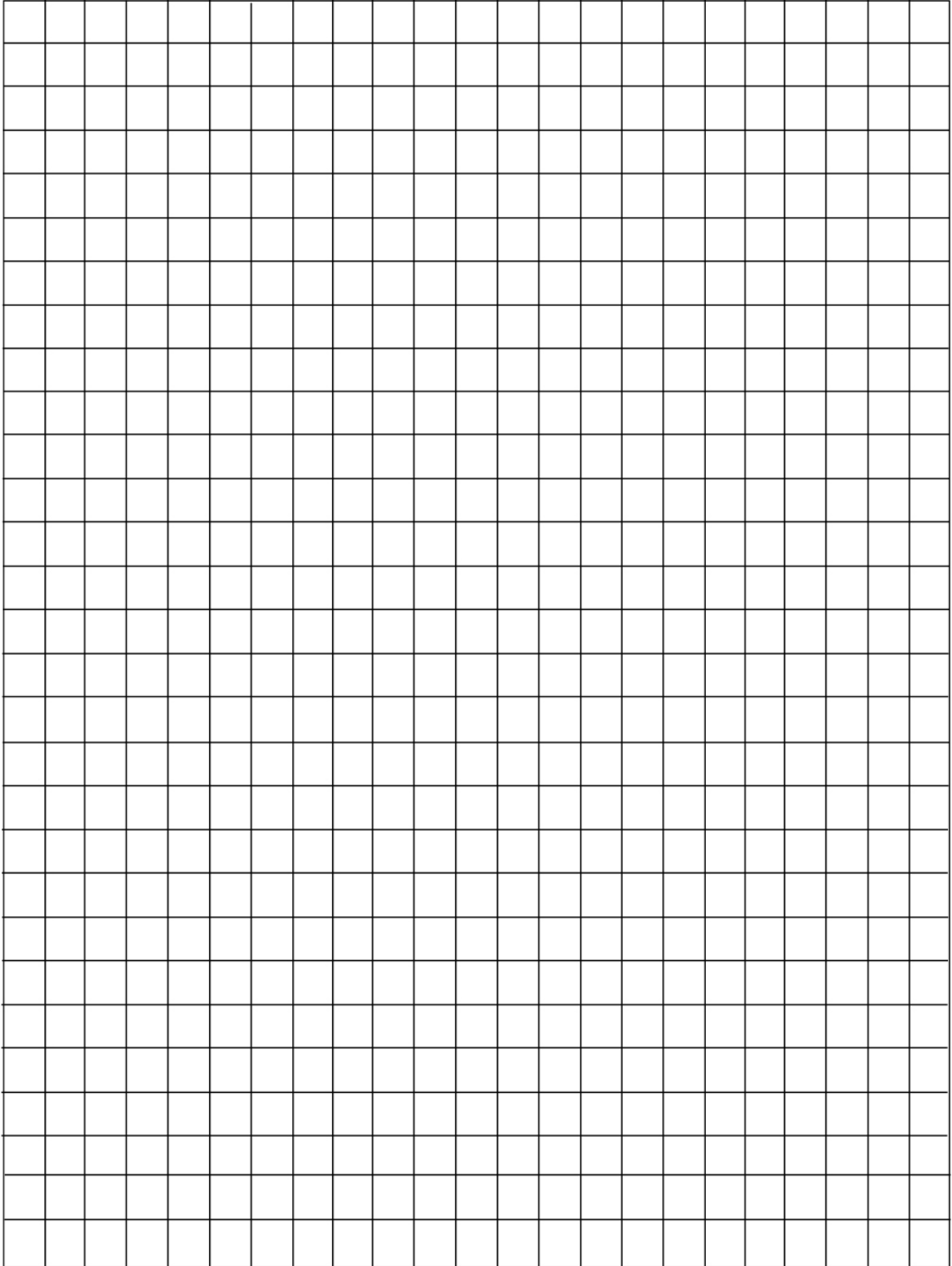
## Frequency Table

Letter	Frequency	Relative Frequency		
		Fraction	Decimal (to 3 places)	Percent (%) (to nearest tenth)
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				
Total				

Name \_\_\_\_\_ Date \_\_\_\_\_

# Blank Grid Paper

You can use this page for your own messages.



Name \_\_\_\_\_ Date \_\_\_\_\_

## Cipher Strip

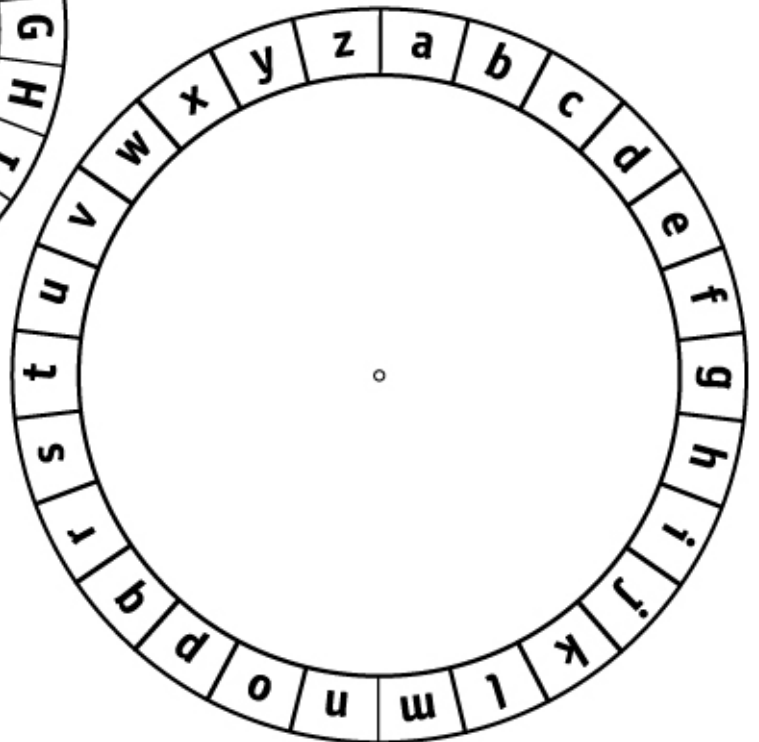
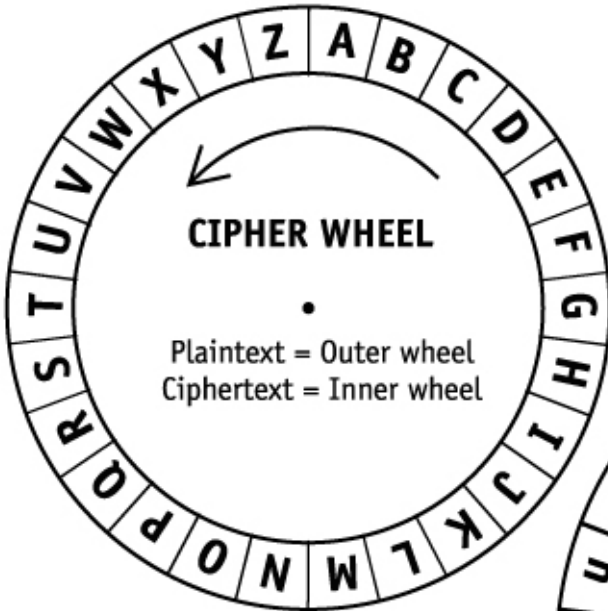
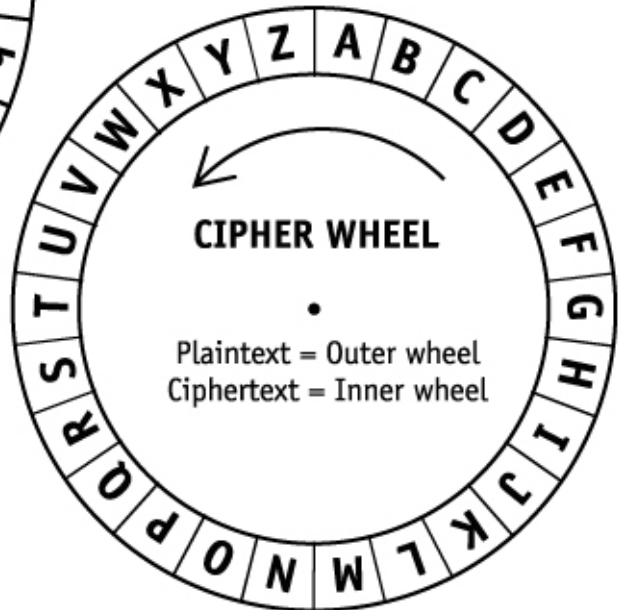
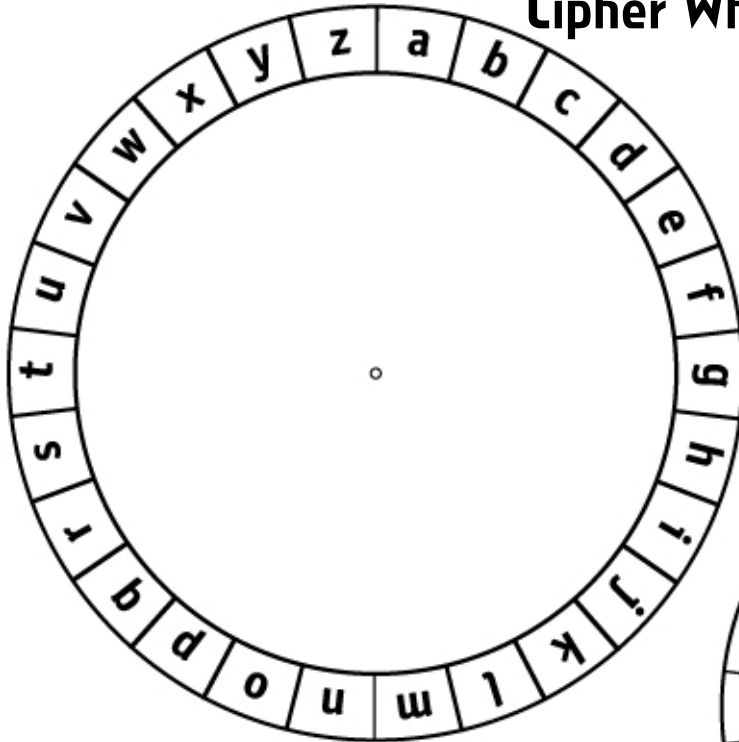
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

## Vigenère Square

	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	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
1	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	A
2	C	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
3	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
4	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
5	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	E
6	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F
7	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G
8	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H
9	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I
10	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J
11	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K
12	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L
13	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M
14	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N
15	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
16	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
17	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
18	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
19	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
20	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
21	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
22	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
23	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
24	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
25	Z	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



# Cipher Wheels



Name \_\_\_\_\_ Date \_\_\_\_\_

## Can You Crack These Messages?

Decrypt the following messages using whatever clues you can find.

1.

(7)

AOL AYLHZBYL PZ  
OPKKLU BUKLY AOL  
VSK VHR AYLL

2.

N XFB YMJ UNWFYJ  
GZWD YMJ LTQI.

3.

EWLHLWLWJSFVEWLGFAYZLSLGMJKWUJWLHDSUW.  
AZSNWKGEWLZAFYWDKWLQLWDDQGM.

Name \_\_\_\_\_ Date \_\_\_\_\_

## Can You Crack This?

CUVB ZPBBLSP HLB PGNTJECPO

HVCU L XPJHRTO NVEUPT.

NULECT 4 HVYY CPYY URH L

BPGOPT NLG OPBNTVMP CUP

BDMBCVDCVRG CLMYP MJ

CPYYVGS JRD RGYJ L XPJHRTO

LGO L XPJ YPCOPT.

Name \_\_\_\_\_ Date \_\_\_\_\_

## Class Letter Frequencies

Letter	Class Letter Frequencies										Total for All Groups
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 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											
Total											



# Teacher-Made Treasure Hunt Clues

## Clue 1

**Teacher's tip:** Make as many copies of this page as there are students per group. Cut clues apart and staple duplicates together to make a packet for each group. Put all the packets in one envelope marked "Clue 1".

-----cut here-----

### Group 1

Clue 1 (Caesar cipher, key 5):

Y M J    K N W X Y    U Q F H J    Y M F Y

-----cut here-----

### Group 2

Clue 1 (Caesar cipher, key 5):

D T Z    X M T Z Q I    Q T T P    N X

-----cut here-----

### Group 3

Clue 1 (Caesar cipher, key 5):

B M J W J    D T Z    H F S    L T

-----cut here-----

### Group 4

Clue 1 (Caesar cipher, key 5):

Y T    L J Y    F    G T T P.

# Teacher-Made Treasure Hunt

## Clue 2

**Teacher's tip:** Make as many copies of this page as there are students per group. Cut clues and staple to make a packet of duplicate clues for each group--one copy for each student in the group. Put all the packets in one envelope marked "Clue 2".

-----cut here-----

### Group 1

Clue 2 (Caesar cipher, key 4):

23 11 12 22 12 22 4 16 4 19

-----cut here-----

### Group 2

Clue 2 (Caesar cipher, key 4):

23 11 4 23 22 11 18 0 22 12 23 4 15 15.

-----cut here-----

### Group 3

Clue 2 (Caesar cipher, key 4):

12 23 22 11 18 0 22 23 11 8 0 18 21 15 7

-----cut here-----

### Group 4

Clue 2 (Caesar cipher, key 4):

18 17 18 17 8 5 12 10 5 4 15 15.

# Teacher-Made Treasure Hunt

## Clue 3

**Teacher's tip:** Make as many copies of this page as there are students per group. Cut clues and staple to make a packet of duplicate clues for each group--one copy for each student in the group. Put all the packets in one envelope marked "Clue 3".

-----cut here-----

### Group 1

Clue 3 (encrypted with times-9 cipher):

15 11 10 13 10 25 15 18 21 24 10

-----cut here-----

### Group 2

Clue 3 (encrypted with times-9 cipher):

15 11 0 15 8 22 24 18 0 13 19 20 13 1

-----cut here-----

### Group 3

Clue 3 (encrypted with times-9 cipher):

20 6 13 10 0 23 15 11 10 5 21 0 18 10

-----cut here-----

### Group 4

Clue 3 (encrypted with times-9 cipher):

15 11 0 15 15 10 21 21 6 15 11 10 15 20 4 10.



# Teacher-Made Treasure Hunt

## Clue 4

**Teacher's tip:** Make as many copies of this page as there are students per group. Cut clues and staple to make a packet of duplicate clues for each group--one copy for each student in the group. Put all the packets in one envelope marked "Clue 4".

-----cut here-----

### Group 1

Clue 4 (keyword cipher, keyword FUNNY, keyletter H):

R I P D K T A W R C K E R J

-----cut here-----

### Group 2

Clue 4 (keyword cipher, keyword FUNNY, keyletter H):

J F W W C V D X J F W V R P,

-----cut here-----

### Group 3

Clue 4 (keyword cipher, keyword FUNNY, keyletter H):

J F U I U I M F W H W J F U C Z I

-----cut here-----

### Group 4

Clue 4 (keyword cipher, keyword FUNNY, keyletter H):

R H W J F H D M C R M R P.

# Teacher-Made Treasure Hunt

## Clue 5

**Teacher's tip:** Make as many copies of this page as there are students per group. Cut clues and staple to make a packet of duplicate clues for each group--one copy for each student in the group. Put all the packets in one envelope marked "Clue 5".

-----cut here-----

### Group 1

Clue 5 (affine cipher, key (21,2)):

16 10 20 8 11 14 20 8 16 23 25 2 18 4,

-----cut here-----

### Group 2

Clue 5 (affine cipher, key (21,2)):

16 10 20 8 11 14 20 8 16 22 19 14 11 8,

-----cut here-----

### Group 3

Clue 5 (affine cipher, key (21,2)):

11 19 14 16 14 16 2 23 10 2 21 13 10 15

-----cut here-----

### Group 4

Clue 5 (affine cipher, key (21,2)):

22 19 14 18 19 11 10 22 21 14 11 8.

# Teacher-Made Treasure Hunt

## Clue 6

**Teacher's tip:** Make as many copies of this page as there are students per group. Cut clues and staple to make a packet of duplicate clues for each group--one copy for each student in the group. Put all the packets in one envelope marked "Clue 6".

-----cut here-----

### Group 1

Clue 6 (affine cipher, key (1,10)):

13 24 23 ' 3 16 14 3 3 18 1 14 13,

-----cut here-----

### Group 2

Clue 6 (affine cipher, key (1,10)):

13 24 23 24 3 1 14 2 3. 15 18 23 13

-----cut here-----

### Group 3

Clue 6 (affine cipher, key (1,10)):

3 1 14 10 2 4 1 14 4 23 13 14 1

-----cut here-----

### Group 4

Clue 6 (affine cipher, key (1,10)):

3 14 10 12 17 14 1 ' 2 13 14 2 20.

# Teacher-Made Treasure Hunt Answer Key

## Clue 1

*Teacher opens envelope #1 and distributes clues to groups*

*Location described: Bookshelf*

Plaintext:

The first place that you should look is where you can go to get a book.

Ciphertext (Caesar cipher, key 5):

YMJ KNWXY UQFHJ YMFY DTZ XMTZQI QTTP  
NX BMJWJ DTZ HFS LT YT LJY F GTTP.

---

## Clue 2

*Hide on bookshelf*

*Location described: Globe*

Plaintext:

This is a map that shows it all.  
It shows the world on one big ball.

Ciphertext (Caesar cipher, key 4):

23 11 12 22 12 22 4 16 4 19 23 11 4 23 22 11 18 0 22 12 23 4 15 15.  
12 23 22 11 18 0 22 23 11 8 0 18 21 15 7 18 17 18 17 8 5 12 10 5 4 15 15.

---

## Clue 3

*Hide under globe.*

*Location described: Clock*

Plaintext:

The next clue that you can find  
Is near the place that tells the time.

Ciphertext (times-9 cipher):

15 11 10 13 10 25 15 18 21 24 10 15 11 0 15 8 22 24 18 0 13 19 20 13 1  
20 6 13 10 0 23 15 11 10 5 21 0 18 10 15 11 0 15 15 10 21 21 6 15 11 10 15 20 4 10.

# Teacher-Made Treasure Hunt Answer Key (continued)

## Clue 4

*Hide near clock.*

*Location described: Garbage can*

Plaintext:

As you clean up at the end of the day,  
This is where things are thrown away.

Ciphertext (Keyword cipher, keyword FUNNY, keyletter H):

RI PDK TAWRC KE RJ JFW WCV DX JFW VRP,  
JFUI UI MFWHW JFUCZI RHW JFHDMC RMRP.

---

## Clue 5

*Hide under garbage can.*

*Location described: Board*

Plaintext:

Sometimes black, sometimes white,  
This is a board on which to write.

Ciphertext (affine cipher, key (21,2)):

16 10 20 8 11 14 20 8 16 23 25 2 18 4, 16 10 20 8 11 14 20 8 16 22 19 14 11 8,  
11 19 14 16 14 16 2 23 10 2 21 13 10 15 22 19 14 18 19 11 10 22 21 14 11 8.

---

## Clue 6

*Hide near board.*

*Location described: Under teacher's desk*

Plaintext:

Don't get tired, do not rest.  
Find treasure under teacher's desk.

Ciphertext (affine cipher, key (1,10)):

13 24 23 3 16 14 3 3 18 1 14 13, 13 24 23 24 3 1 14 2 3.  
15 18 23 13 3 1 14 10 2 4 1 14 4 23 13 14 1 3 14 10 12 17 14 1' 2 13 14 2 20.

# Make-Your-Own Treasure Hunt

## Student Instructions

### Prepare your clue:

1. With your group, choose a secret place where you will hide a clue.
2. Write a clue that describes the location of your secret place.
3. Encrypt your clue. (Decide with your classmates and teacher whether you will tell the key and cipher or leave that for others to crack.)
4. Make copies of your clue—one for each group. Put your copies in an envelope. Write your group's number on your envelope.

### Directions for hiding your clue:

5. Give your clue envelope to the group whose number is one less than yours. They will hide your clue in *their* secret location, but they won't read it. (Group 1 gives their clue to the teacher.)
6. Hide the clue prepared by the group whose number is one greater than yours. Hide it in *your* secret place, but do not read it. (The last group hides the clue prepared by the teacher.)