Worksheet 1: Route Cipher Encryption

1. Decorated →

D	E	C
O	R	A
T	E	D

Write along the rows, read down the columns:
→ DOTERECAD

2. Flowerpot →

F	L	O
W	E	R
P	O	T

Read down the columns:
→ FWPLEOORT

Extension:

3. Clucking chickens →

C	L	U	C
K	I	N	G
C	H	I	C
K	E	N	S

Read down the columns:
→ CKCKLIHEUNINCGCS

4. Lost train: →

L	O	S
T	T	R
A	I	N

Read down the columns:
→ LTAOTISRN

Worksheet 1, Further extension: Eating fruit is good for you!
Encrypt this sentence using the different shaped rectangular grids below:

5.

E	A	T	I
N	G	F	R
U	I	T	I
S	G	O	O
D	F	O	R
Y	O	U	!

Reading down the columns:
ENUSDY AGIGFO TFTOOU IRIOR!
→ ENUSDYAGIGFOTFTOOUIRIOR!

6.

E	A	T	I	N	G	F	R
U	I	T	I	S	G	O	O
D	F	O	R	Y	O	U	!

Reading down the columns:
EUD AIF TTO IIR NSY GGO FOU RO!
→ EUDAIFTTOIIR NSYGGOFOURO!

7.

E	A	T	I	N	G
F	R	U	I	T	I
S	G	O	O	D	F
O	R	Y	O	U	!

Reading down the columns:
EFSO ARGR TUOY IIOO NTDU GIF!
→ EFSOARGRTUOYIIOONTDUGIF!

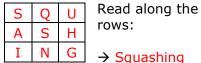8. What do you notice about using different sized grids?
They give different answers. This means we have to be careful that everyone knows the right sized grid when exchanging messages encrypted with a route cipher.

Worksheet 2: Route Cipher Decryption

1. BHIDRATY →

B	I	R	T
H	D	A	Y

Write down the columns, read along the rows:
→ Birthday

2. SAIQSNUHG →

S	Q	U
A	S	H
I	N	G

Read along the rows:
→ Squashing

Worksheet 2, Extension:

3. HIEHAELAPSENPTPT →

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

Read along the rows:
→ Happiest elephant

4. HLTIIEGGRHHS →

H	I	G	H
L	I	G	H
T	E	R	S

Read along the rows:
→ Highlighters

Worksheet 2, Further extension

5. IESSVDETIBLYSRS
   EIULATSAR

I	V	I	S	I	T
E	D	B	R	U	S
S	E	L	S	L	A
S	T	Y	E	A	R

I visited Brussels last year

6. IBLVRAIUSSSTISYT
   EEELADSR

I	V	I	S	I	T	E	D
B	R	U	S	S	E	L	S
L	A	S	T	Y	E	A	R

I visited Brussels last year

7. CRHATAIEMMTNCII
   SKRELDTESK

C	A	T	S	D
R	I	N	K	T
H	E	C	R	E
A	M	I	E	S
T	M	I	L	K

Cats drink the creamiest milk

Worksheet 3: Breaking the Route Cipher

1. ***What are the factors of the following numbers?***
   16 : 1, 2, 4, 8, 16
   What is this type of number called? A square number, as it is 4x4

   24: 1, 2, 3, 4, 6, 8, 12, 24

   21: 1, 3, 7, 21

   17: 1, 17
   What is this type of number called? A prime number, as it's only factors are itself and 1.

2. **CEIXOTOXMINXPTSX**

   How many letters are there? __16__ What size will the grid be? __4x4__

C	O	M	P
E	T	I	T
I	O	N	S
X	X	X	X

   Decrypted message: Competitions
   (Ignoring the four 'X's which have been added to fill the grid)

3. **BKSOCEOAZ**

   How many letters are there? __9__ What size will the grid be? __3x3__

B	O	O
K	C	A
S	E	Z

   Decrypted message: Bookcase
   (Ignoring the 'Z' which was added to fill the grid)
   Extension:

4. **I like buttons**

I	L	I	K
E	B	U	T
T	O	N	S
A	**B**	**C**	**D**

   How many letters are there? 12
   What size grid will you need? 4x4, 16 spaces
   How many extra letters will you need to add? 4

   Encrypted message: IET**A**LBO**B**IUN**C**KTS**D**

   (The **bold** letters are the extra letters – they could be any letters you like, as long as the others are correct)

5. I will call at midnight

I	W	I	L	L
C	A	L	L	A
T	M	I	D	N
I	G	H	T	A
B	C	D	E	F

How many letters are there? 19
What size grid will you need? 5x5, 25 spaces
How many extra letters will you need to add? 6

Encrypted message: ICTI**B**WAMG**C**ILLH**D**LLDT**E**LAN**AF**

(The **bold** letters are the extra letters – they could be any letters you like, as long as the others are correct)
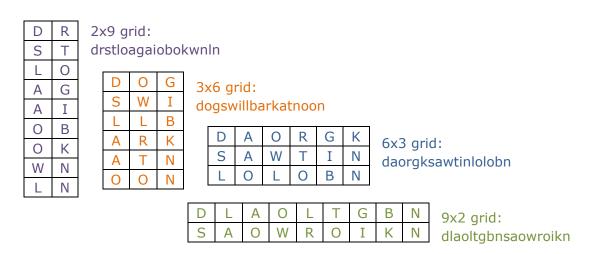
Worksheet 3, Further Extension

DSLAAOOWLRTOGIBKNN

1. How many letters? 18

2. Write down the factors: 1, 2, 3, 6, 9, 18

3. There are six possible grid sizes. Write them down in this table:

Columns	x	Rows
1	x	18
2	x	9
3	x	6
6	x	3
9	x	2
18	x	1

4. Which two grids would not be sensible to use for encryption? 1x18 & 18x1

5.

D	R
S	T
L	O
A	G
A	I
O	B
O	K
W	N
L	N

2x9 grid:
drstloagaiobokwnln

D	O	G
S	W	I
L	L	B
A	R	K
A	T	N
O	O	N

3x6 grid:
dogswillbarkatnoon

D	A	O	R	G	K
S	A	W	T	I	N
L	O	L	O	B	N

6x3 grid:
daorgksawtinlolobn

D	L	A	O	L	T	G	B	N
S	A	O	W	R	O	I	K	N

9x2 grid:
dlaoltgbnsaowroikn

Decrypted message: The only one which makes sense is:

dogswillbarkatnoon → dogs-will-bark-at-noon → Dogs will bark at noon

What size grid did you use? Columns = 3 Rows = 6

Worksheet 4: Caesar shift cipher

Encryption

1. Thank you
   WKDQN BRX

2. Telephone
   WHOHSKRQH

3. Codebreaker
   FRGHEUHDNHU

4. Croaking frog
   FURDNLQJ IURJ

5. A long walk
   D ORQJ ZDON

Decryption

6. FLSKHUV
   Ciphers

7. IORZHU
   Flower

8. SODQHW
   Planet

9. VPLOH
   Smile

10. PDWKV LV IXQ.
    Maths is fun.

Worksheet 4, Extension

11. The aliens were from Mars
    WKH DOLHQV ZHUH IURP PDUV

12. KHOS! ZH'UH VWUDQGHG!
    Help! We're stranded!

13. The enemy base is in the north.
    WKH HQHPB EDVH LV LQ WKH QRUWK

14. WKH TXLFN EURZQ IRA MXPSV RYHU WKH ODCB GRJ.
    The quick brown fox jumps over the lazy dog.