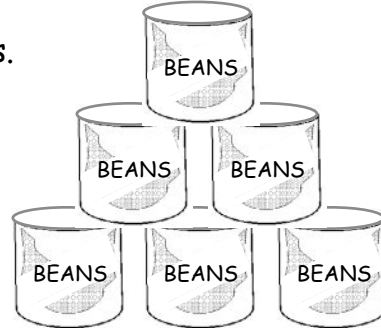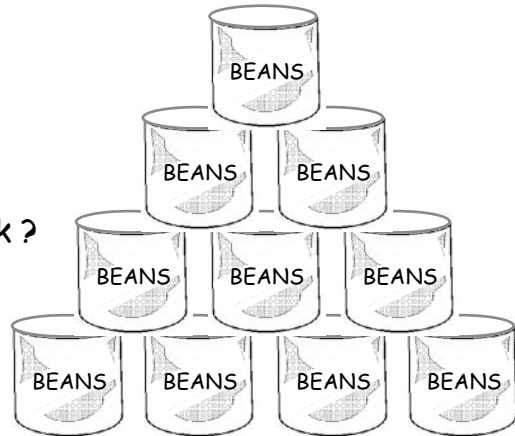# Continuing Patterns

Solve the following problems by making a **TABLE**
and continuing the **PATTERN**.

1   A supermarket often stacks tins like this.

This stack has 6 tins arranged in 3 rows.

If you added one row to make 4 rows
the stack would look like this.

a)   How many tins are in the stack ?

b)   Draw the next stack

c)   Copy and complete this table

ROWS	1	2	3	4	5	6	7
TINS	1		6				

d)   How many tins would you need
      to make a stack 6 rows high ?

e)   Continue your table to include a stack with 10 rows.

f)   What is the highest stack you could make using 28 tins ?
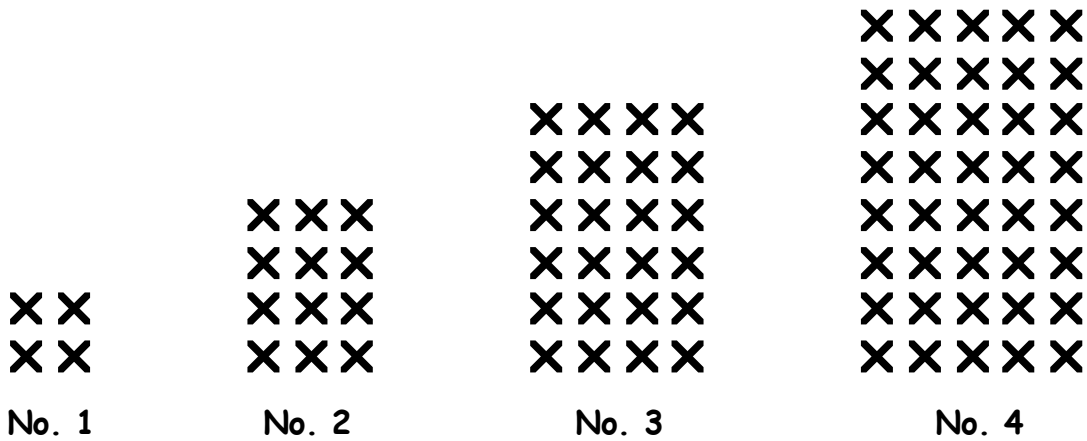
2   On Monday a magic plant is 2cm high. By Tuesday
     the plant has doubled its height and is 4cm high.
     Each day the plant doubles its height from the day before.
     How high will the plant be on Friday ?

3   Kelly and Sue rode their bikes to the park.
     They rode 1 km every 4 minutes.
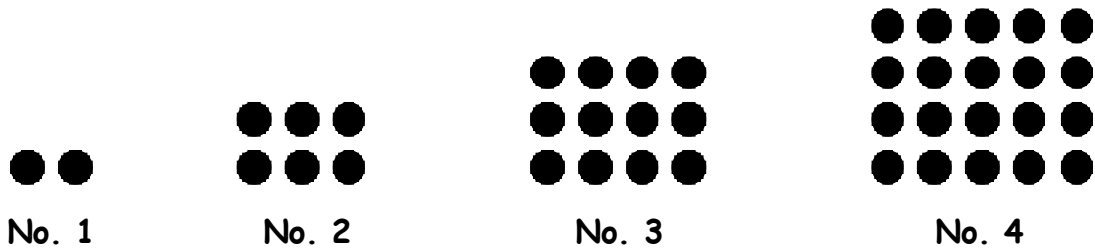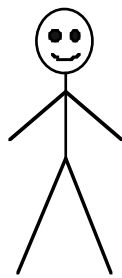   How far did they ride in 28 minutes ?

4

```
                                              X X X X X
                                              X X X X X
                        X X X X                X X X X X
                        X X X X                X X X X X
            X X X        X X X X                X X X X X
            X X X        X X X X                X X X X X
X X         X X X        X X X X                X X X X X
X X         X X X        X X X X                X X X X X
No. 1       No. 2        No. 3                  No. 4
```

a)   Draw the fifth picture.

b)   Describe the fiftieth picture.

5

```
                        ● ● ● ●        ● ● ● ● ●
            ● ● ●        ● ● ● ●        ● ● ● ● ●
● ●         ● ● ●        ● ● ● ●        ● ● ● ● ●
No. 1       No. 2        No. 3          No. 4
```
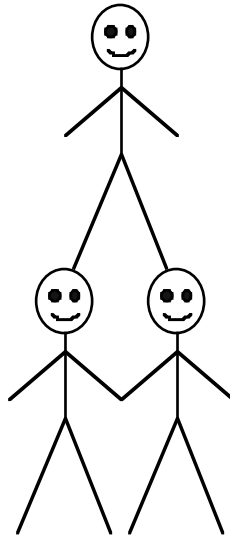
a)   Describe the pattern in the twentieth picture.

b)   How many dots are there in the twentieth picture ?

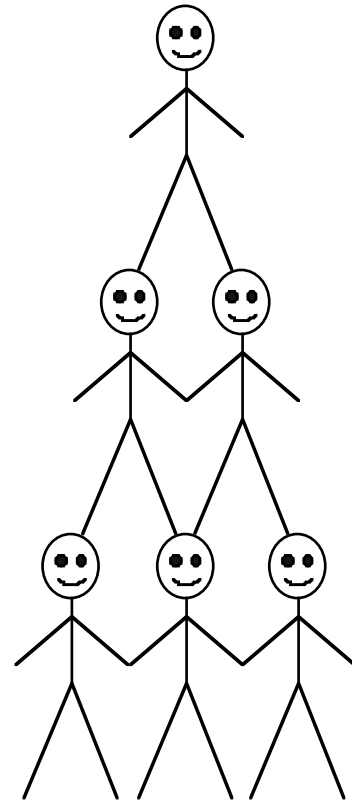6   <u>The Human Tower</u>

<u>1 stage tower</u>   <u>2 stage tower</u   <u>3 stage tower</u>

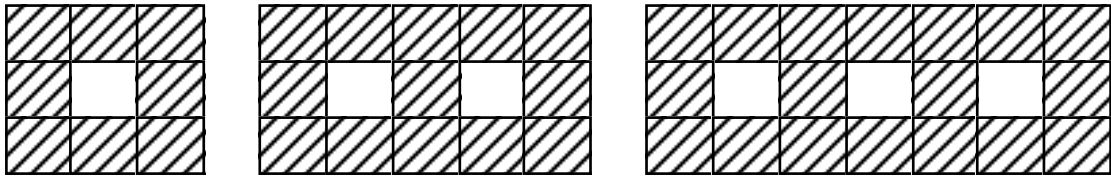These acrobats can build a human tower.

a)   How many acrobats are there in each tower ?

b)   Draw diagrams to show a 4 stage tower and a 5 stage tower.

c)   Copy and complete the table.

| Number of Stages	1	2	3	4		
Number of Acrobats	1	3				

d)   If it was possible to build a 12 stage tower, how many men would there be in it ?

7   Consider the following pattern.

a)   How many striped squares are there
      if there is only <u>one</u> white square ?

b)   How many striped squares are there
      for <u>two</u> white squares?

c)   Draw the <u>next</u> pattern.

d)   Put your results in a table:

e)   Try and work out the <u>rule</u> for your table.
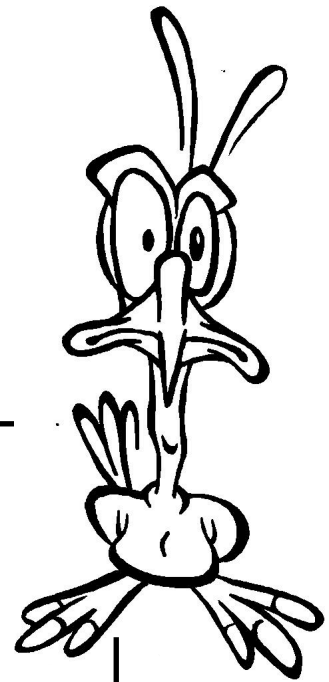
HELP

What do you do to the <u>top</u> number
to get the number <u>below</u> ?

Still stuck ?

For this rule you <u>multiply by 5</u> and
then <u>add on</u> a number.

Which number do you add on ?

The rule is: "Multiply by   ?   and add on   ? "

---

f)   How many striped squares would you have if
      there were 9 white squares ? (Use the rule.)

Finding the Rule

Find the rules for the following examples.
The first one has been done for you.

A

1	2	3	4	5
5	9	13	17	21

4   4   4   4

Goes up by 4 each time - like the 4 times table.

The rule is:
'multiply by four and add on 1'

B

1	2	3	4	5
3	5	7	9	11

E

1	2	3	4	5
3	7	11	15	19

C

1	2	3	4	5
5	8	11	14	17

F

1	2	3	4	5
4	6	8	10	12

D

1	2	3	4	5
6	11	16	21	26

G

1	2	3	4	5
2	10	18	26	34

Discovering the Rule

Copy and complete the tables and describe the rule in words.
The first one has been done for you.

A

1	2	3	4	5	6	7	8	9	n
5	7	9	11	13	15	17	19	21	2n+3

'multiply by 2 and add 3'

B

1	2	3	4	5	6	7	8	9	n
8	14	20	26						

C

1	2	3	4	5	6	7	8	9	n
2	5	8	11						

D

1	2	3	4	5	6	7	8	9	n
10	13	16	19						

E

1	2	3	4	5	6	7	8	9	n
									3n+7

Discovering the Rule 2

Copy and complete the tables and
describe the rule in words.
The first one has been done for you.

A

1	2	3	4	5	6	7	8	9	n
3	9	15	21	27	33	39	45	51	6n-3

'multiply by 6 and take away 3'

B

1	2	3	4	5	6	7	8	9	n
7	10	13	16						

C

1	2	3	4	5	6	7	8	9	n
1	4	7	10						

D

1	2	3	4	5	6	7	8	9	n
13	20	27	34						

E

1	2	3	4	5	6	7	8	9	n
									4n-1

28

Harder Patterns

Look at this table:

1	2	3	4	5
4	7	12	19	28

n
?

```
4   7   12   19   28
  3   5   7   9
    2   2   2
```

To help find the pattern we look at the **differences** between the numbers. These are not the same, so we look at the **differences between the differences**. These **are** the same and this gives us a <u>clue</u> to the pattern.

If the **second** differences are the **same** then the pattern involves n x n which can be written n^2.

Rewrite the table with a new row for n^2.

1	2	3	4	5	n
1	4	9	16	25	n^2
4	7	12	19	28	$n^2 + 3$

The pattern is that you "square the number and add three". ($n^2 + 3$)

Write these patterns in a similar way:-

a)   "square the number and subtract 5"

b)   "square the number and multiply by 2"

c)   "square the number + add it to the number itself"

Harder Patterns Continued

Use the method shown on the previous
page to write down the rules
for each of the following.

A

1	2	3	4	5	n
3	6	11	18	27	?

B

1	2	3	4	5	n
8	11	16	23	32	?

C

1	2	3	4	5	n
0	3	8	15	24	?

D

1	2	3	4	5	n
2	8	18	32	50	?

E

1	2	3	4	5	n
14	17	22	29	38	?

F

1	2	3	4	5	n
99	96	91	84	75	?

G

1	2	3	4	5	n
1	8	27	64	125	?

Hint: look at the third difference.

Problems With Patterns

Solve these problems by making a <u>table</u> and looking for the <u>rule</u> for each one.

1   Mary makes a row of 3 equilateral triangles using matches as shown.
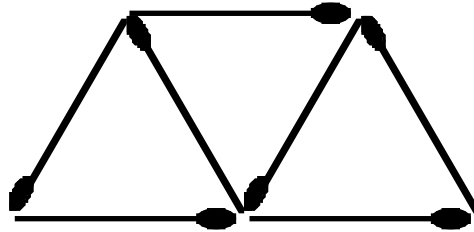
a)   She has used 7 matches.

Copy and complete this table.

Number of Triangles	1	2	3	4	5	6	20	
Number of Matches			7					89

b)   Write down a rule for finding the number of matches used to make a row of triangles.

2   When making booklets a printer counts how many sheets of paper are needed for different numbers of pages.

Number of Pages	Number of Sheets
12	3
16	4
20	5
24	6
?	7
?	?

a)   Complete the pattern shown in the table.

b)   Write down the <u>rule</u> for finding the number of sheets.

3   The cost of hiring a television set on a
           monthly basis is shown in the table below.

    a)   Complete the table.

Number of Months	1	2	3	4	5	6	7	8
Total Cost	£15	£30						

    b)   Write down a rule for the total cost of hiring
              the television for any number of months.

    c)   How much would it cost to hire a TV for 10 months ?

    d)   If you had £80, for how long could you afford to hire a TV ?

4   Susan is making patterns with matches.

       For 1 rectangle she needs 6 matches.
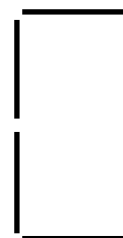
       For 3 rectangles in a row she needs 14 matches.

    a)   Draw the pattern for 2 rectangles
             and 4 rectangles.

    b)   Write down the rule for finding the
             number of matches needed for any
             number of rectangles. (Hint: you may
             wish to make an organised table.)
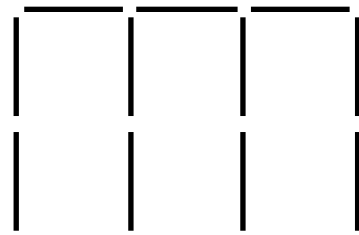
    d)   How many matches would you need to
             make 10 rectangles ?

32

5

Billy and Hanna like to collect "celebrity stickers".

Both have notebooks to put their stickers in.

Billy puts 5 stickers in his notebook each day and Hanna puts 3 stickers in her notebook each day.

How many stickers will Hanna have in her notebook when Billy has 25 in his notebook ?
(HINT: Continue this table.)
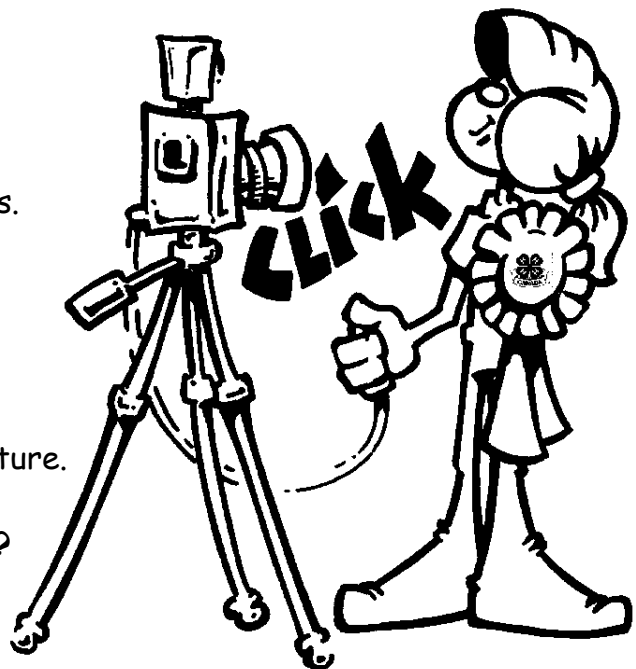
Day	Billy's Stickers	Hanna's Stickers
1	5	3
2	10	6

6   Primary Three were having their school picture taken.

The photographer put them in rows.

1 person was in the first row,
2 in the second row,
3 in the third and so on.

There are 7 rows of pupils in the picture.

How many pupils are in the class ?

Trickier Problems
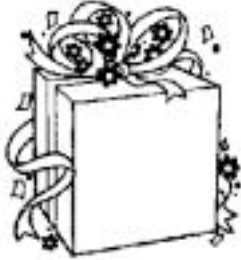
1   It is traditional in many families
    at Christmas time for each family
    member to give a gift
    to each of the other members.

    If a family of ten followed
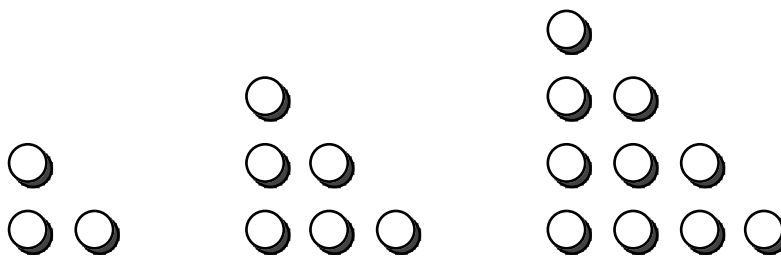   this tradition, how many
    gifts would be given ?

2   A pie can be cut into seven pieces with three straight cuts.

    What is the largest number of pieces that
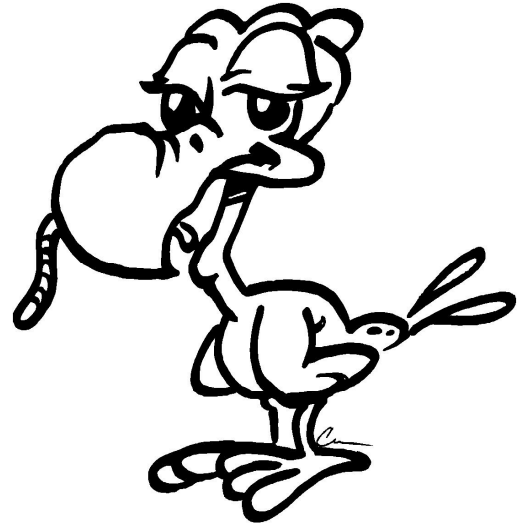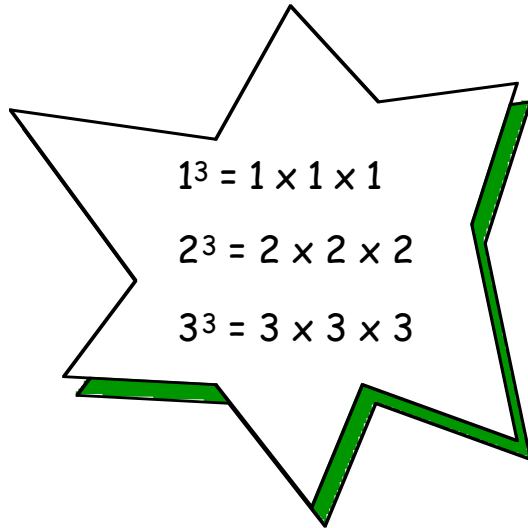   can be made with eight straight cuts ?

3   Robert decided to count the pennies in his piggy bank.
    After he counted them he made triangle patterns.
    His patterns looked like this:

    How many pennies does he need for a
    triangle with 100 pennies in the bottom row ?
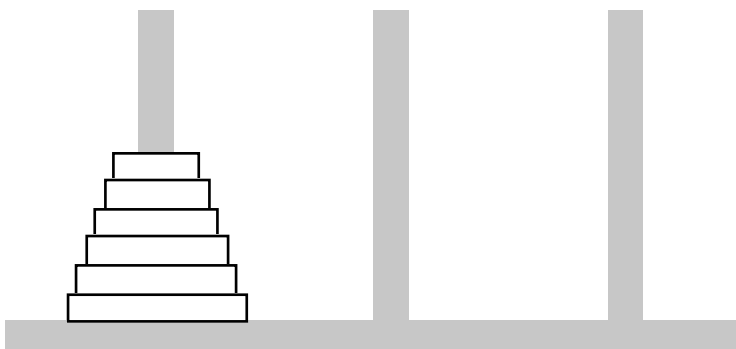
4

$$1^3 = 1 \times 1 \times 1$$

$$2^3 = 2 \times 2 \times 2$$

$$3^3 = 3 \times 3 \times 3$$

$$1^3 = 1$$

$$2^3 + 1^3 = 9$$

What do you notice about the sums of cubes ?

$$3^3 + 2^3 + 1^3 =$$

5   <u>Tower of Hanoi - 3 Pegs</u>

First peg contains a 'tower' of 6 discs of decreasing radii.

PROBLEM: to transfer the discs to peg 3, arranged in the same order as on peg 1, by moving only <u>one</u> disc at a time to any of the three pegs.

Also, no disc may sit above one of smaller radius. Describe the moves – how many are there ?

Complicated ?

Try a similar simpler problem first.

To Marry Or Not To Marry

In the world of astrology,
Zodlan considers it unwise
for people born under the
same sign to marry.

One should also avoid marriage
to persons born under a sign
adjacent to one's own.

Marriage between other pairs
of signs are considered good.

How many pairs of signs will result in good marriages ?