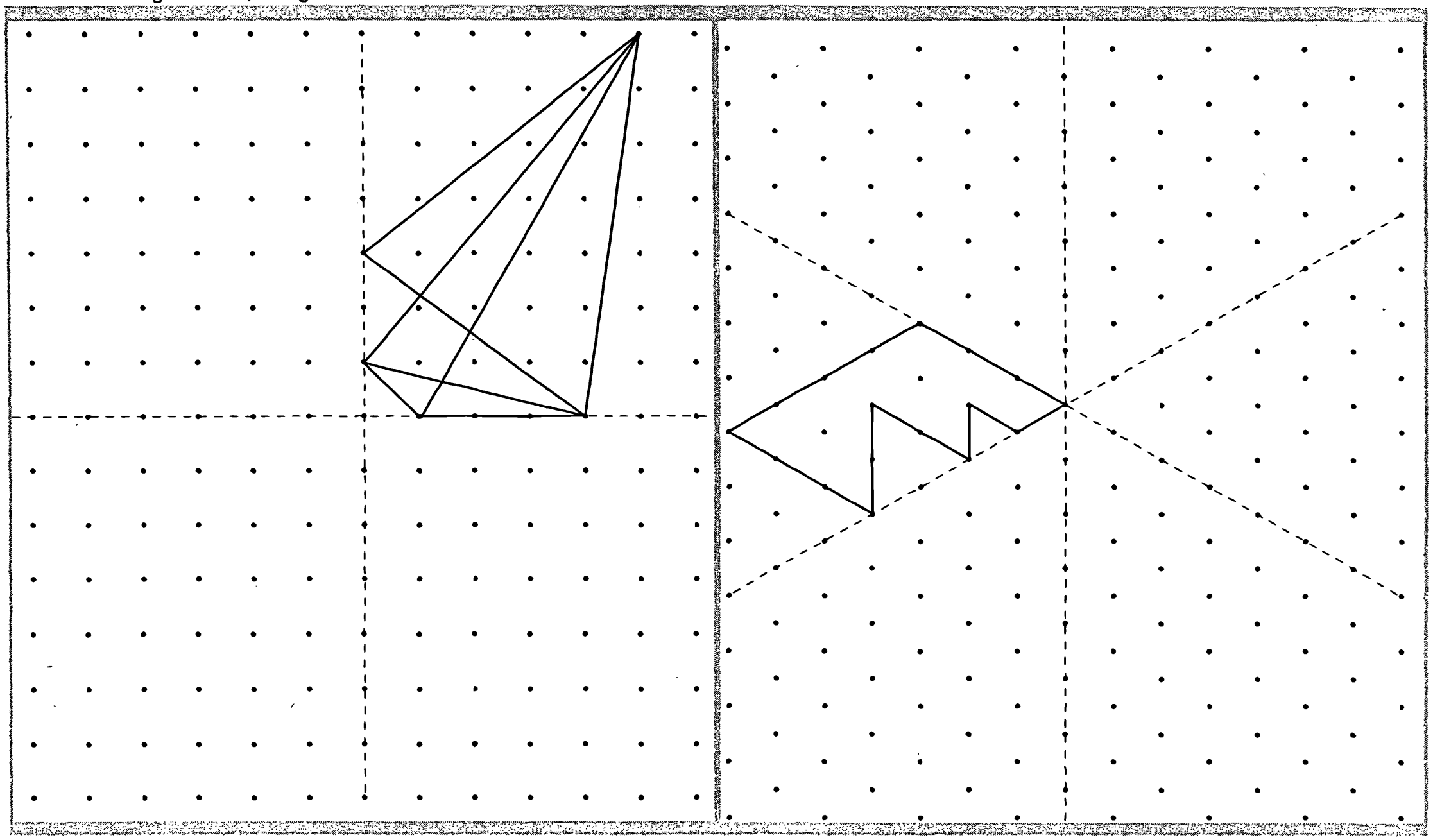
Reflect

Smile Worksheet **0577**

Reflect the designs below, using the broken lines as mirror lines.



Colour the designs and their reflections. **Make sure the colours are reflected too.**
Try a design of your own, reflect it in 2, 3, or 4 mirror lines.

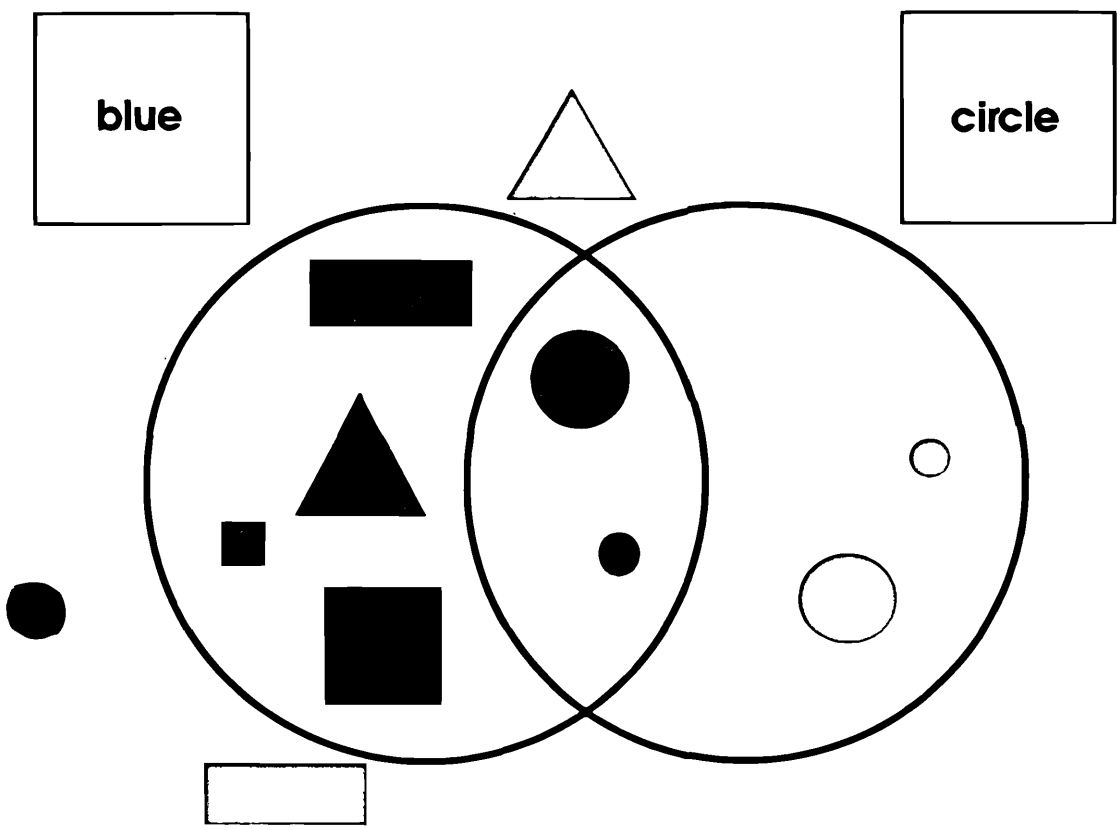
TWO LOOPS

An activity for two or more people.

You will need:

- a 2 loop set board – *you may need to draw one.*
- logiblocks
- logicards Smile **0579a**.

1. Choose a logicard for each loop.
2. Share out the logiblocks.
3. Take turns to place the logiblocks in the correct part of the board.



- Ask someone to check your completed board.
- Try using different logicards.

Two Loops Cards

Cut out these 12 cards

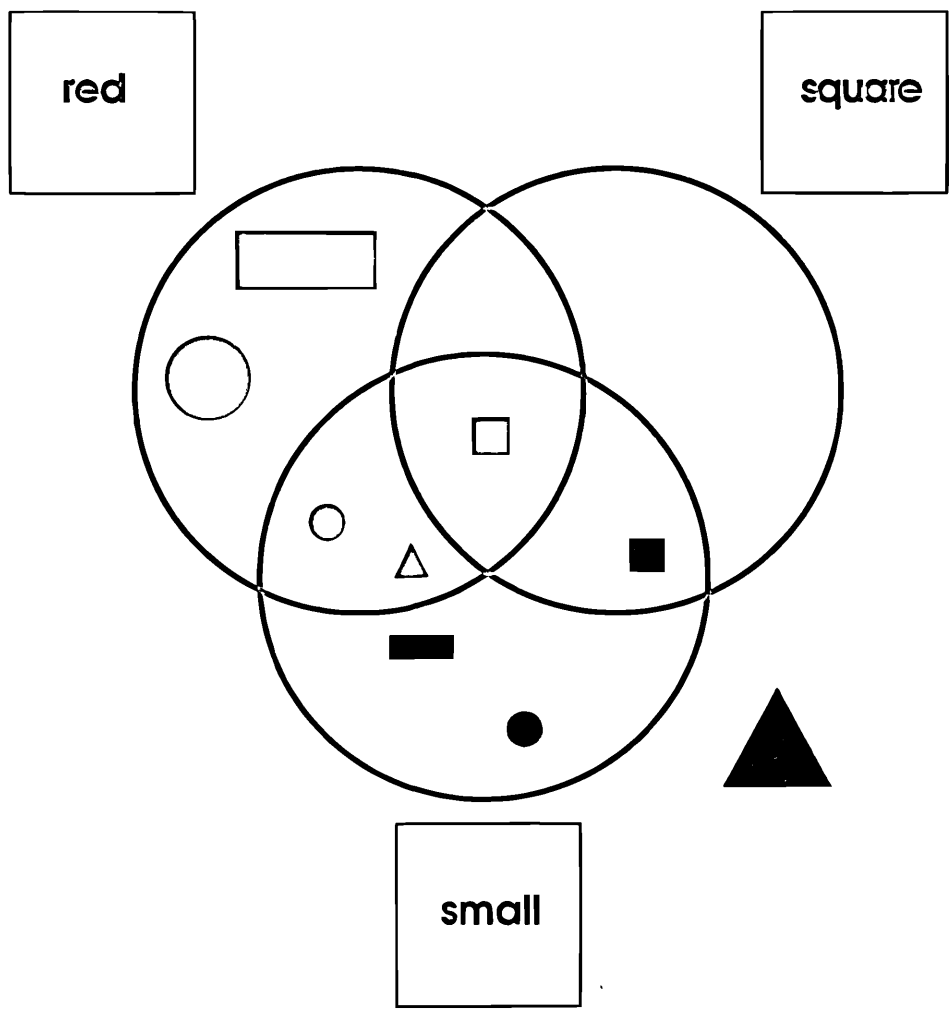
RED	BLUE	YELLOW
circle	LARGE	SMALL
square	THICK	THIN
rectangle	triangle	hexagon

THREE LOOPS

An activity for two or more people.

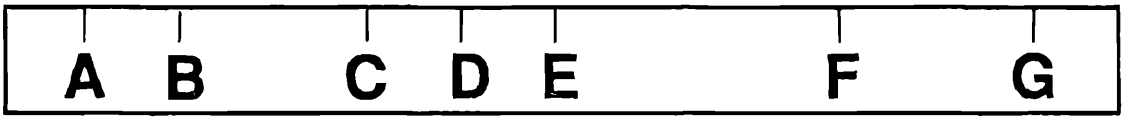
You will need:
- a 3 loop set board – *you may need to draw one.*
- logiblocks
- logicards Smile **0579a**.

1. Choose a logicard for each loop.
2. Share out the logiblocks.
3. Take turns to place the logiblocks in the correct part of the board.

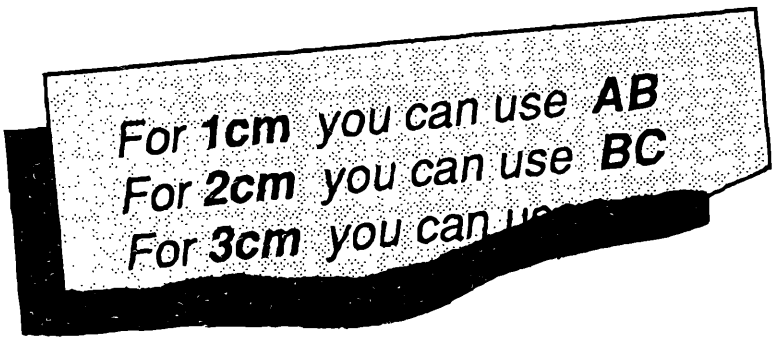


- Ask someone to check your completed board.
- Try using different logicards.

Less marks are best !



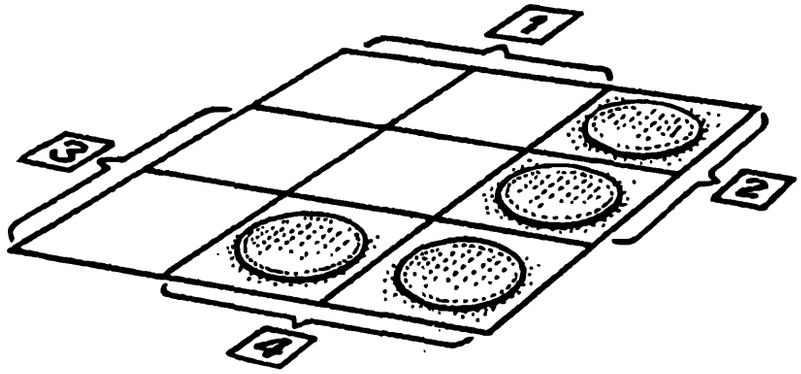
- Each of the distances from 1cm up to 10cm can be measured using these 7 marks on a strip of paper.



- Complete this list for 1cm up to 10cm.

- Can you find a way of marking the strip so that all the measurements can be made with fewer marks? *How few?*

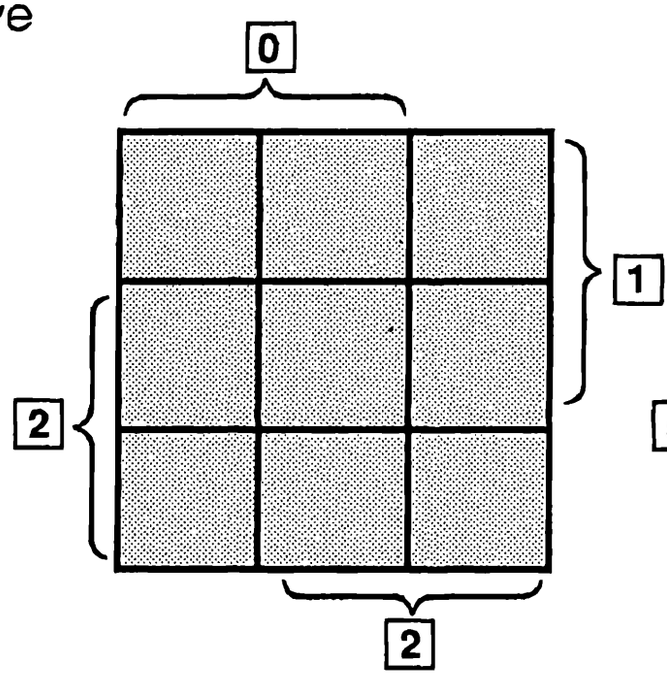
- How few marks would be needed to measure up to 10cm in half centimetres?

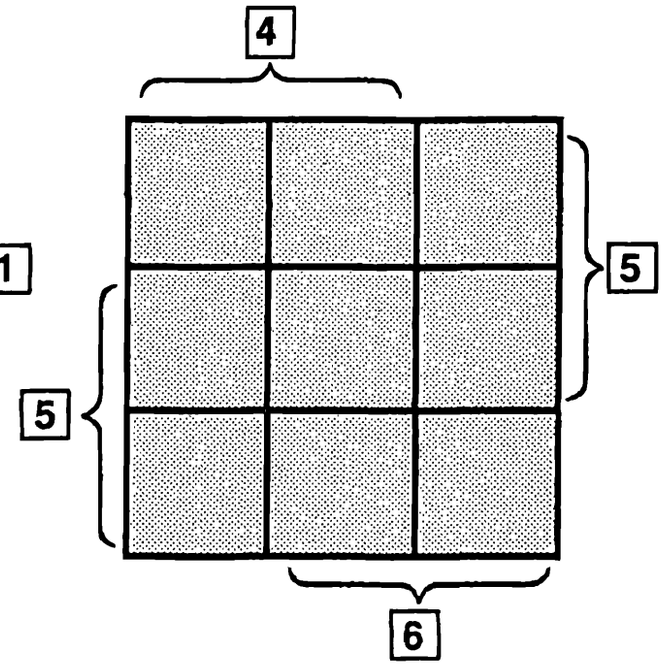


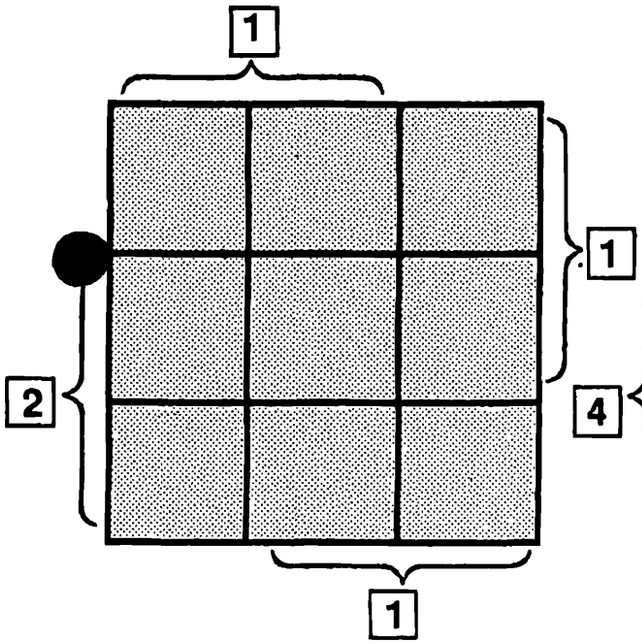
COUNTER PLACING

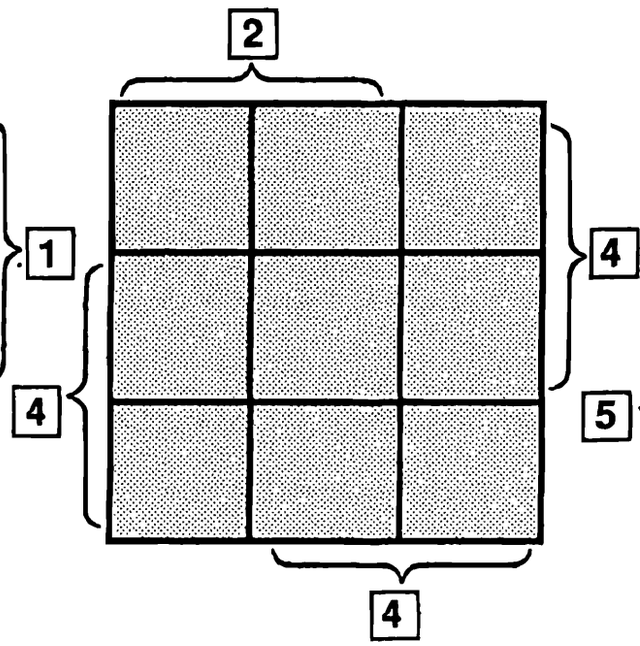
What is the connection between the numbers and the counters?

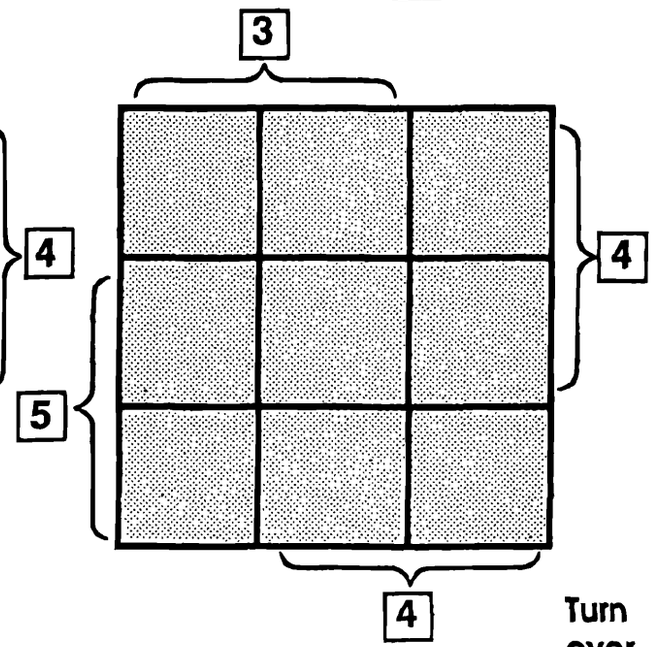
Use counters to solve the following.





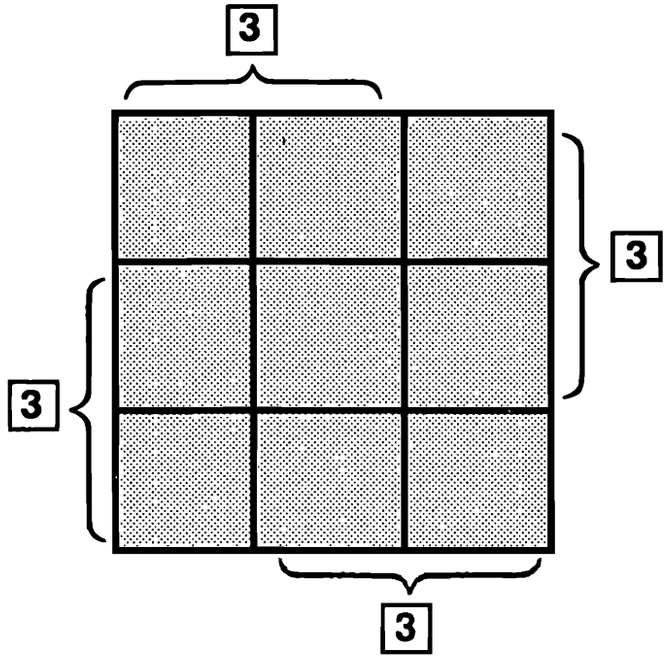


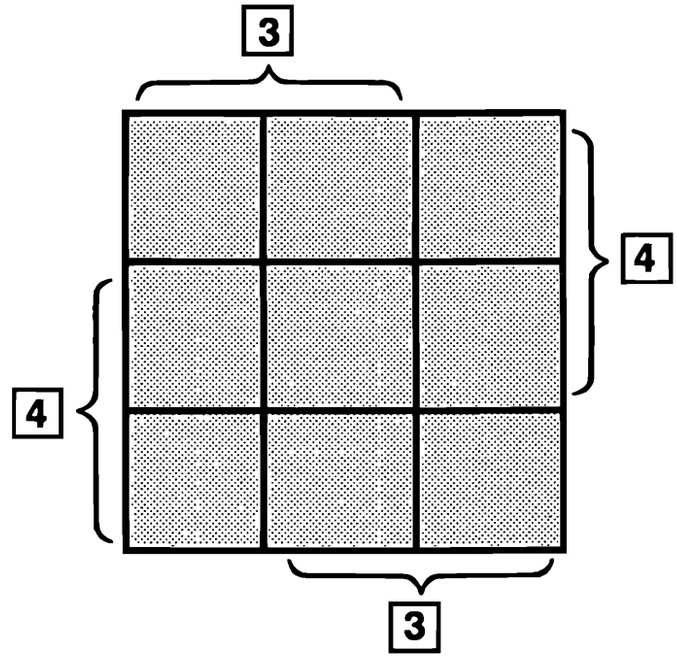




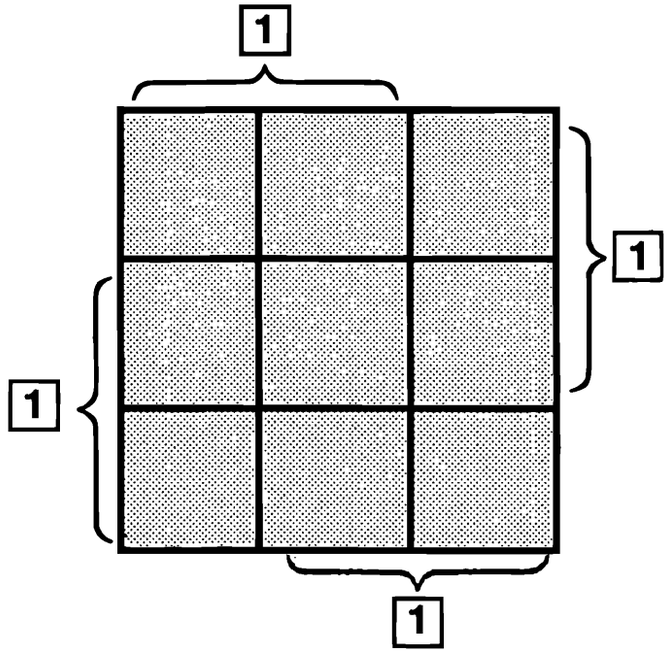
Turn over

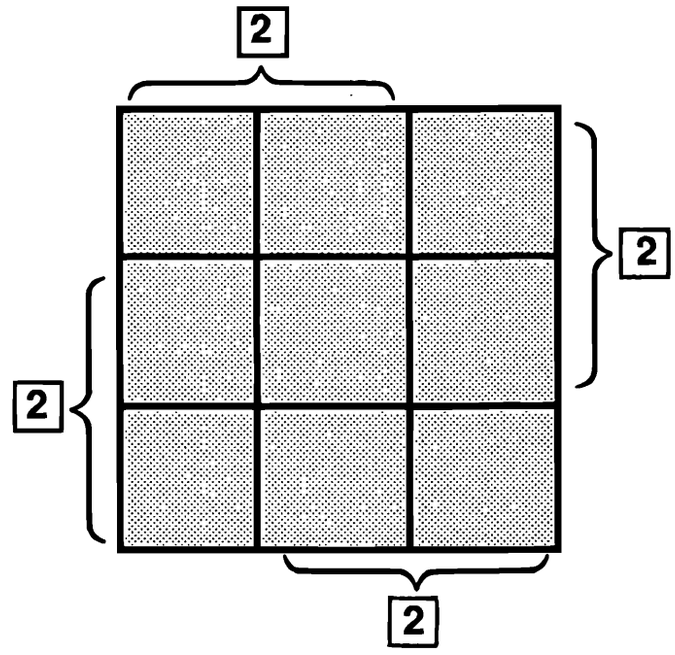
Can you find 2 different solutions for each of these?





How many different solutions can you find for each of these?



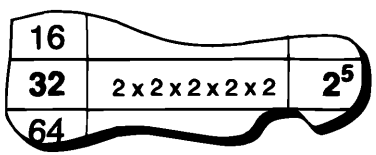


Powerful Rules

Powers of Two and Three

You will need Smile Worksheet 0592a.

1 Complete both tables on the worksheet.



From the powers of 2 table

$2^5 = 32$

$2^5 = 32$ is read '2 to the power of 5 equals 32'.

2 3^4 means 3 x 3 x 3 x 3

What do these mean?

a) 2^6 c) 3^1 e) k^7

b) 2^3 d) 3^6 f) a^6

3 $5^3 = 5 \times 5 \times 5$
$= 125$

Find the value of these.

a) 7^3 c) 9^3 e) 14^2

b) 10^6 d) 6^4 f) 1^5

Multiplying Powers

1 Copy and complete:

$5^3 = \blacksquare \times \blacksquare \times \blacksquare$

$5^4 = \blacksquare \times \blacksquare \times \blacksquare \times \blacksquare$

so $5^3 \times 5^4 = (\blacksquare \times \blacksquare \times \blacksquare) \times (\blacksquare \times \blacksquare \times \blacksquare \times \blacksquare)$

$= \blacksquare \times \blacksquare \times \blacksquare \times \blacksquare \times \blacksquare \times \blacksquare \times \blacksquare$

$= \blacksquare^{\blacksquare}$

2 Work out these. Leave your answers in power form.

a) $6^2 \times 6^3$ c) $7^6 \times 7^2$ e) $12^5 \times 12$

b) $4^3 \times 4^2$ d) $2^4 \times 2^3$ f) $5^5 \times 5^2$

This shows a method for multiplying powers of the same number.

$5^{\textcircled{5}} \times 5^{\textcircled{2}} = 5^{\textcircled{7}}$ (+)

$5^5 \times 5^2 = 5^{5+2} = 5^7$

3 Check your answers for question **2** using this method.

4 Copy and complete these. Leave your answers in power form.

a) $2^5 \times 2^2 = 2^{\blacksquare}$ e) $5^{63} \times 5^2 = \blacksquare^{\blacksquare}$

b) $4^2 \times 4^3 = \blacksquare^{\blacksquare}$ f) $a^5 \times a^3 = a^{\blacksquare}$

c) $3^4 \times 3^6 = \blacksquare^{\blacksquare}$ g) $n^2 \times n^7 = \blacksquare^{\blacksquare}$

d) $15^{10} \times 15^3 = \blacksquare^{\blacksquare}$ h) $a^m \times a^n = \blacksquare^{\blacksquare}$

Using Powers to Multiply

Before continuing check your answers to the worksheet using the Answer Book.

Multiplying powers of 2 is easy if you use the table . . . heres's how:

8		2^3
16		2^4
32		2^5
64		2^8
128		2^7

$8 \times 16 \longrightarrow 2^3 \times 2^4$

$2^7 \longrightarrow 128$

so $8 \times 16 = 128$

Use your table for powers of **2** to complete these.

1) 8 x 32
2) 16 x 64
3) 4 x 128
4) 2 x 8192
5) 16 x 1024
6) 32 x 32
7) 4 x 8 x 16
8) 2 x 16 x 512
9) 32 x 32 x 32

Use your table for powers of **3** to complete these:

10) 9 x 27
11) 81 x 3
12) 27 x 243
13) 59049 x 27
14) 3 x 9 x 27
15) 9 x 9 x 9
16) 81 x 27 x 9 x 3
17) 81 x 81 x 3 x 3
18) 27 x 27 x 27 x 27

Dividing Powers

$$\frac{3^5}{3^3} = \frac{3 \times 3 \times 3 \times 3 \times 3}{3 \times 3 \times 3} = \frac{\cancel{3} \times \cancel{3} \times \cancel{3} \times 3 \times 3}{\cancel{3} \times \cancel{3} \times \cancel{3}} = 3^2$$

1 Do the following in the same way:

a) $\frac{2^7}{2^3}$

b) $\frac{3^7}{3^3}$

c) $\frac{2^9}{2^4}$

d) $2^7 \div 2^4$

e) $5^{10} \div 5$

f) $10^5 \div 10^2$

g) $7^9 \div 7^8$

h) $\frac{6^5}{6^2}$

i) $18^5 \div 18^2$

j) $q^6 \div q^2$

k) $\frac{m^8}{m^7}$

This shows a method for multiplying powers of the same number.

$2^{\textcircled{7}} \div 2^{\textcircled{3}} = 2^{\textcircled{4}}$ (−)

$2^7 \div 2^3 = 2^{7-3} = 2^4$

2 Check your answers in question **1** using this method.

3 Use the method to complete these. Leave your answers in power form.

a) $\frac{3^{10}}{3^6} = 3^{\blacksquare}$

b) $\frac{13^9}{13} = \blacksquare^{\blacksquare}$

c) $9^{10} \div 9^6 = \blacksquare^{\blacksquare}$

d) $17^3 \div 17^2 = \blacksquare^{\blacksquare}$

e) $2^3 \div 2^2 = \blacksquare^{\blacksquare}$

f) $a^7 \times a^4 = \blacksquare^{\blacksquare}$

Powers of Ten

10	10	10^1
100	10 x 10	10^2
1000	10 x 10 x 10	10^3

1 Copy this table and complete it as far as 10^{10}.

2 Can you give an example where a number as big as 10^{10} might be used?

3 You can use a table of powers to divide as well as to multiply.

$100000 \div 100 \longrightarrow 10^5 \div 10^2$

$1000 \longleftarrow 10^3$

so $100000 \div 100 = 1000$

a) $1000 \div 100$

b) $100000 \div 100$

c) $1000000 \div 1000$

d) $100000 \div 10000$

e) $10000000000 \div 10$

f) $1000 \div 1000$

Is there a problem here?

4 Try some more like (f) . . .
. . . How can you solve this problem?

Mixed Bag

Check your answers so far before you do any more.

1 The value of 2^7 is 128. What is the value of these?

a) 3^3
b) 7^3
c) 3^4
d) 1^9
e) 0^9
f) 6^4
g) 6×6^3
h) $6^2 \times 6^2$
i) $11^7 \div 11^5$
j) $2^3 \times 5^2$
k) $2^3 \times 2^7$
l) $2^7 \div 2^3$

2 Copy and complete.

a) $125 = 5^{\blacksquare}$
b) $7776 = 6^{\blacksquare}$
c) $14641 = 11^{\blacksquare}$
d) $169 = \blacksquare^2$

3 Simplify these. Leave your answers in power form.

a) $9^{11} \div 9^7$
b) $6^5 \times 6^{29}$
c) $y^5 \div y^2$
d) $2^3 \times 3^2 \times 2^4 \times 3^7$
e) $3^2 \times 3^2 \times 3^2$
f) $8^4 \times 8^4 \times 8^4 \times 8^4$
g) $(5^4 \times 5^6) \div 5^2$
h) $5^4 \times (5^6 \div 5^2)$
i) $\dfrac{2^5 \times 5^2}{2^3 \times 5}$
j) $7^9 \div 7^9$

4 Write in your own words the rules for multiplying and dividing powers of the same number.

Powers of two

2	2	2^1
4	2 x 2	2^2
8	2 x 2 x 2	2^3
16	2 x 2 x 2 x 2	2^4
128		2^7
	2 x 2 x 2 x 2 x 2 x 2 x 2 x 2	
1024		
8192		
	2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2	

Powers of three

3^1	3	3
3^2	3 x 3	9
3^3	3 x 3 x 3	27
3^4	3 x 3 x 3 x 3	81
		2187
3^8		
	3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3	
		59049
	3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3	
		1594323
	3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3	14348907

128 = 2^7 *7 is called the 'power' or 'index'*

Smile Worksheet **0592a**

Powers of two

2	2	2^1
4	2 x 2	2^2
8	2 x 2 x 2	2^3
16	2 x 2 x 2 x 2	2^4
128		2^7
	2 x 2 x 2 x 2 x 2 x 2 x 2 x 2	
1024		
8192		
	2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2	

Powers of three

3^1	3	3
3^2	3 x 3	9
3^3	3 x 3 x 3	27
3^4	3 x 3 x 3 x 3	81
		2187
3^8		
	3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3	
		59049
	3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3	
		1594323
	3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3	14348907

128 = 2^7 *7 is called the 'power' or 'index'*

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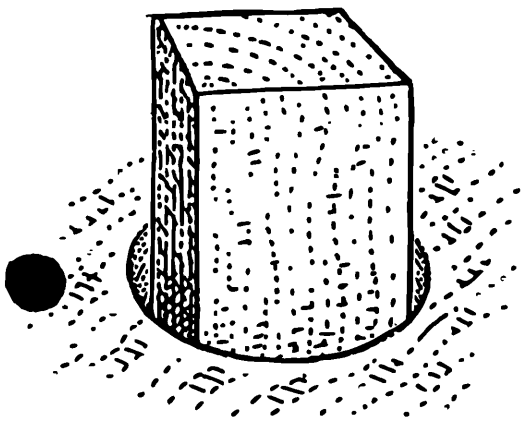
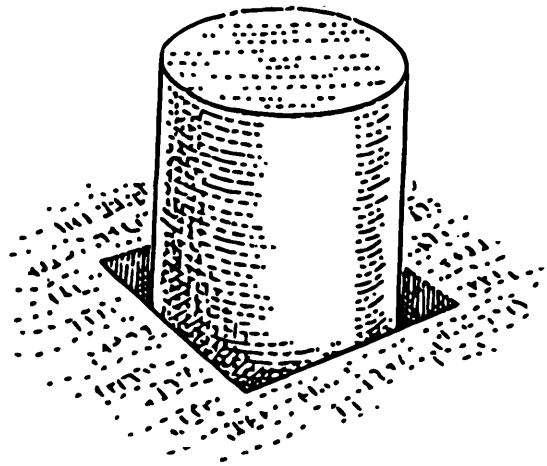
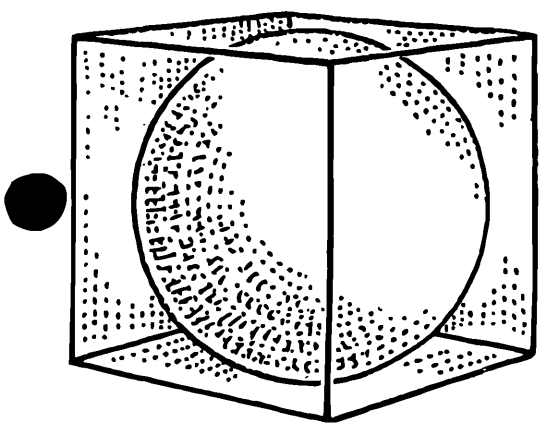
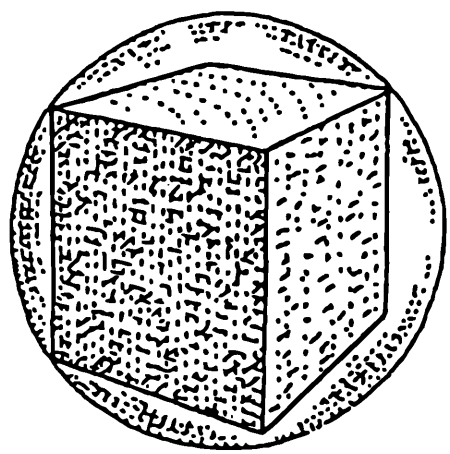
BEST FITTING PEG



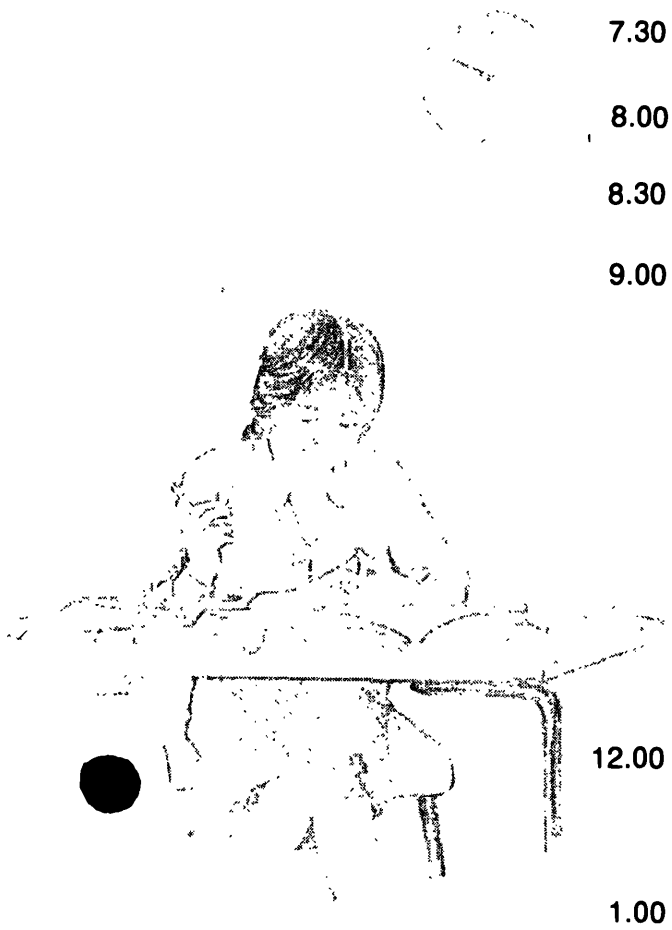


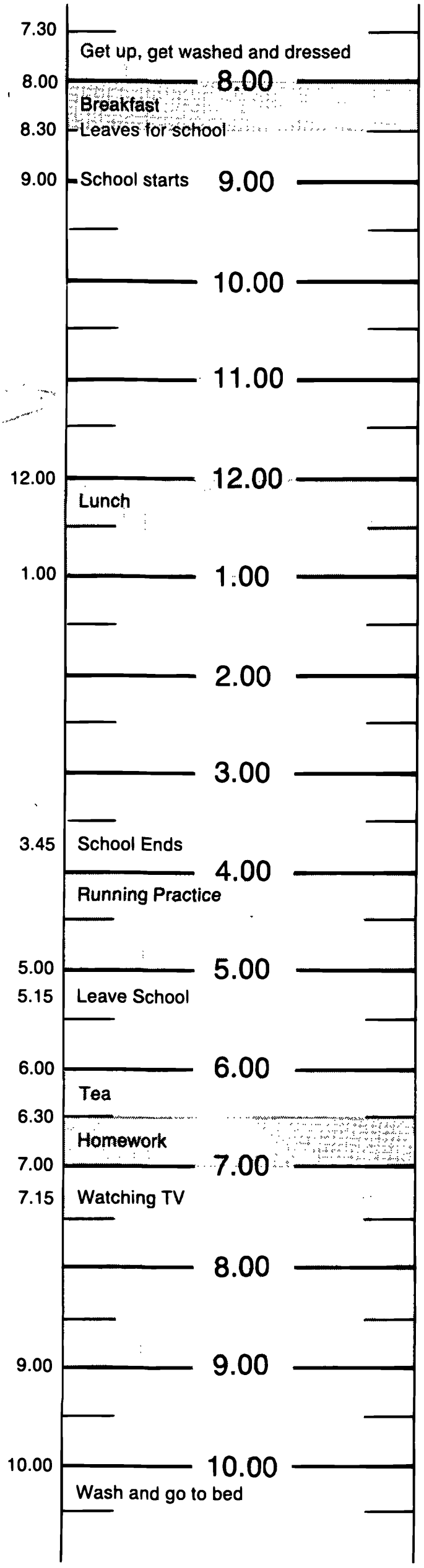
Which fits better — a square peg in a round hole
. . . or a round peg in a square hole?
Explain how you decided.





A sphere inside a cube . . . or a cube inside a sphere? Which fits best?





Sunita's Day

Use the time line.

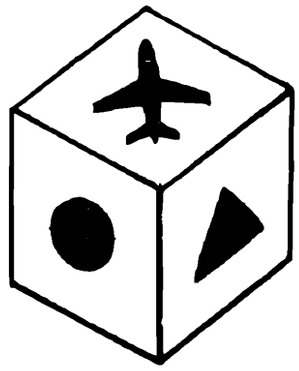
1. (a) Sunita starts watching TV at 7.15 and finishes at 9.00. How much time does she spend watching?
(b) How much time does she spend at running practice?
(c) On homework?
(d) In school lessons?

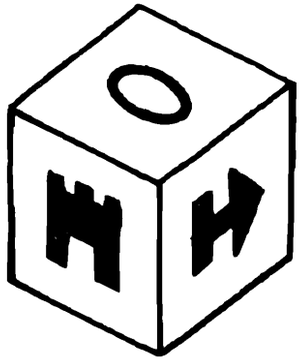
2. How long is Sunita's day?

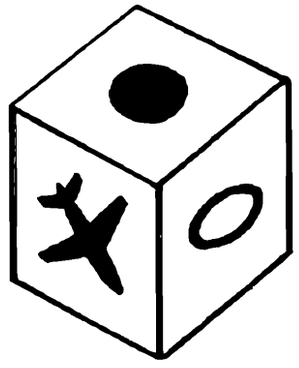
3. If she gets up at the same time tomorrow how much sleep will she have had?

In your mind

Here are 3 views of the same dice.

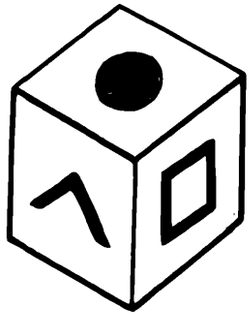


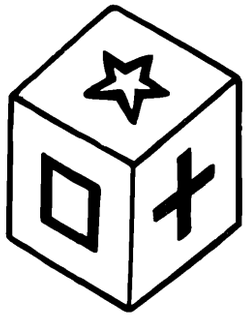


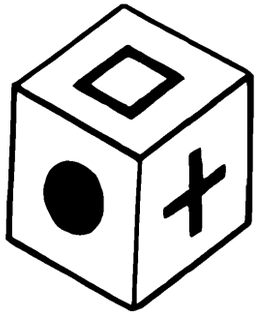


In your mind work out which symbols are opposite each other.

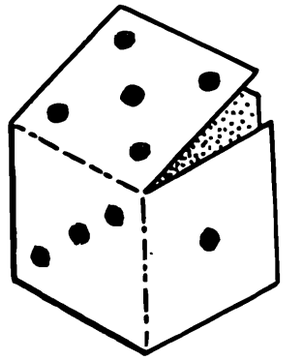
Are these three the same dice? Explain your answer.

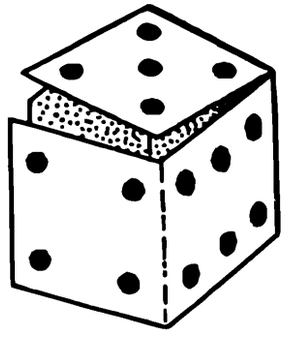


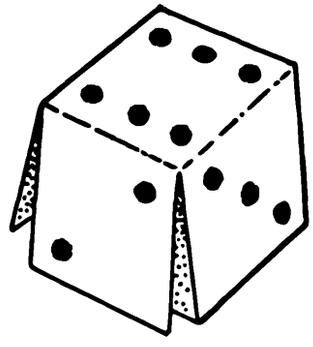




Draw the net of this dice when it is laid out flat.

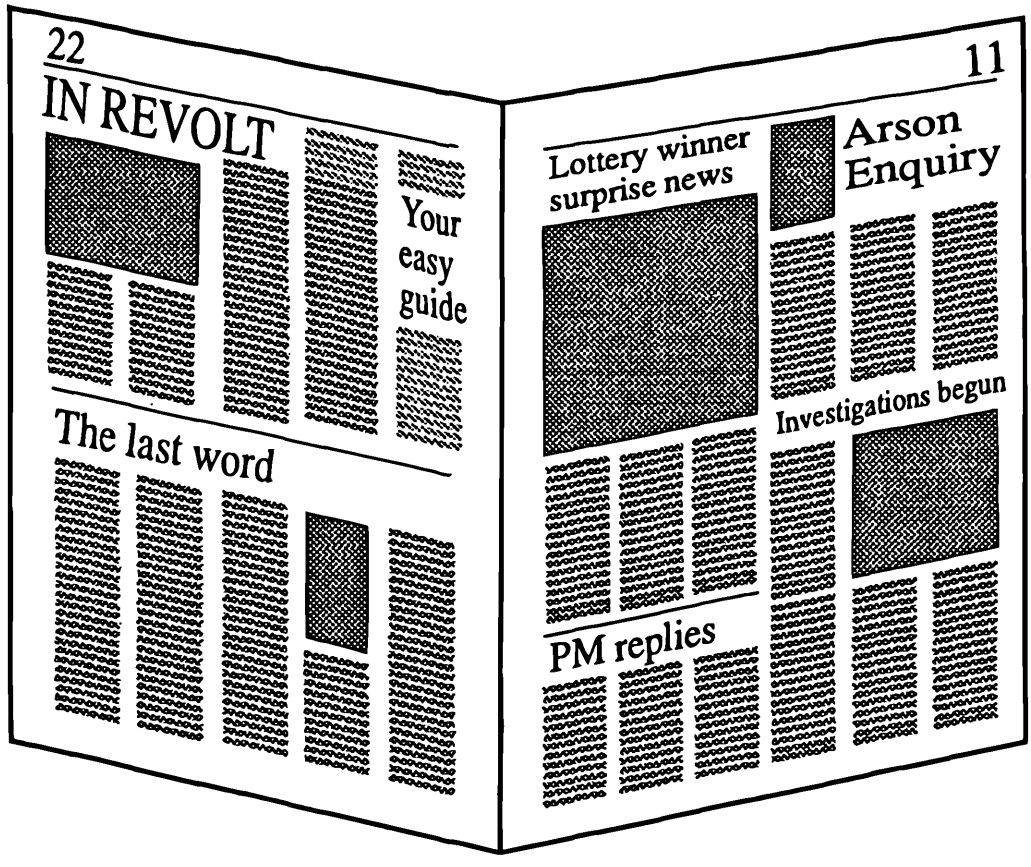






Numbering the Pages

This shows one sheet from a newspaper.



- How many pages were there in the complete paper?

- Make a small newspaper with 6 sheets of scrap A4 paper.
  Number the pages.
  What patterns do you notice in the page numbers?

- *Investigate page number patterns for other newspapers.*

Powers of Ten

10^6	1 000 000	10 x 10 x 10 x 10 x 10 x 10
10^5		
10^4		
10^3		10 x 10 x 10
10^2		
10^1	10	
10^{-1}		
		$\frac{1}{10} \times \frac{1}{10}$
	$\frac{1}{1000}$	
10^{-4}		

Complete this part first.

Look for patterns in the columns to complete the table.

Smile Worksheet **0614**

Powers of Ten

10^6	1 000 000	10 x 10 x 10 x 10 x 10 x 10
10^5		
10^4		
10^3		10 x 10 x 10
10^2		
10^1	10	
10^{-1}		
		$\frac{1}{10} \times \frac{1}{10}$
	$\frac{1}{1000}$	
10^{-4}		

Complete this part first.

Look for patterns in the columns to complete the table.

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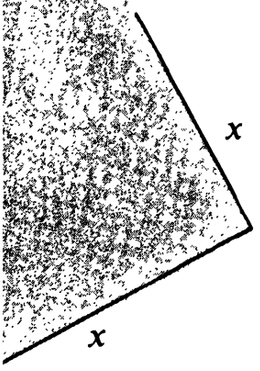
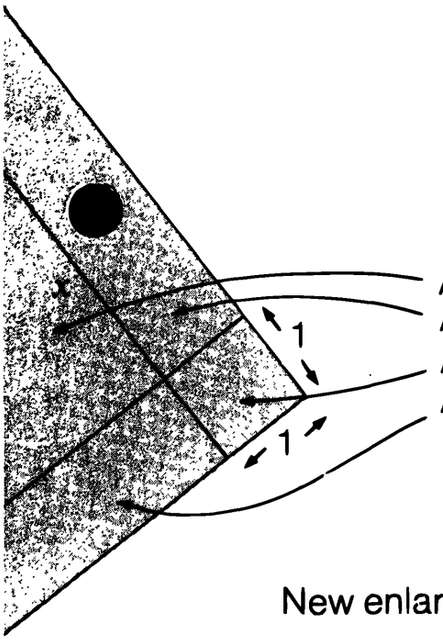
The unknown square



Area = x^2

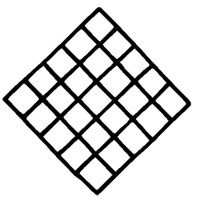
The sides of this unidentified square are increased by 1 unit



Area = x^2
Area = $x \times 1 = x$
Area = $1 \times 1 = 1$
Area = $1 \times x = x$

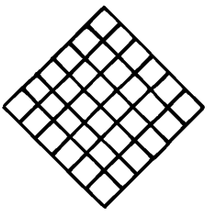
New enlarged area = $x^2 + 2x + 1$

If $x = 5$,
then the smaller square is 5×5 ....



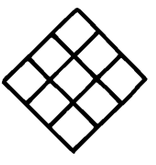
...and the larger square $(x + 1)^2$ is [redacted] 6...

and $6^2 = 5^2 + (2 \times 5) + 1$

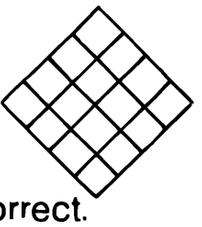


Check $6^2 = 5^2 + (2 \times 5) + 1$
$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
$36 \quad 25 + \quad 10 \quad + 1$

If $x = 3$,
then the smaller square is 3×3...



....and the larger square $(x+1)^2$ is 4×4...



Complete this identity:
$4^2 =$ ■ + $(2 \times$ ■ $) + 1$
and check that your answer is correct.

$4^2 = 3^2 + (2 \times 3) + 1$

1. Write a similar identity to describe the areas if $(x + 1) = 8$. . . and check it.

2. Investigate other values for $(x + 1)$ and list your results in a table:

4^2	$(3 + 1)^2$	$3^2 + (2 \times 3) + 1^2$	$9 + 6 + 1$	16
5^2	$(4 + 1)^2$			
6^2	$(5 + 1)^2$			
	$(6 + 1)^2$			
	$(7 + 1)^2$			
	$(8 + 1)^2$			

3. Compare and check the first and last columns

4. Writing $(x + 1)^2$ as $(x^2 + 2x + 1)$ makes calculations like 101^2 much easier.

For example, $101^2 = (100 + 1)^2$
$= 100^2 + (2 \times$ [redacted] $) +$ [redacted]
$= 10000 +$ [redacted] $+$ [redacted]
$=$ [redacted]

5. Use this method to calculate
   (a) 21^2
   (b) 51^2
   (c) 301^2

6. Find the value of $(x + 1)^2$ if $x = ½$

Looking Around

Everything has shape and there is a word to describe each shape.

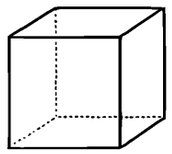
Look around to find examples of these shapes.

Look in the classroom.
Look outside.
Look at home.

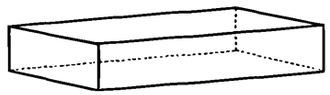
List as many as you can.

Which solid has most examples? Why?

Cube



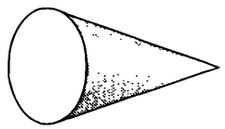
Cuboid



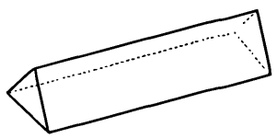
cupboard

Cylinder

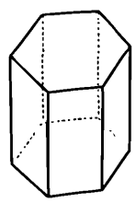
Cone



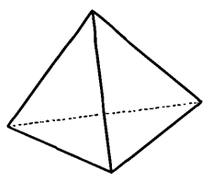
Triangular Prism



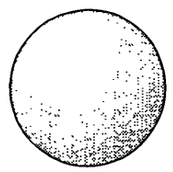
Hexagonal Prism



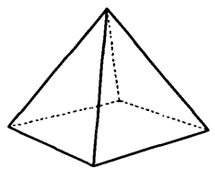
Tetrahedron (Triangular based pyramid)



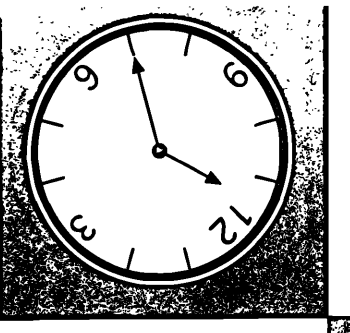
Sphere



Square Based Pyramid



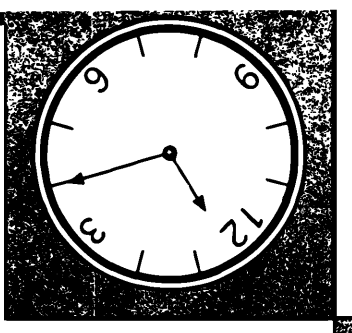
10:30am



02:06

Seven minutes past 5 in the afternoon

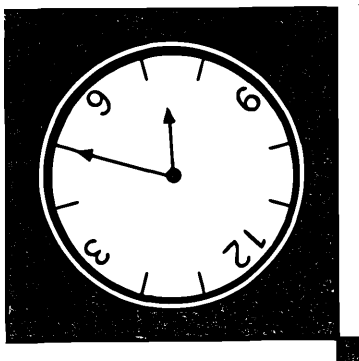
5:07pm



Quarter to 2 in the afternoon

12:00

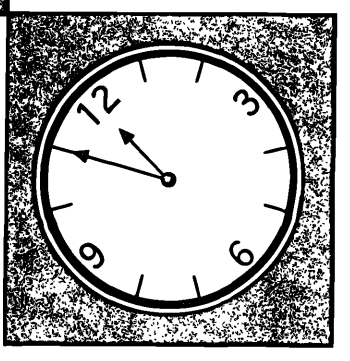
12:40am



08:55

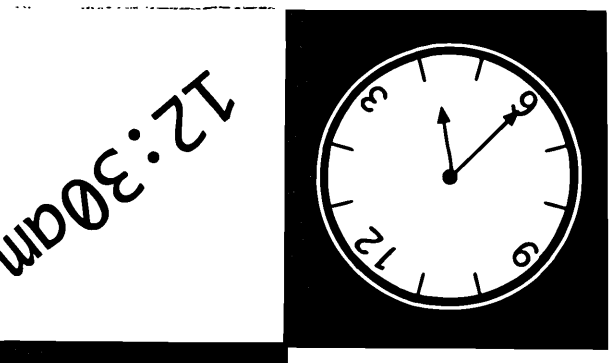
Five minutes to 7 in the evening

11:35pm



10:30

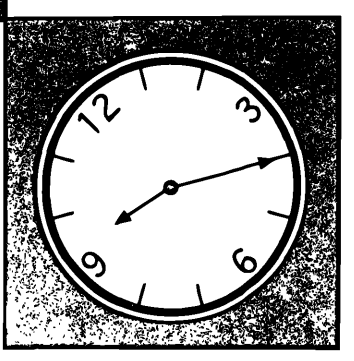
Half past 4 in the afternoon



13:45

Five minutes to midnight

12:30am



03:05

Half past midnight

5:20am

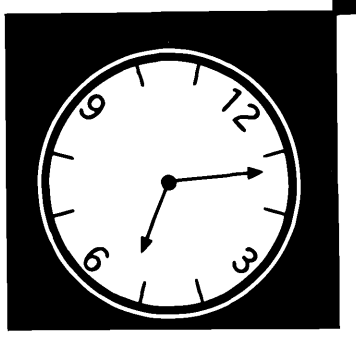
00:40

Twenty minutes past midday

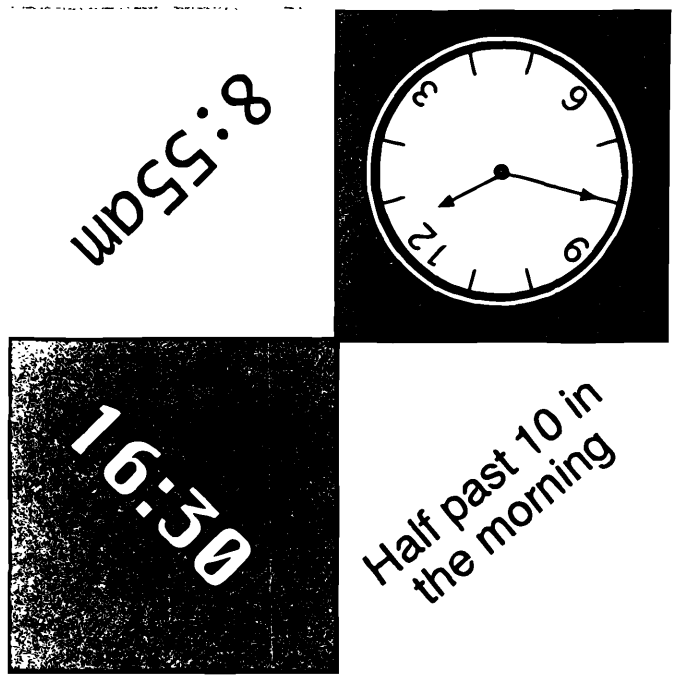
7:25pm

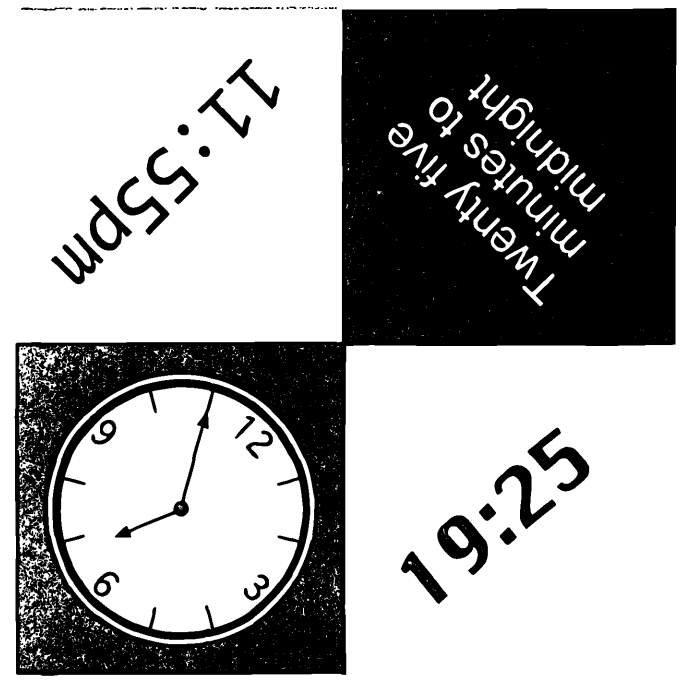
Twenty five minutes past 7 in the afternoon

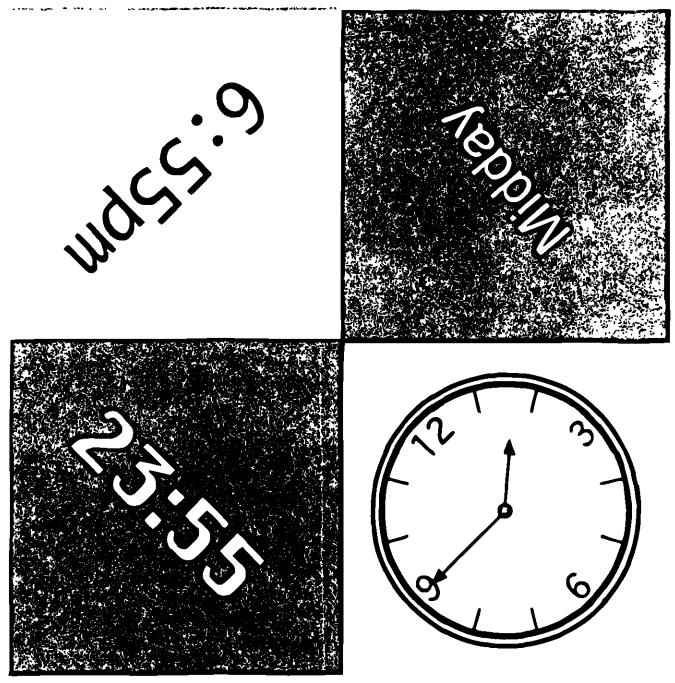
12:20pm

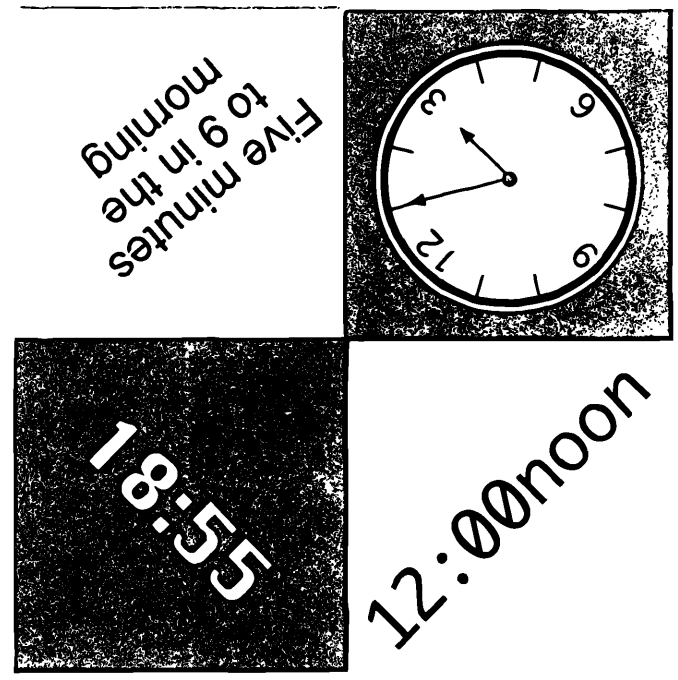


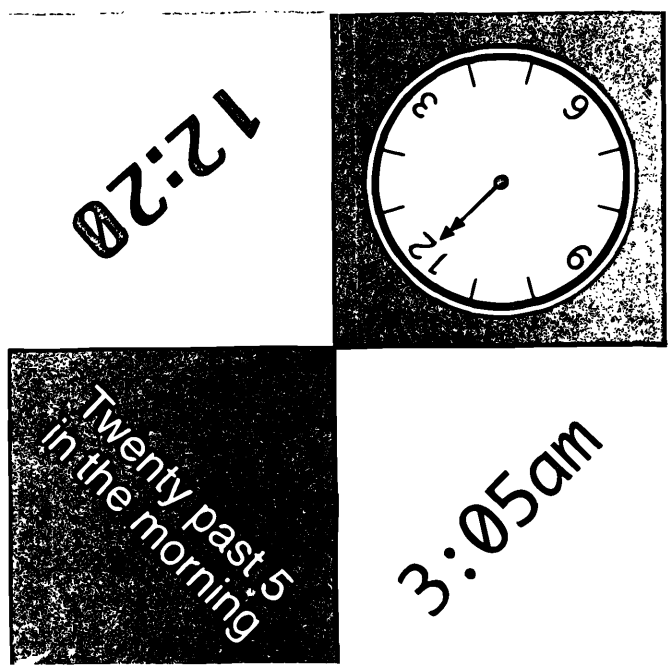
23:35

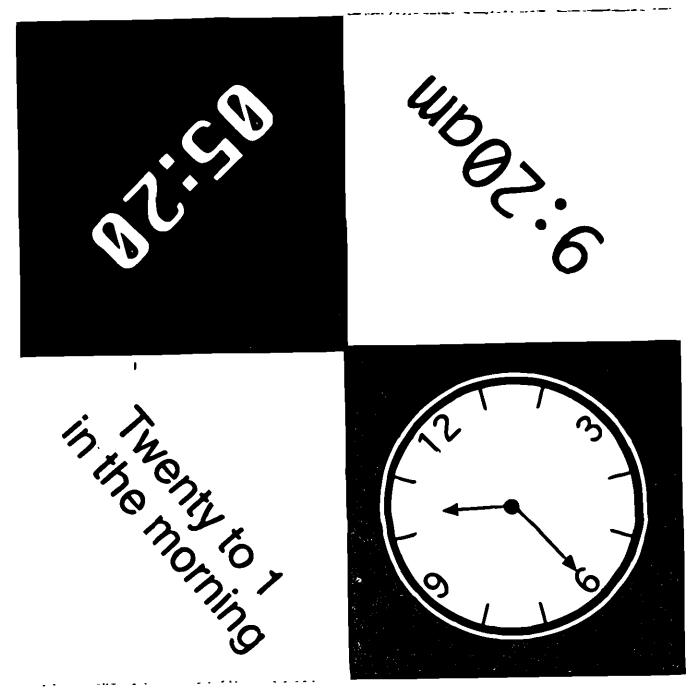

8:55am
16:30
Half past 10 in the morning


11:55pm
Twenty five minutes to midnight
19:25


6:55pm
Midday
23:55

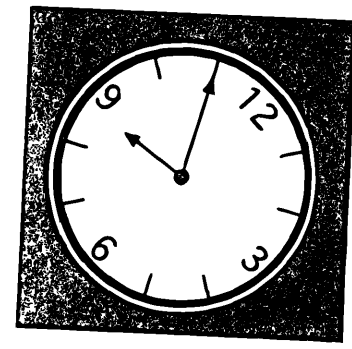

Five minutes to 9 in the morning
12:00noon
18:55


12:20
Twenty past 5 in the morning
3:05am


9:20am
05:20
Twenty to 1 in the morning

00:30

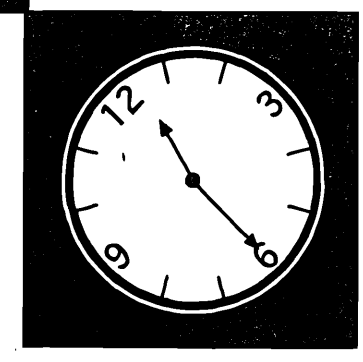
4:30pm



Five minutes
past 3 in the
morning

17:07

Twenty past 9
in the morning



1:45pm

Smile **0629**

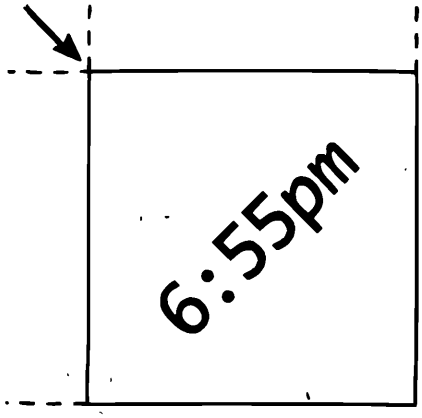
Time Tiles

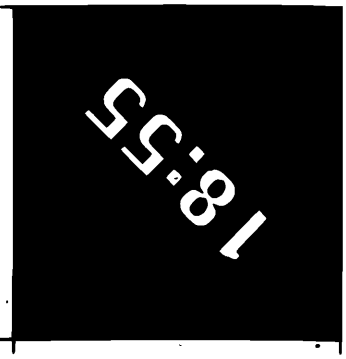
This envelope contains 16 Time Tiles
An activity for **2** people.

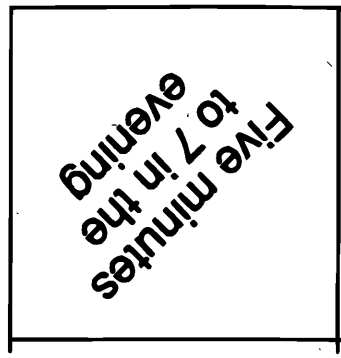
Using the 12 hour clock.

For example.

A clock face.







Using the 24 hour clock.

In words.

Match the tiles so that all touching edges show the same time in 4 different ways.

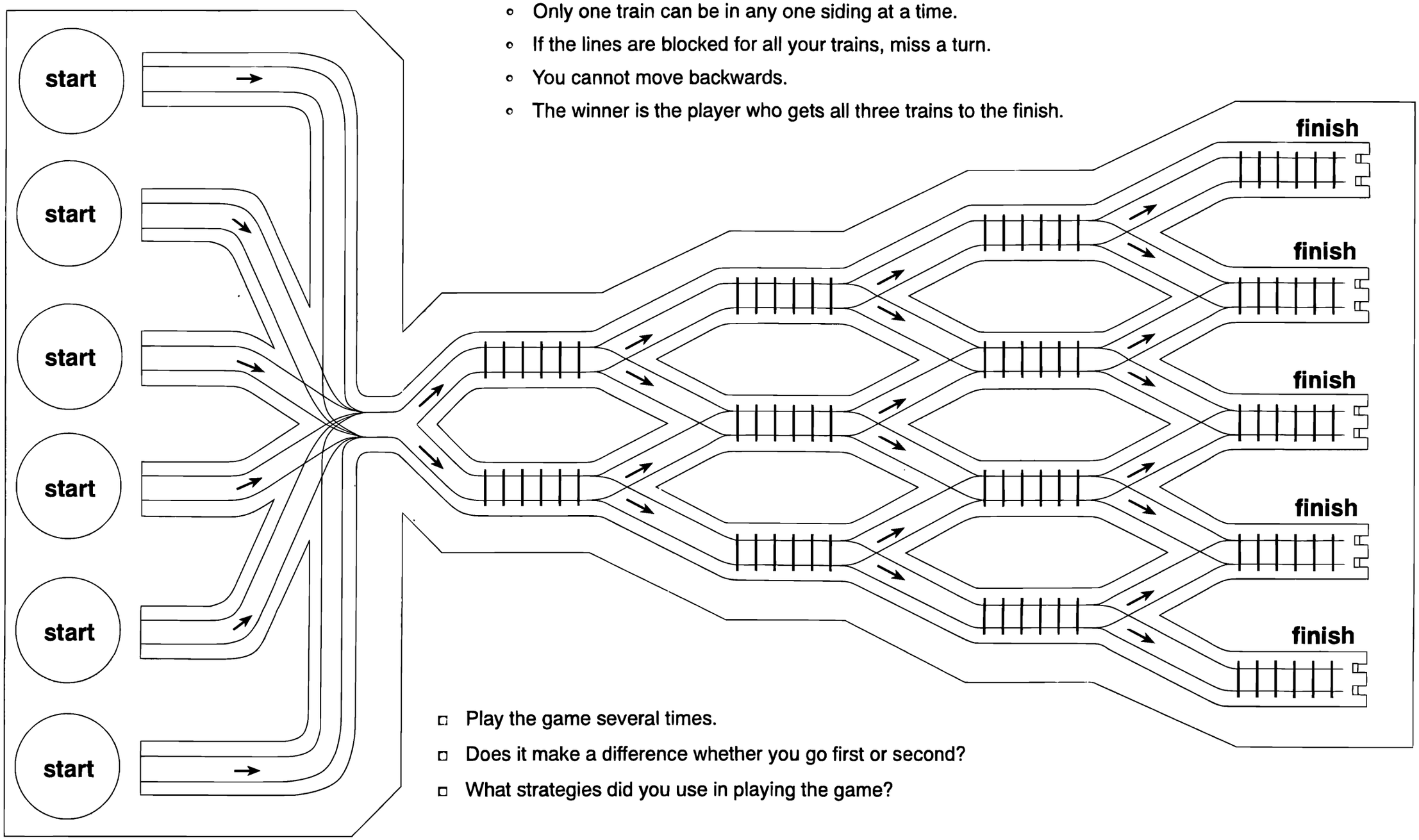
Sidings

A game for 2 players

- Each choose 3 counters of one colour.
  Each counter represents a **train**.
  Each ##### represents a **siding**.

Rules

- Place the (trains) counters on the six positions marked 'start'.
- Take turns to move one of your trains from the start to one of the next sidings.
- You may move any one of your trains.
- Only one train can be in any one siding at a time.
- If the lines are blocked for all your trains, miss a turn.
- You cannot move backwards.
- The winner is the player who gets all three trains to the finish.

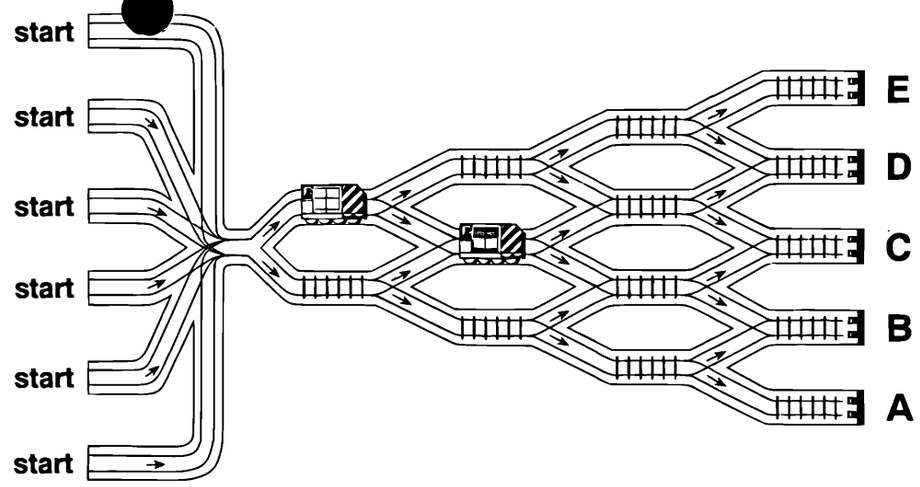


- Play the game several times.
- Does it make a difference whether you go first or second?
- What strategies did you use in playing the game?

1 From where the orange train is shown, how many finishing points can you get to? Which are they?

2 From where the grey train is shown, how many finishing points can you get to? Which are they?

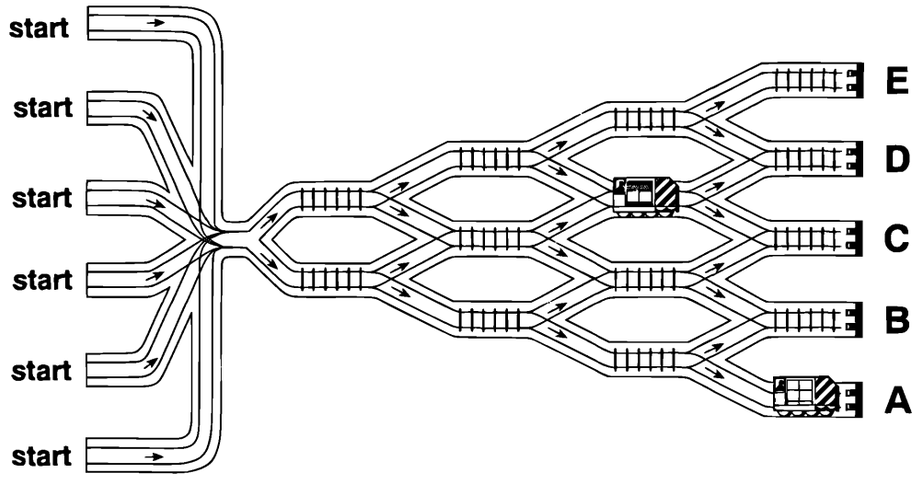
3 Answer the same questions for each of the other sidings.



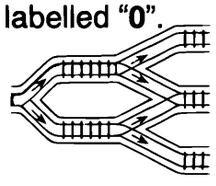
4 How many ways are there of getting to where the grey train is shown?

5 How many ways are there of getting to where the orange train is shown?

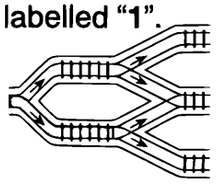
5 How many ways are there of getting to each of the 14 sidings? What is the total number of routes to sidings **A**, **B**, **C**, **D**, and **E**?



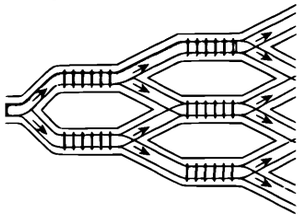
This route can be labelled "**0**".



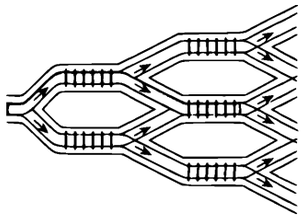
This route can be labelled "**1**".



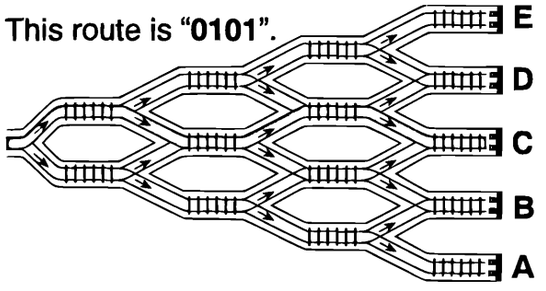
This route is "**00**".



This route is "**01**".



This route is "**0101**".



7 Find one route that finishes at **A**. What is its label? Can you find any other routes that finish at **A**?

8 a) Where would route **1011** finish?
b) How many more routes can you find that finish at the same point?

9 Copy and complete this table.

Finish	Routes
A	1111
B	1110
	1101

A HUNGRY DEATH ?

I LEFT 3 BOXES IN MY OFFICE,
ONE WITH A BOMB INSIDE,
ONE WITH MY LUNCH IN IT,
AND ONE WITH MY SECRET FILE.

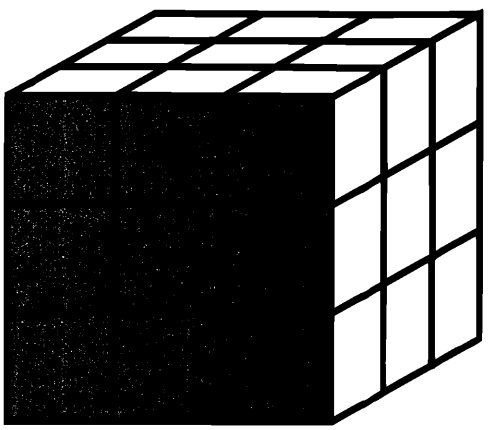
A SPY BROKE IN WHILE I WAS OUT AND CHANGED THE LABELS SO THAT EVERY LABEL IS NOW ON THE WRONG BOX.

IF I OPEN THE BOX WITH THE BOMB INSIDE, I WILL BE BLOWN UP !

HOW CAN I EAT MY SANDWICHES SAFELY ?

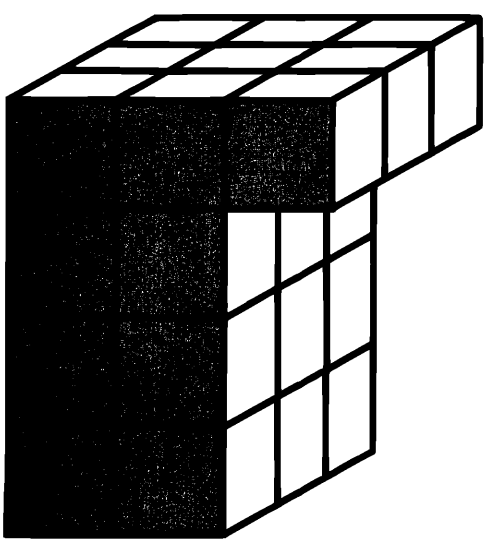
Cube Cuts

You will need: cubes



Problem

Cut the cubes with a saw into centimetre cubes.
How many cuts are needed?



If you may re-arrange the pieces after each cut, can you do it with fewer cuts?

Try a 4 by 4 by 4 cube.
Try other cuboids.