SMILE WORKCARDS

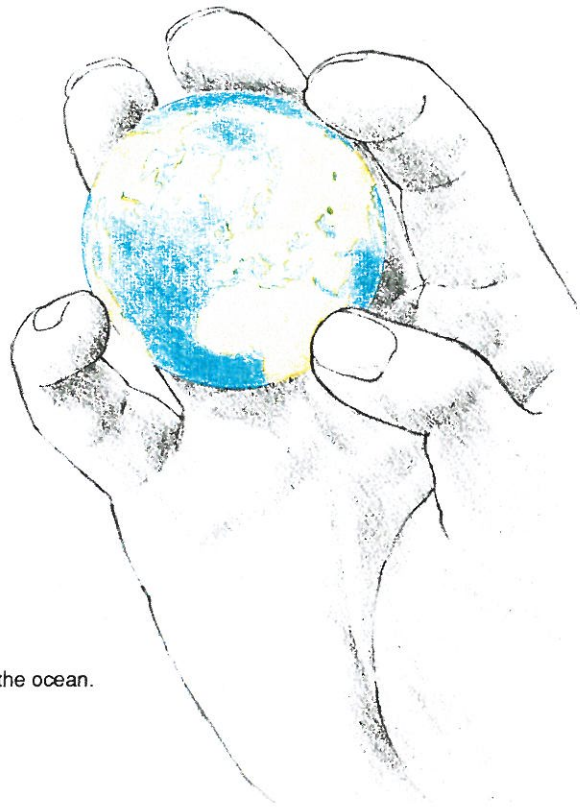
Ratio Pack Two

Contents

Shrinking Earth

An atlas may be useful.

If the earth were shrunk to the size of a golf ball, would you be able to feel the mountains?

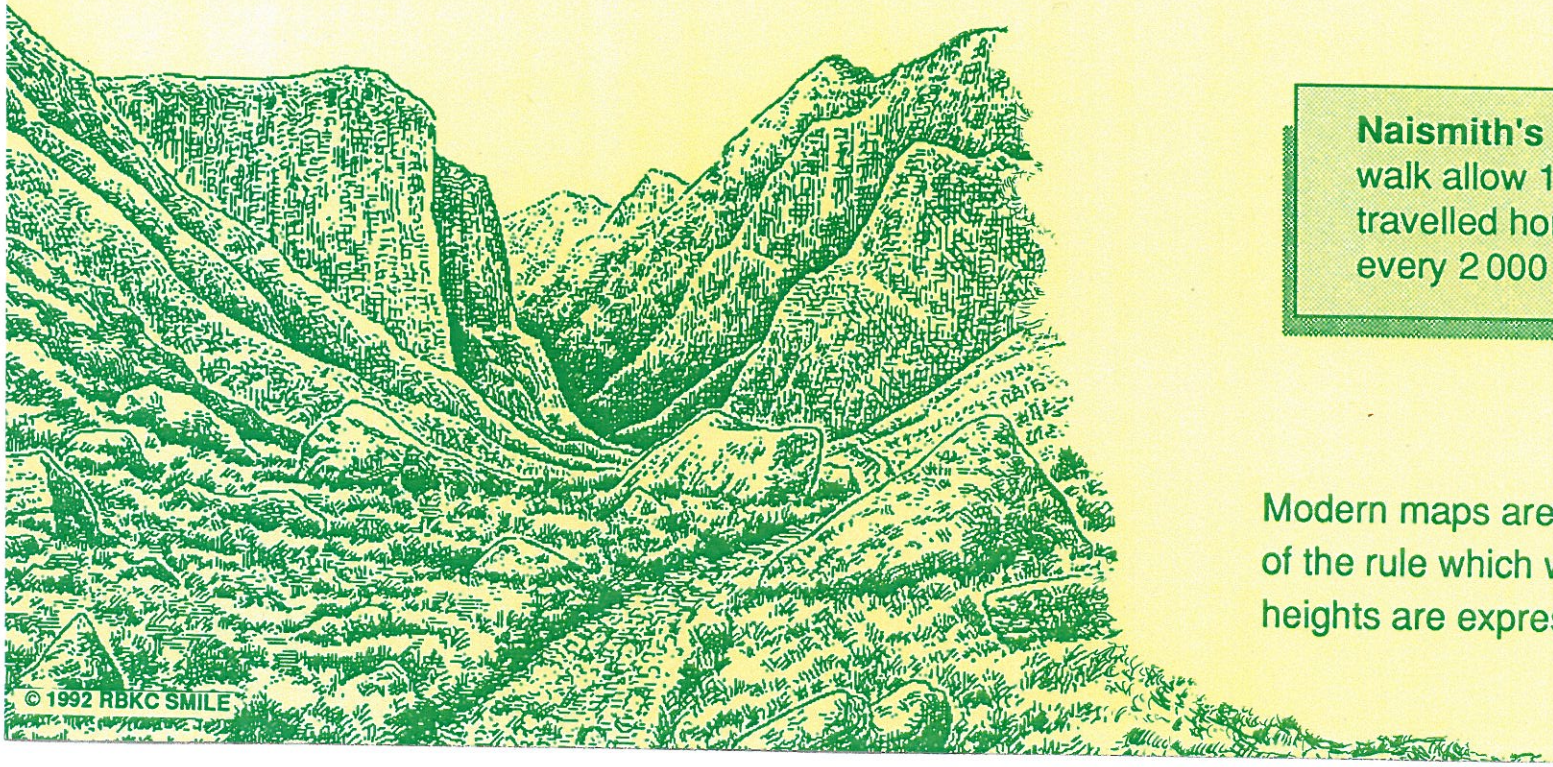


- Mount Everest is the highest mountain.
- The 'Marianas trench' is the deepest part in the ocean.

A Mountain Walk

Smile 2006

When planning a walk in a mountainous area you need to estimate how long the walk will take.



Naismith's Rule: On a mountain walk allow 1 hour for every 3 miles travelled horizontally plus 1 hour for every 2 000 feet climbed up.

Modern maps are metric. Invent a new version of the rule which will work if the distances and heights are expressed in metric units.

Unibond mixtures

The five problems in this booklet are all concerned with making mixtures which are specified by the ratio of *chemical* to *water*.

The BBC TV programme "Ratio and Proportion" (from the Maths Help series) revises the techniques necessary for this work. You may find it useful to watch this programme before starting work on this booklet.

UNIBOND SOLUTIONS	USED FOR	UNIBOND	WATER
STIFFENING	STIFFENING FABRIC FOR BLINDS ETC.	1	20
A	PRIMING POROUS OR DUSTY SURFACES	1	5
B	PRIMING GLOSS SURFACES FOR PAPERHANGING, ASBESTOS	1	1
C	SAND AND CEMENT BONDING	3	1
D	BONDING WOODWORK AND LAMINATES	5	1
E	FINAL BONDING FOR DIFFICULT SURFACES	UNDILUTED	
SLURRY	2 PARTS SHARP SAND, 1 PART CEMENT, 1 PART UNIBOND AND 1 PART WATER.		

Mixtures

"Unibond" is an adhesive used both in industry and around the home.

When undiluted it is a powerful wood glue and can also be used for sticking down formica and other plastics.

In its various diluted states it can be used to prime concrete surfaces (1 part Unibond : 5 parts water), or as the water base to make plaster more adhesive (3 : 1), or any of the uses listed in the table.

Problem A

Kristy needs 2 pints of solution D (5 : 1) to stick a new formica top on the kitchen worktop.

5 pints of Unibond and 1 pint of water would give the correct mixture, but this would be very wasteful.

1. Why?

To make 2 pints of mixture, Kristy uses $1\frac{2}{3}$ pints of Unibond and $\frac{1}{3}$ pint of water.

2. Would the ratio $1\frac{2}{3} : \frac{1}{3}$ give the correct mixture?

3. What fraction of Kristy's mixture is water?

Problem B

Dave is laying new tiles around the bath. First of all he needs to prime the surface of the plaster. He makes 6 pints of solution A.

1. How many pints of water does he use?

2. How many pints of Unibond does he use?

3. What fraction of the final solution is Unibond?

Dave finds that he needs less than half of this mixture.

4. What quantities of water and Unibond would have given a mixture of 3 pints of solution A?

Problem C

Dave needs to make a mixture of Unibond and water to stick the tiles around the wall. Solution C is suitable for this. He reckons 3 pints of solution C will be enough.

1. How much water and how much Unibond will give 3 pints of solution C?

Problem D

Dave has 3 pints of solution A left over.

1. How much water should he add to this to change it to a *stiffening solution* for making blinds for the bathroom?

Turn over

2. How many pints of stiffening solution will Dave have made?

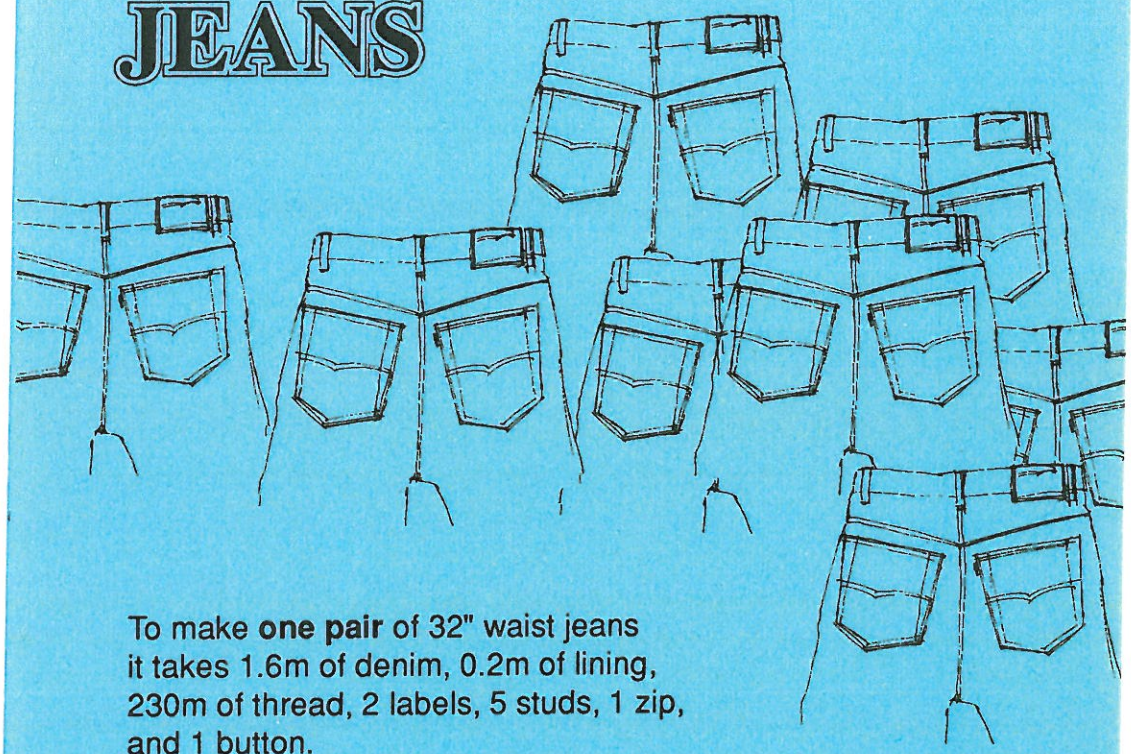
Problem E

Jane wants to lay new tiles on the kitchen floor. She needs 1 litre of the weak solution (1 : 5) to prime the concrete surface, and 6 litres of the bonding solution (3 : 1) for the tile cement.

1. How much Unibond will she use?

2. How much Unibond will she buy?

JEANS



To make **one pair** of 32" waist jeans
it takes 1.6m of denim, 0.2m of lining,
230m of thread, 2 labels, 5 studs, 1 zip,
and 1 button.

Your factory has just received an order for **5000 dozen pairs.**

You have accepted the following prices for the raw materials.

Denim	£250 per 100m roll
Lining	£106 per 100m roll
Thread	£5 per 5000m cone
Labels	£15 per 1000
Studs	£20 per 1000
Zips	£12.50 per 100
Buttons	£3 per 100

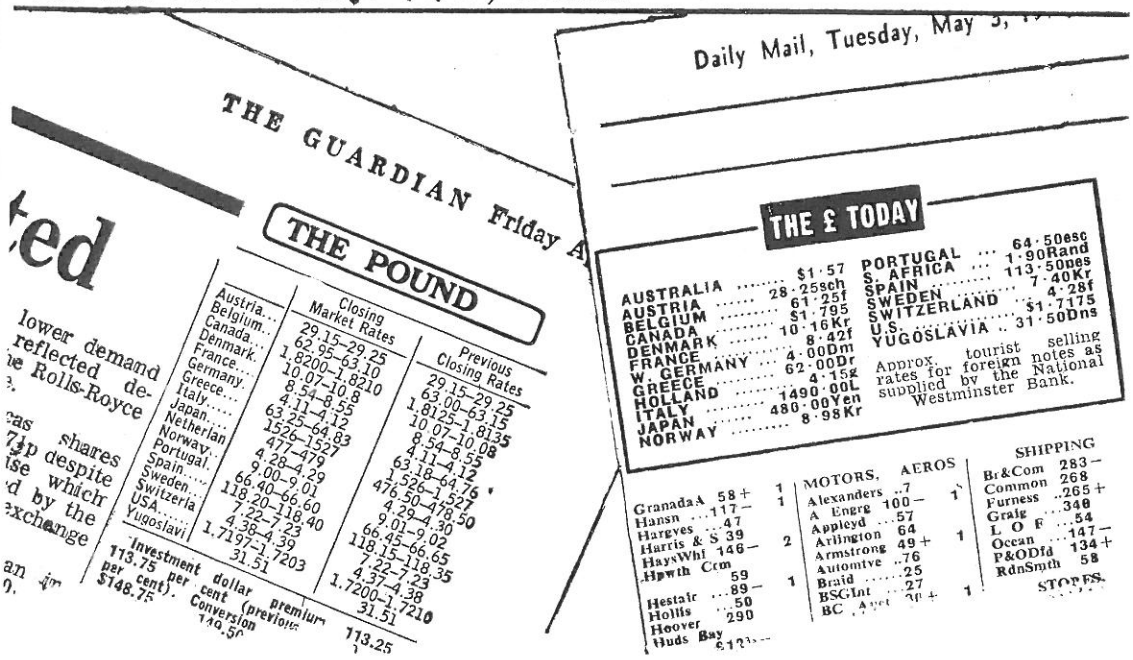
A spreadsheet might help.

1. Find a good way of setting out all the information you need:
   a) to order the correct quantity of all the raw materials you will want.
   b) to calculate the cost of the raw materials for one pair of jeans.

2. a) Denim goes up in price by 5%.
   How does this affect the cost of one pair of jeans?
   b) If there was a 5% increase in one of the raw materials which one would have the greatest effect on the cost of one pair of jeans?

0791

You will need : today's paper, calculator SMILE



THE GUARDIAN Friday A

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lower demand reflected de- he Rolls-Royce

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THE POUND

	Closing Market Rates	Previous Closing Rates
Austria	29.15–29.25	29.15–29.25
Belgium	62.95–63.10	63.00–63.15
Canada	1.8200–1.8210	1.8125–1.8135
Denmark	10.07–10.08	10.07–10.08
France	8.51–8.55	8.54–8.55
Germany	4.11–4.12	4.11–4.12
Greece	63.25–64.83	63.18–64.76
Italy	1526–1527	1526–1527
Japan	477–479	476.50–478.50
Netherlan	4.28–4.29	4.29–4.30
Norway	9.00–9.01	9.01–9.02
Portugal	66.40–66.60	66.45–66.65
Spain	118.20–116.40	118.15–118.35
Sweden	7.22–7.23	7.22–7.23
Switzerla	4.38–4.39	4.37–4.38
USA	1.7197–1.7203	1.7200–1.7210
Yugoslavi	31.51	31.51

Investment dollar premium per cent (previous 113.75 per cent). Conversion $148.75 140.50 113.25

Daily Mail, Tuesday, May 3,

THE £ TODAY

AUSTRALIA	$1·57	PORTUGAL	64·50esc
AUSTRIA	28·25sch	S. AFRICA	1·90Rand
BELGIUM	61·25f	SPAIN	113·50pes
CANADA	$1·795	SWEDEN	7·40Kr
DENMARK	10·16Kr	SWITZERLAND	4·28f
FRANCE	8·42f	U.S.	$1·7175
W. GERMANY	4·00Dm	YUGOSLAVIA	31·50Dns
GREECE	62·00Dr		
HOLLAND	4·15g		
ITALY	1490·00L		
JAPAN	480·00Yen		
NORWAY	8·98Kr		

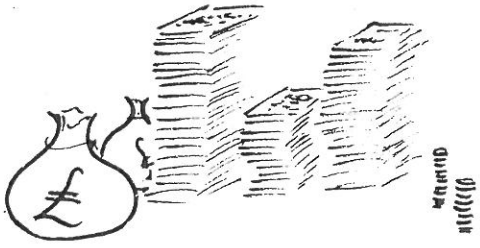
Approx. tourist selling rates for foreign notes as supplied by the National Westminster Bank.

			MOTORS, AEROS			SHIPPING	
GranadaA	58+	1	Alexanders	7	1	Br&Com	283–
Hansn	117–	1	A Engrg	100–	1	Common	268
Hargves	47		Appleyd	57		Furness	265+
Harris & S	39	2	Arlington	64		Graig	348
HaysWhf	146–		Armstrong	49+	1	L O F	54
Hpwth Ccm	59	1	Automtve	76		Ocean	147–
Hestair	89–		Braid	25		P&ODfd	134+
Hollis	50		BSG Int	27		RdnSmth	58
Hoover	290		BC Aero	38+	1	STORES	
Huds Bay	612½						

In today's newspaper you should be able to find a foreign currency table which gives the rate of exchange for £ sterling.

1. Is a millionaire in the United States as wealthy as a millionaire in England ?
2. How much is an Italian millionaire worth ?
3. How much more money would a French millionaire need, to become a millionaire in England ?
4. If an oil shipment is worth 3 million German marks, how much will it cost a British buyer ?

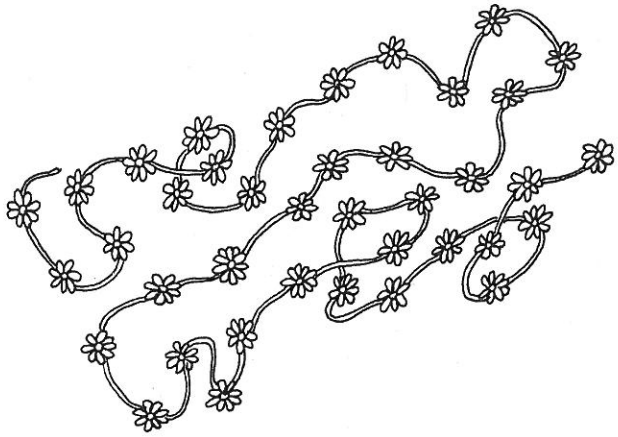
A mi££ionaire



The Champion Flea

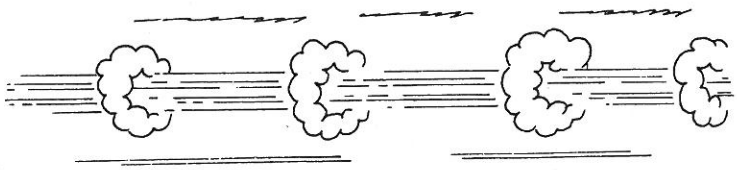
1. The champion jumper among fleas is the common flea. In one experiment in 1910 a common flea made a high jump of 197mm. It jumped 130 times its own height. What was the height of the flea?

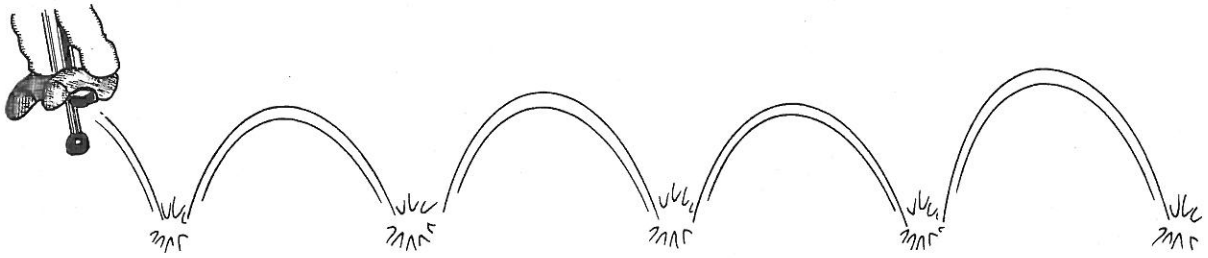
2. The biggest selling British record of all time is 'I Wanna Hold Your Hand' by the Beatles, released in 1963 with a world sale of 12 000 000. The group received 2p for each record sold. How much did each of the four Beatles earn on this record alone?



3. The longest daisy chain in the world was made in Clwyd, Wales,in 7 hours. It was 1244 metres long.
   (a) Work out how much was completed in 5 minutes.
   (b) How long did one metre take to complete?
   (c) People worked for 1¼ hours only, completing on average 4 metres per hour.
   How many people were involved?

4. The land speed record by a wheeled vehicle was 1 016.086 km/h, set in 1970. If the distance between your school and home were 8 km, how long would it take you to get home at this speed?



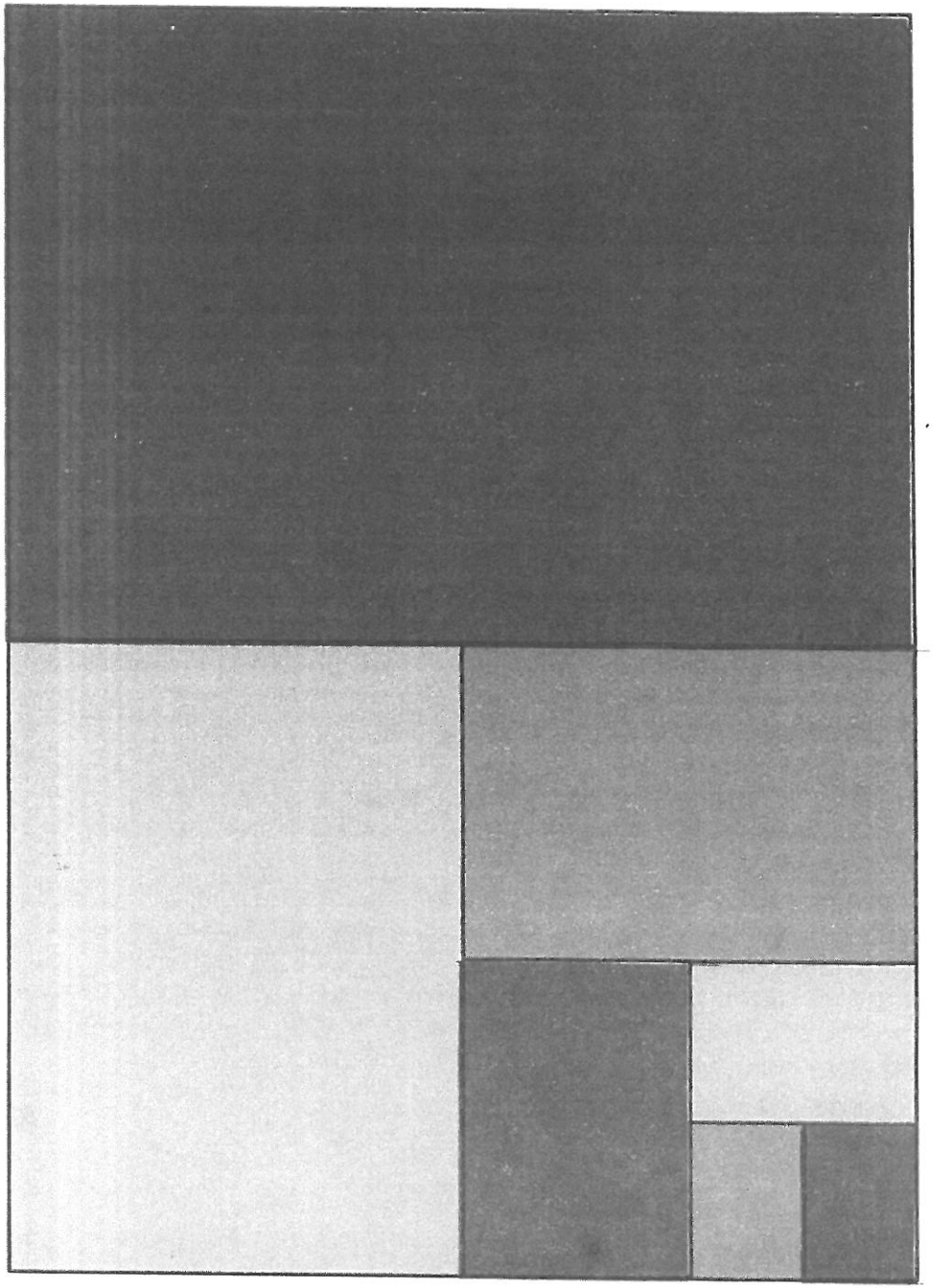


5. The greatest number of jumps achieved on a pogo stick is 36 218 in 5 hours 15 mins. If the person started at 9.42am, how many jumps had she completed by 10.26am?

6. Make up a problem for your class to solve. You will probably find The Guinness Book of Records is the most useful source of information. (The school library will have a copy.)

You will need a calculator and access to the I.P.S. Poster.

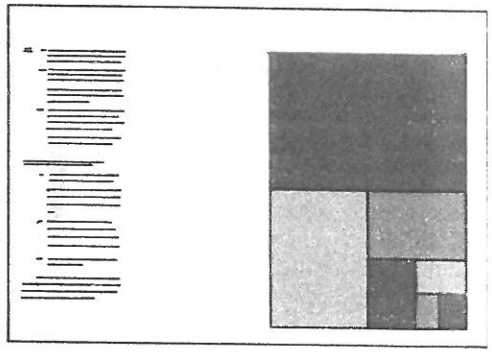
International Paper Sizes



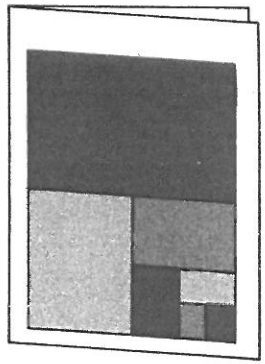
International Paper Sizes

The system of international paper sizes is used in many countries. One of its main advantages is that each size can be obtained by cutting a larger size in half . . .

. . . this card unfolded is A4



. . . and this is A5.



This means that smaller sizes of paper can be cut with very little waste.

The A series of paper sizes has other interesting features and in order to find out about them you will first need to record measurements in tabular form.

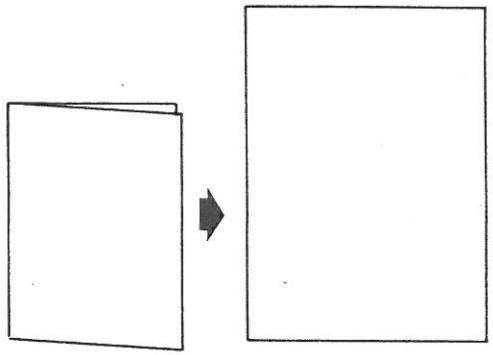
1) Copy and complete this table. You can get the measurements from the I.P.S. poster . . . but if you do not have access to it, you can work out the measurements. You will have to start with A4 (measure this card) and then ...

Paper Size	Width (mm)	Length (mm)	Area (mm^2)	Length ÷ Width
A7				
A6				
A5				
A4	210	297		
A3				
A2				
A1				
A0				

2) (a) How would you expect the area of successive sizes to increase?

(b) Do the areas in your table agree with this expectation? If not why not?

(c) In theory the area of an A0 sheet is one square metre. Your result is unlikely to agree exactly with this. Can you think of an explanation?



3) (a) What do you notice about the ratio length ÷ width for each size?

(b) By folding and cutting A4 sheets make all the paper sizes from A4 to A8.

Arrange them to show that they are enlargements of one another.

(c) In theory the ratio length ÷ width is $\sqrt{2}$ for each A size.

Check that your results agree with this.

Some further activities:

* Find out how much the different A sizes are used. Measure SMILE cards, posters headed notepaper, newspapers, books etc. to find out.

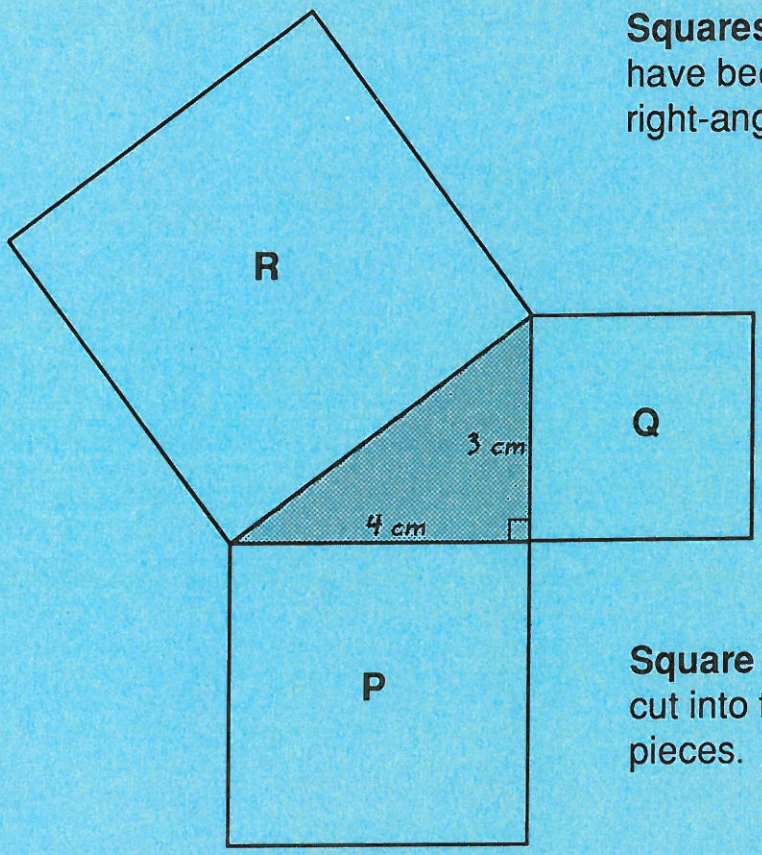
* Find out about the C and D series of envelopes . . .

* . . . and the B series for books.

Letters, Paper and Envelopes (C9) from the Communication Pack (MMCP) will be a useful source.

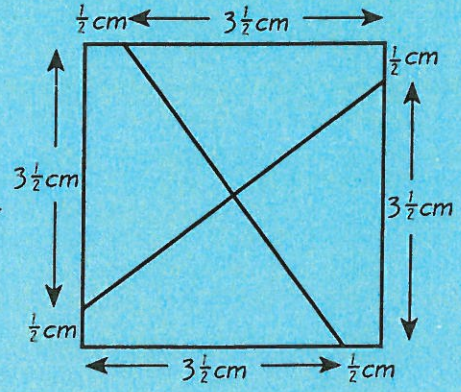
Turn over

PYTHAGORAS DISSECTION



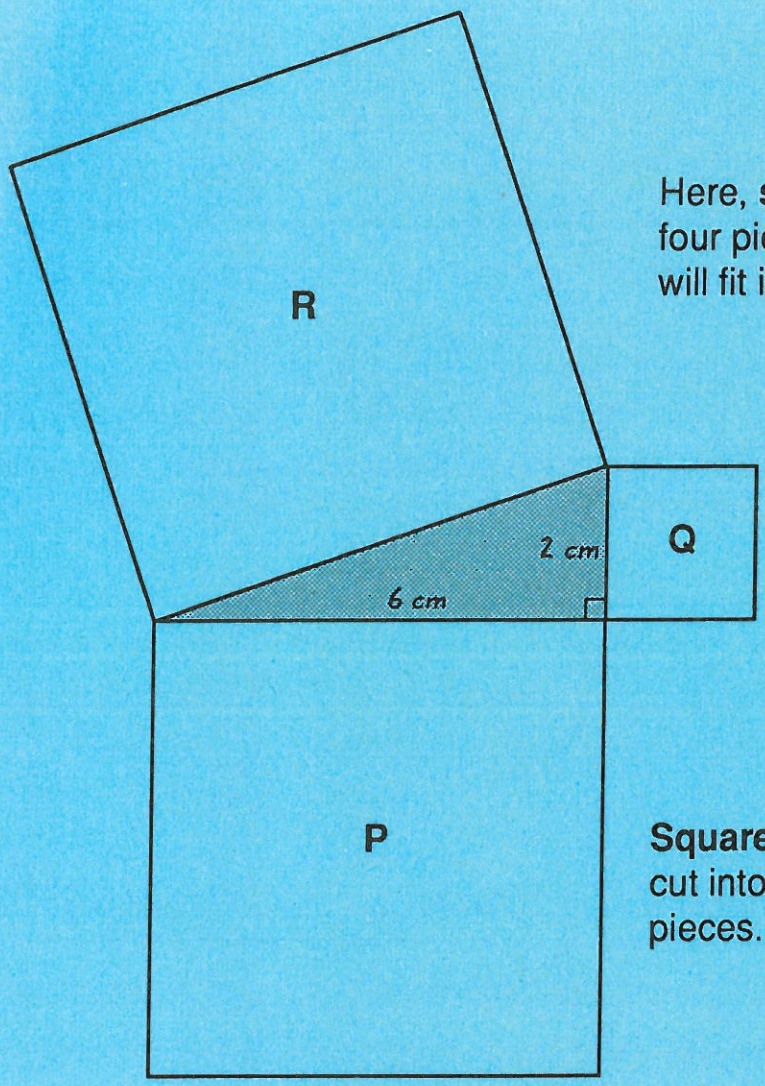
Squares P, Q and **R** have been drawn on this right-angled triangle.

Square P is cut into four pieces.



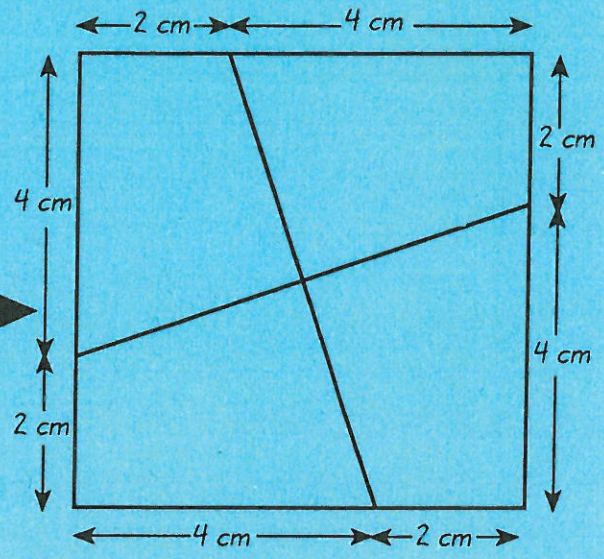
Show how **square Q** and the four pieces of **square P** will fit into **square R.**

Turn over



Here, **square Q** and the four pieces of **square P** will fit into **square R**.

Square P is cut into four pieces.



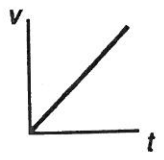
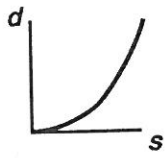
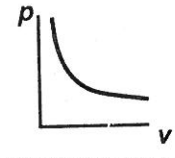
Investigate the dissection of square P for right-angled triangles.

Hints

Look carefully at the ratio of the dissection.
What do you notice about the lines of the dissection?

Proportion

If two quantities p and q, are directly in proportion to each other, the notation $p \propto q$ is used. The quantities can be linked by an equation of the form $p = kq$, where 'k' is the constant of proportionality.

Statement	Notation	Formula	Graph
'Velocity, v, is directly proportional to time, t.'	$v \propto t$	$v = kt$	
'Stopping distance, d, of a car is proportional to the square of its speed, s.'	$d \propto s^2$	$d = ks^2$	
'The pressure, p, is inversely proportional to the volume, v.'	$p \propto \frac{1}{v}$	$p = \frac{k}{v}$	

1. Express these statements

(i) in notation, (ii) as formulae, (iii) sketch the graph.

a) The increase in length, d, of a rod is directly proportional to the increase in temperature, t.

b) The circumference, c, of a circle is directly proportional to its radius, r.

c) The mechanical energy of motion, e, of a car is proportional to the square of its velocity, v.

d) The volume, v, of a sphere is proportional to the cube of its radius, r.

e) The distance to the horizon, d, is proportional to the square root of the observer's height , n, above the surface of the sea.

If there is more information connecting the two quantities the *constant of proportionality* (k) can be calculated.

A quantity y, is inversely proportional to the square of a quantity x, and when $x = 5$, $y = 4$.

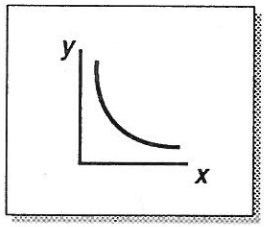
'y is inversely proportional to x^2' $\quad y \propto \frac{1}{x^2} \quad y = \frac{k}{x^2}$

Substitute $x = 5$, $y = 4$ $\quad 4 = \frac{k}{25}$

The *constant of proportionality* is $\quad k = 100$

The relationship between x and y is $\quad y = \frac{100}{x^2}$

A sketch of the graph of this relationship.



2. y is proportional to x and when $y = 12$, $x = 2$.

- Find the expression connecting x and y and find y when $x = 5$.
- Sketch a graph of this relationship.

3. y is inversely proportional to the square of x and when $x = 4$, $y = 3$.

- Find the expression connecting x and y and find y when $x = 8$.
- Sketch a graph of this relationship.

4. y is proportional to x^3, so $y \propto x^3$ and $y = ax^3$.

- Find the constant of proportionality, a, if $x = 2$ when $y = 0.1$
- Complete the table of values:

x	2	6	8	
y	0.1			12.5

- Sketch a graph of this relationship.

5. Some corresponding values of x and y are shown in the table:

x	1	5	10	20
y	5	125	500	2000

- Which of the following could be true?
  a) $y \propto x^2$
  b) $y = 5x$
  c) $y = 5x^2$
  d) $y = 30x - 25$

6. Some corresponding values of F and W are shown in the table:

F	100	200	300	500
W	30	15	10	6

- Which of the following is a possible relationship between F and W?
  a) W is directly proportional to F
  b) F is inversely proportional to W
  c) $W = {}^3/_{10}F$
  d) $FW = 3000$

7. Given that $y \propto \frac{1}{x^2}$ complete the table of values:

x	20	17	14	10	8
y		240		693·6	

- Sketch a graph of this relationship.

8. Find the equation for which the following are corresponding pairs:

(20, 35), (24, 42), (48, 84), (50, 87·5).

- Sketch a graph of this relationship.

Here are some familiar formulae containing a *constant of proportionality*.

	Formula		Constant of proportionality
Volume of a sphere	$v = \frac{4}{3}\pi r^3$	v is proportional to the cube of r.	$\frac{4}{3}\pi$
Time of a swinging pendulum	$T = 2\pi\sqrt{\frac{L}{g}}$	T is proportional to the square root of L.	$\frac{2\pi}{\sqrt{g}}$