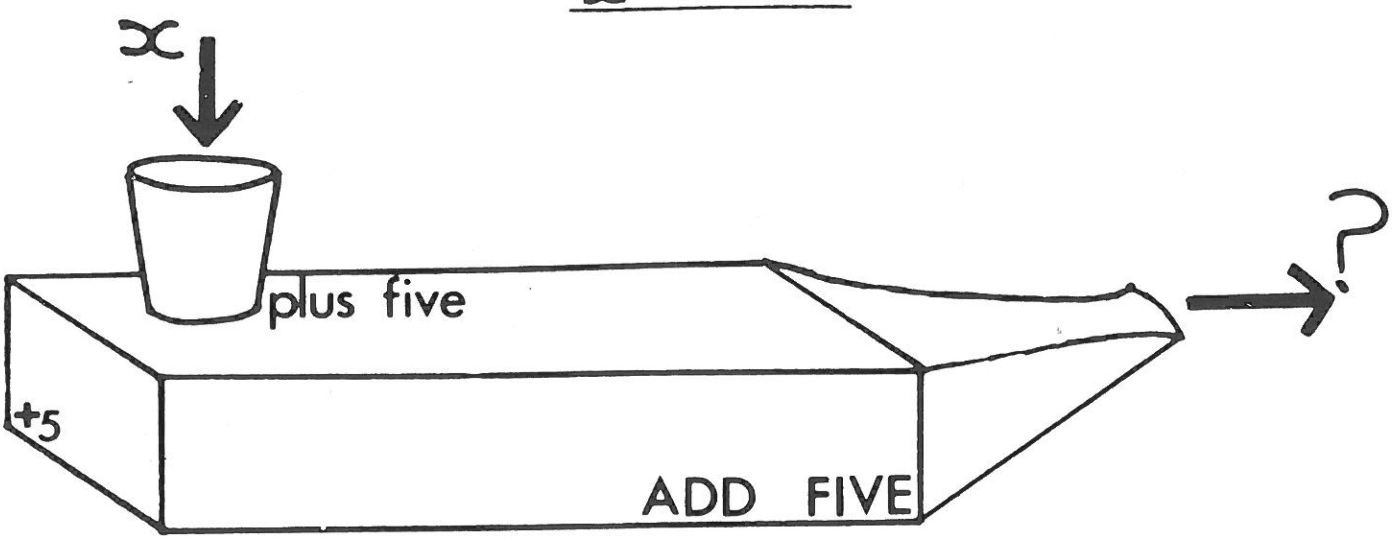
SMILE WORKCARDS

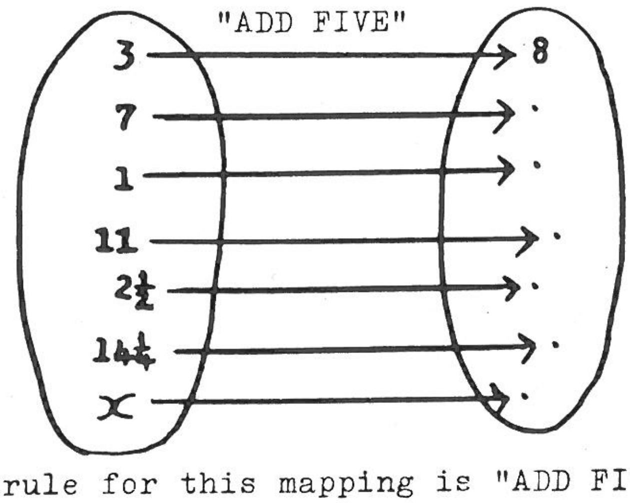
Mappings Pack Two

Contents

x for Tea



Copy and complete this mapping diagram.



The rule for this mapping is "ADD FIVE" so if x goes in, $x+5$ comes out. x can be any number.

We write this mapping as $x \longrightarrow x+5$

Write the following mappings in the form $x \longrightarrow$.

(1) add seven

(2) multiply by four

(3) divide by nine

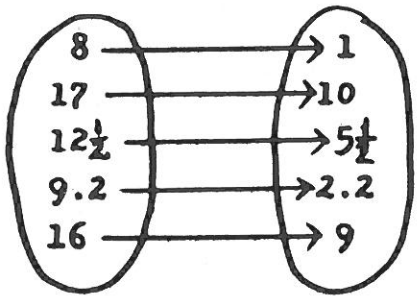
(4) subtract <u>from</u> six

(5) multiply by three and subtract four.

Turn over

Decide on the rules for these mappings and then write them in the form $x \longrightarrow$.

(6)



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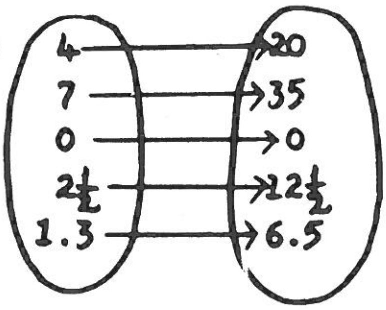

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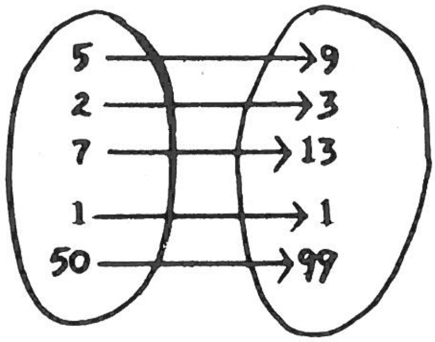

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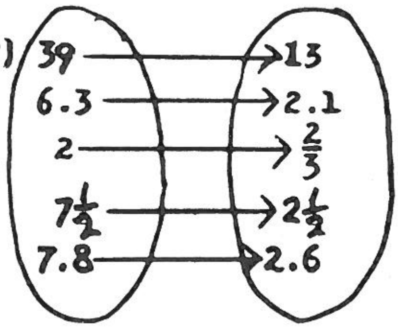

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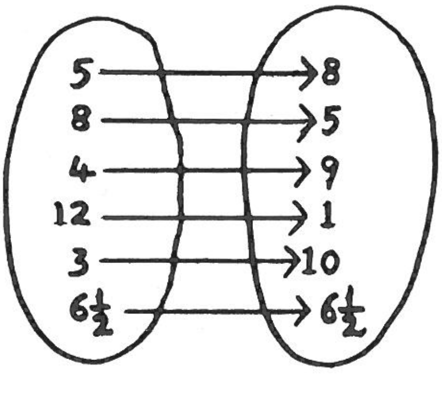

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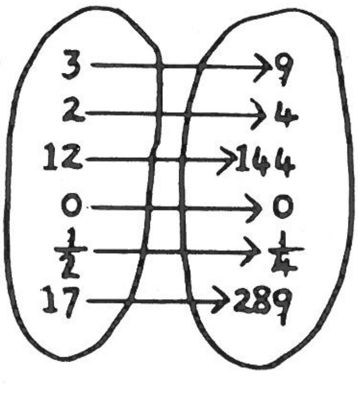


Mappings

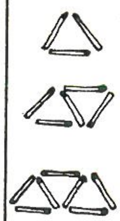
1. How many tyres?—*not forgetting the 'spare'.*

Cars	Tyres
1 ⟶	5
2 ⟶	10
3 ⟶	15
4 ⟶	
5 ⟶	
12 ⟶	
100 ⟶	
n ⟶	

2. How many legs on an insect?

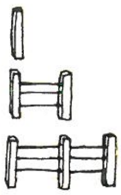
Insects	Legs
1 ⟶	6
2 ⟶	12
3 ⟶	18
4 ⟶	
5 ⟶	
12 ⟶	
100 ⟶	
n ⟶	

3. How many matches?



Triangles	Matches
1 ⟶	3
2 ⟶	5
3 ⟶	7
4 ⟶	
5 ⟶	
12 ⟶	
100 ⟶	
n ⟶	

4. How many rails?



Posts	Rails
1 ⟶	0
2 ⟶	3
3 ⟶	6
4 ⟶	
5 ⟶	
12 ⟶	
100 ⟶	
n ⟶	

Use the general mapping n ⟶ ■ to describe each of these mappings:

5.

0 ⟶	0
1 ⟶	4
2 ⟶	8
3 ⟶	12
4 ⟶	16
50 ⟶	
n ⟶	

6.

0 ⟶	1
1 ⟶	5
2 ⟶	9
3 ⟶	13
4 ⟶	17
50 ⟶	
n ⟶	

7.

0 ⟶	0
1 ⟶	$\frac{1}{2}$
2 ⟶	1
3 ⟶	$1\frac{1}{2}$
4 ⟶	2
50 ⟶	
n ⟶	

8. Which of these mappings could describe 3 ⟶ 9?
(a) n ⟶ 3n (b) n ⟶ n + 6 (c) n ⟶ 4n + 3 (d) n ⟶ n^2 (e) n ⟶ 3 (n-1)

9. Find 3 different mappings which could describe 4 ⟶ 12

Algebra Puzzle

Think of a number

Add 5

Multiply by 2

Subtract 8

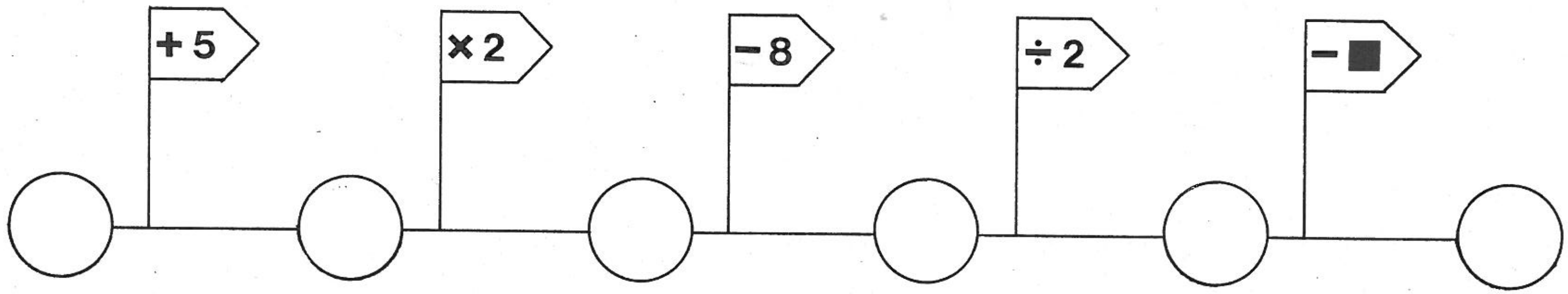
Divide by 2

Subtract the number you first thought of

Try this game a few times.

1. What answers do you get when you start with:
   (a) 100
   (b) 1000
   (c) a fraction or a decimal
   (d) a negative number

Can you explain your results?



Flagcharts are a useful way to write down the operations you are doing.

2. Use the flagchart above once or twice to make sure you understand it.

3. To prove that the game **always** works, it may help to start with x (or y or z or . . .). Use the same flagchart. Write x in the first circle and work out each stage as you go.

   Do you finish with 1?

Turn over

4.

Think of a number

Add 2

Multiply by 3

Subtract 6

Divide by 3

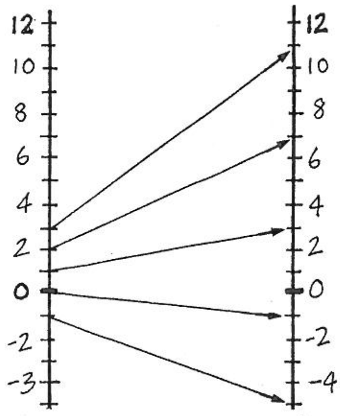
Subtract the number you first thought of

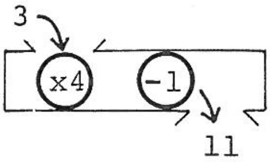
Draw a flagchart. Try starting with:

(a) an integer *(whole number)*
(b) a fraction or a decimal
(c) a negative number
(d) a letter

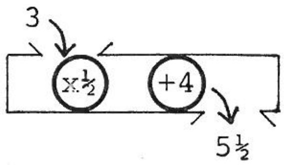
5. Invent a game which always ends with 3.

This mapping diagram shows what happens to numbers which are put through a machine like $y \rightarrow 4y - 1$

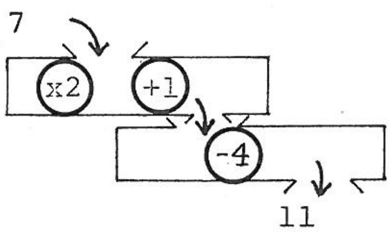


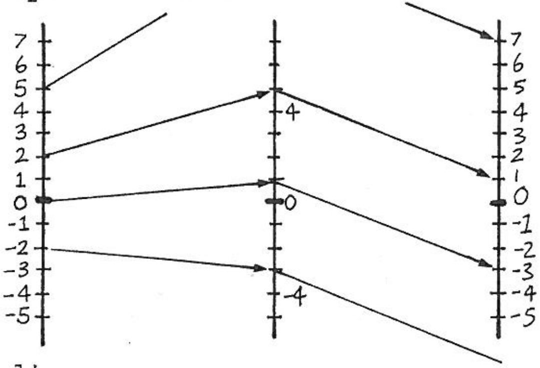


(1) Draw a mapping diagram to illustrate $k \rightarrow \frac{1}{2}k + 4$



(2) Here is a mapping diagram to show what happens to numbers put through this compound machine:





Copy and complete the mapping diagram.

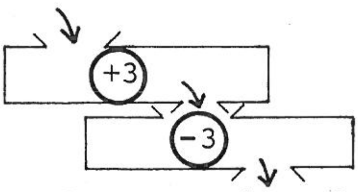
(3) What is the central number line used for?

(4) $x \rightarrow 2x + 1$ describes the L.H.mapping (e.g. $7 \rightarrow 15$)

$x \rightarrow x - 4$ describes the R.H. mapping (e.g. $15 \rightarrow 11$)

What describes the combined mapping (e.g.$7 \rightarrow 11$)?

(5) Draw a mapping diagram with 3 number lines for this compound machine:

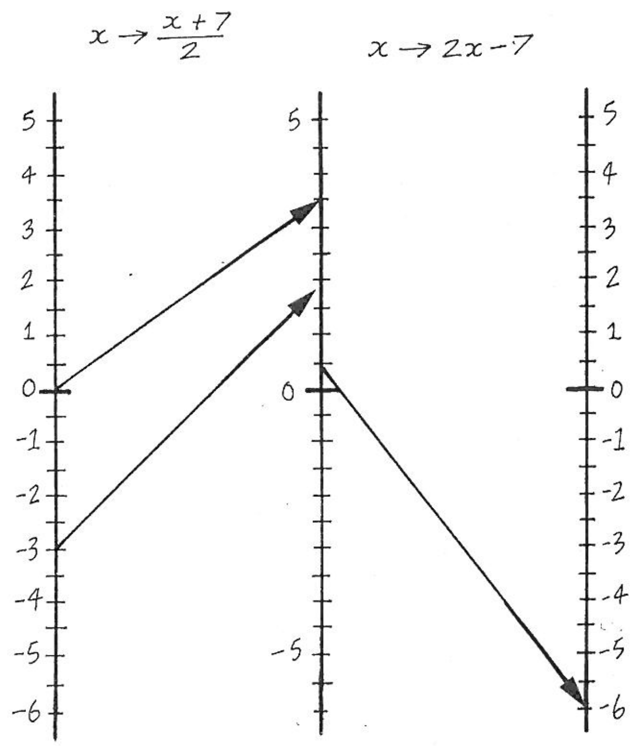


(6) Your L.H. mapping should show $x \rightarrow x + 3$
Your R.H. mapping should show $x \rightarrow x - 3$
What does the combined mapping show?

-turn over-

This diagram shows the combined mappings

$x \longrightarrow \frac{x+7}{2}$ and $x \longrightarrow 2x - 7$



(7) Copy the diagram and put in some more arrows. What is the result of the combined mappings?

You should have found in question (6) and in question (7) that the arrows are symmetrical - whatever is done by the L.H. mapping is undone by the R.H. mapping.

$x \longrightarrow x + 3$ and $x \longrightarrow x - 3$ are INVERSE mappings

so are $x \longrightarrow \frac{x + 7}{2}$ and $x \longrightarrow 2x - 7$

(8) Use mapping diagrams with 3 number lines to find which of the following pairs are inverse mappings:

(a) $x \longrightarrow 3x$ and $x \longrightarrow \frac{x}{3}$

(b) $x \longrightarrow 7 + x$ and $x \longrightarrow 7 - x$

(c) $x \longrightarrow 6 - x$ and $x \longrightarrow 6 - x$

(d) $x \longrightarrow \frac{x}{2} + 3$ and $x \longrightarrow \frac{x}{2} - 3$

(9) In two of the four examples in question (8) the mappings are not inverses of one another.

Find the correct inverse of each of these mappings.

(10) If $x \longrightarrow 2x - 7$ is the inverse of $x \longrightarrow \frac{x+7}{2}$, what is the inverse of $x \longrightarrow 2x - 7$?

SMILE

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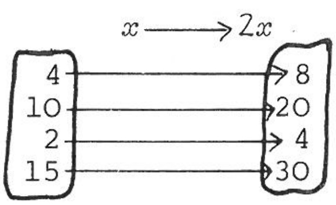
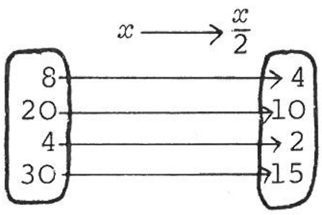
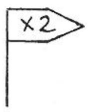
INVERSES

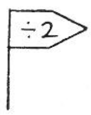




double



halve



(1) These mappings are INVERSES of each other - explain why.

(2) Find the inverses of the following (mapping diagrams will help):

(a) $x \longrightarrow x + 7$

(b) $x \longrightarrow x$

(c) $x \longrightarrow \frac{x}{6}$

(d) $x \longrightarrow x - 2$

(e) $x \longrightarrow 3 - x$

(f) $x \longrightarrow \frac{4}{x}$

Composite Functions

The function 'subtract 2 and multiply by 3' can be written $x \longrightarrow 3(x-2)$.

1. Write these functions in the form $x \longrightarrow$

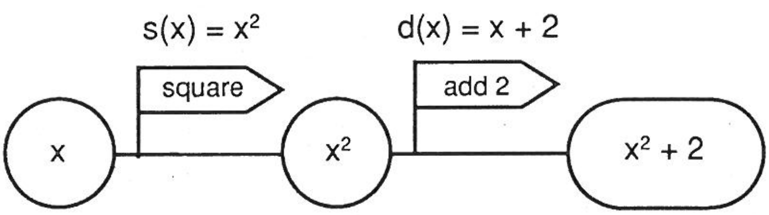
(i) 'multiply by 3 and add 2'
(ii) 'divide by 3 and add 2'
(iii) 'add 2 and multiply by 3'
(iv) 'add 2 and divide by 3'
(v) 'square and subtract 7'
(vi) 'subtract 7 and square'

2. Is the function $x \longrightarrow 3x^2$ the same as the function $x \longrightarrow (3x)^2$?
Explain your answer.

s is the function '**square**' $s(x) = x^2$

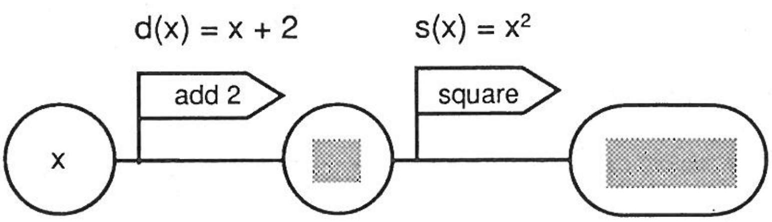
d is the function '**add 2**' $d(x) = x + 2$

The composite function **ds(x)** means 'do function **s**, then do function **d** to your answer'.



$ds(x) = x^2 + 2$

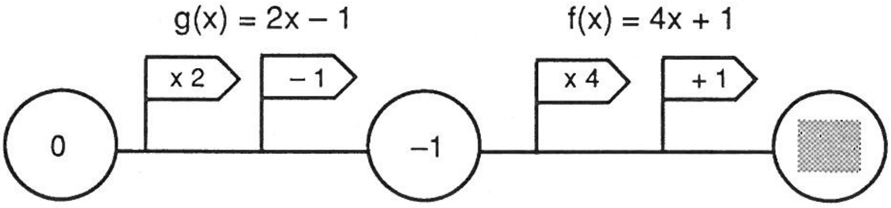
3. Copy and complete the flag diagram to find the composite function **sd(x)**.



sd(x) =

4. The functions **f** and **g** are defined as $f(x) = 4x + 1$ and $g(x) = 2x - 1$.

(i) Copy and complete the flag diagram to find $fg(0)$.



Find (ii) $fg(-2)$ (iii) $gf(0)$ (iv) $gf(-2)$

Complete $fg(x) =$

$gf(x) =$

5. The functions **f** and **g** are defined as $f(x) = 2x - 1$ and $g(x) = 3x - 2$.

Find (i) $fg(2)$ (ii) $gf(2)$

(iii) $gf(0)$ (iv) $fg(0)$

(v) $fg(^1/_2)$ vi) $gf(^1/_2)$

Complete $fg(x) =$

$gf(x) =$

6. $f(x) = {^1/_x}$ and $g(x) = x + 2$.

Complete $fg(x) =$

$gf(x) =$

7. $f(x) = x + 1$ and $gf(x) = x$. Complete $g(x) =$

8. $f(x) = 2x + 1$ and $fg(x) = x$. Complete $g(x) =$