

SMILE WORKCARDS

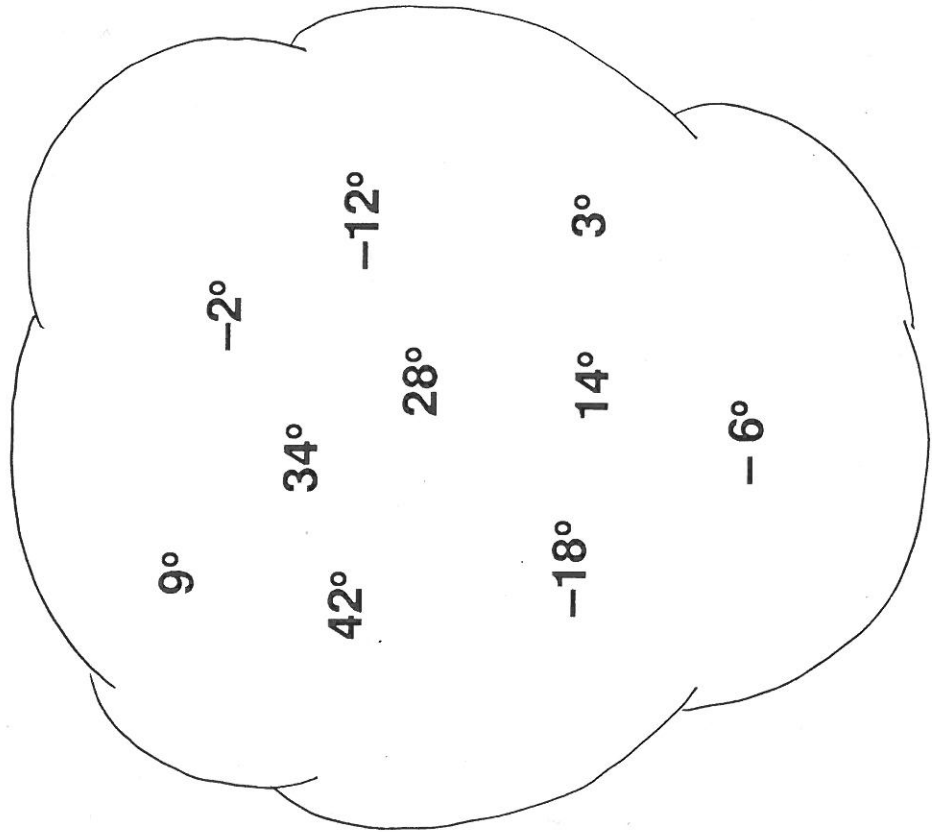
Directed Numbers

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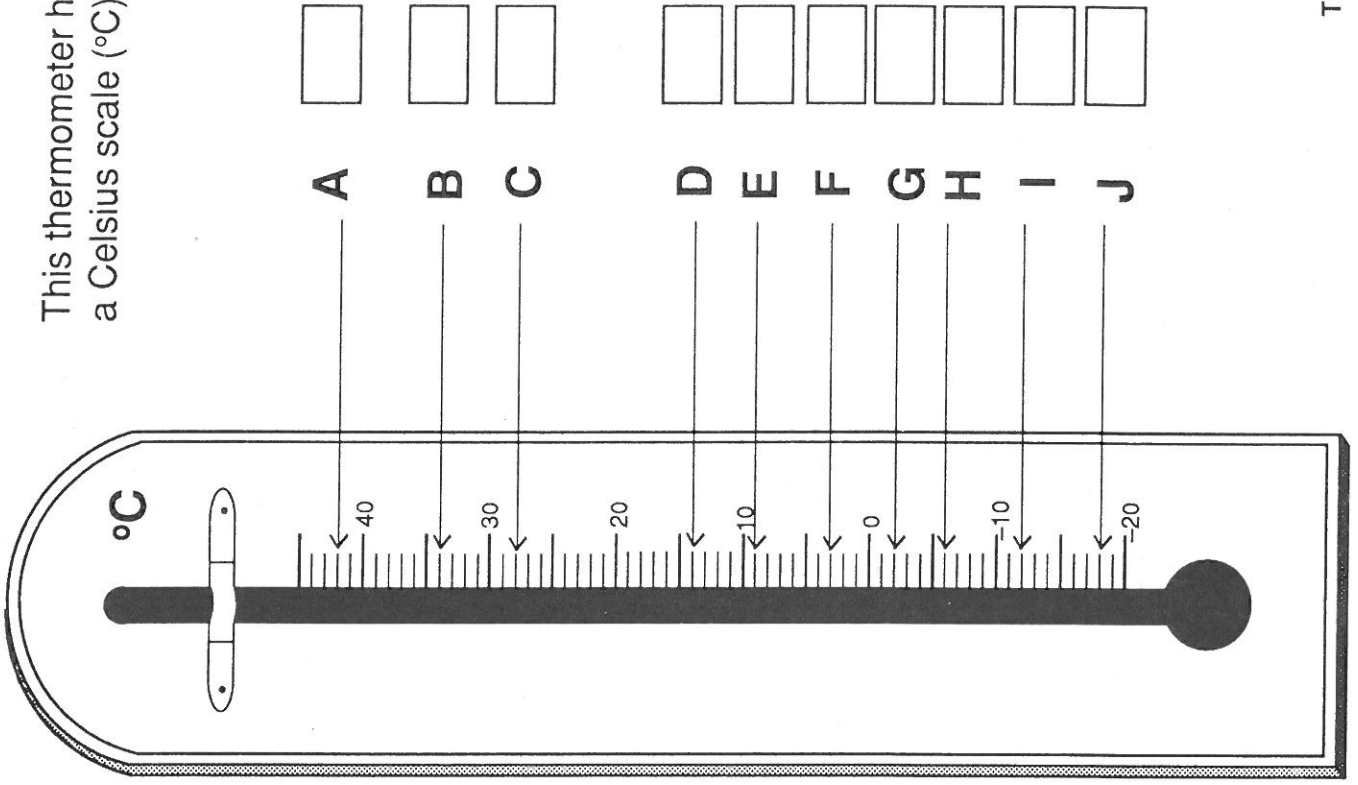
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HOT and COLD

Match the temperatures below with the letters on the scale.

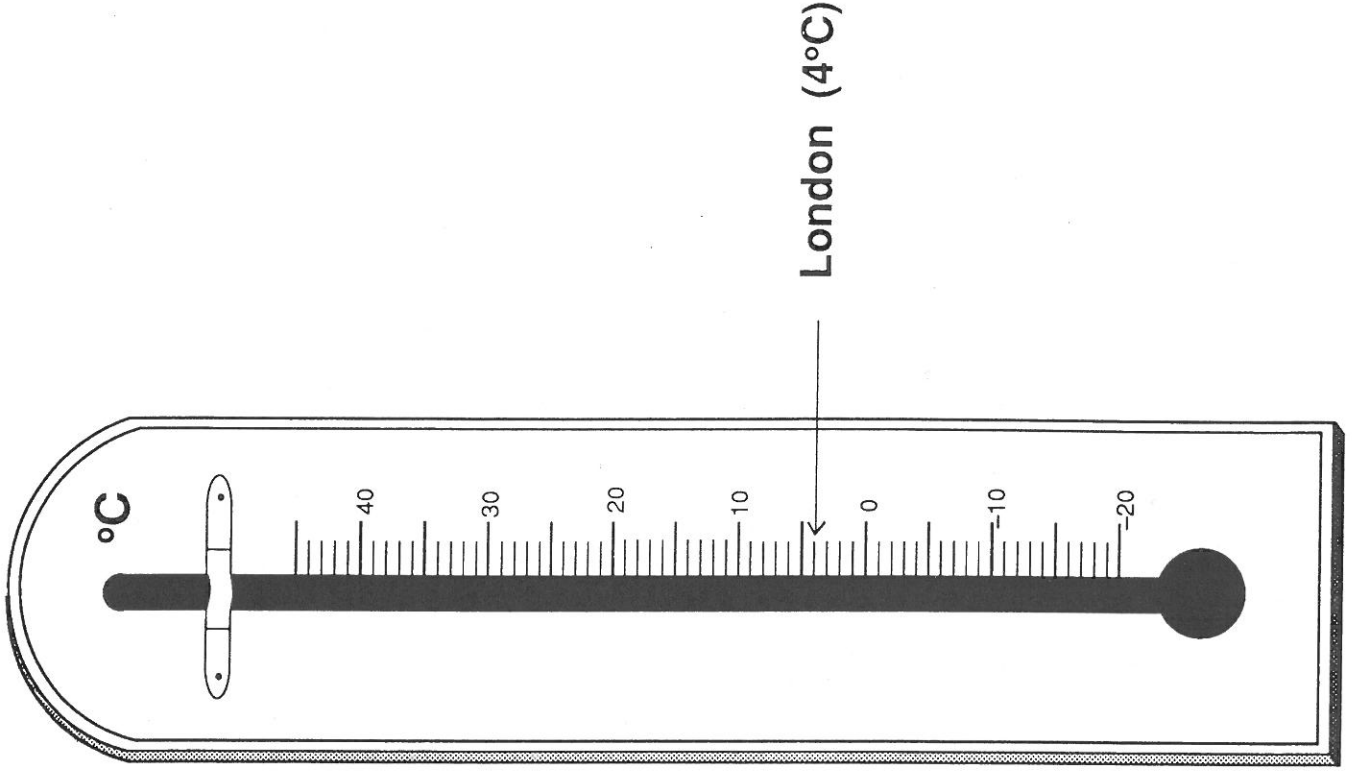


This thermometer has a Celsius scale (°C).



Here are some temperatures from around the world, taken on the same day.

Place	Temperature
Alice Springs	38°C
Delhi	14°C
Kingston	26°C
London	4°C
Moscow	-12°C
New York	-1°C
Beijing	-6°C
Rome	8°C
Winnipeg	-19°C



- 1) Label the temperatures on this thermometer.
(London has been done for you.)
- 2) In which month of the year do you think these temperatures were taken?

- 3) Which city is colder, Moscow
or Beijing?

- 4) How much colder is New York
than London?

- 5) Which is colder, -6°C or -10°C?

Boxes

This game is played exactly like ordinary "Boxes" except that when you complete a box you add (or take away) the score in the box to (or from) your score so far.

If you can carry on, then you *must*.

The winner is the one with the most points when all boxes are complete.

.
+3	0	-1	+1	+2	-2		
.
0	-3	-1	+1	0	-2		
.
-1	-2	+1	-2	+1	-3		
.
+3	0	-3	+5	-1	-2		
.
+1	0	+1	-2	+1	+1		
.
+4	-7	+2	-1	0	+1		
.

If you want to play again get another copy of the worksheet or make up a grid of your own.

Boxes

This game is played exactly like ordinary "Boxes" except that when you complete a box you add (or take away) the score in the box to (or from) your score so far.

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The winner is the one with the most points when all boxes are complete.

.
+3	0	-1	+1	+2	-2		
.
0	-3	-1	+1	0	-2		
.
-1	-2	+1	-2	+1	-3		
.
+3	0	-3	+5	-1	-2		
.
+1	0	+1	-2	+1	+1		
.
+4	-7	+2	-1	0	+1		
.

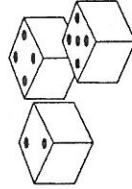
If you want to play again get another copy of the worksheet or make up a grid of your own.

Shakes and Adders

A game for 2 players.

You will need:
 • 3 dice
 • Counters of a different colour for each player.

- Take turns to roll the 3 dice.
- **Add** or **subtract** the three numbers in any way you like. The answers can be positive or negative.
- Cover your answer with a counter.



With these three numbers you could cover:

11	[2 + 4 + 5]	or	-3	[4 - 2 - 5]	or	3	[2 + 5 - 4]	or
-1	[5 - 4 - 2]	or	-7	[2 - 5 - 4]	or ... ?			

Rules

- You may cover only **one** number in any go.
- Only **one** counter may be placed on each square.
- The winner is the player who covers the most squares.

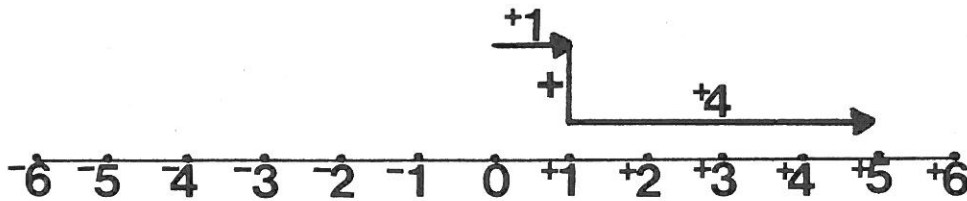
-7	-6	-5	-4	-3	-2	-1	-8
1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18						

Adding Shifts Worksheet

0550

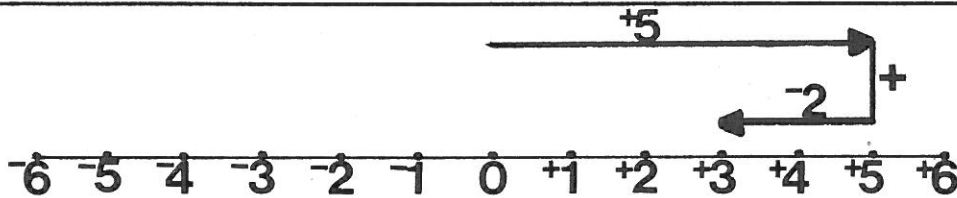
Add these shifts. (The first one is done for you.)

1.



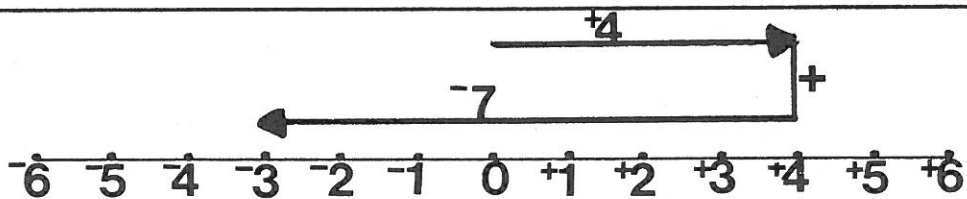
$$+1 + +4 = +5$$

2.



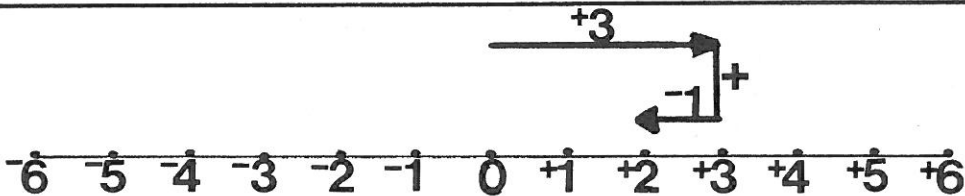
$$+5 + -2 = \square$$

3.



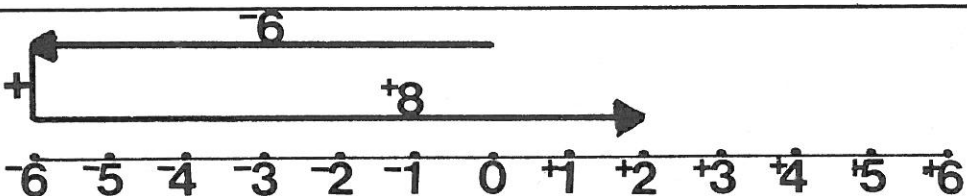
$$\square + \square = \square$$

4.

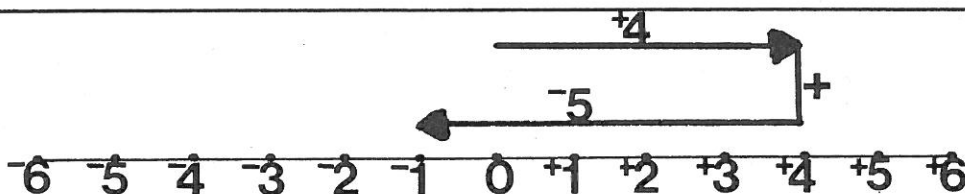


$$\square + \square = \square$$

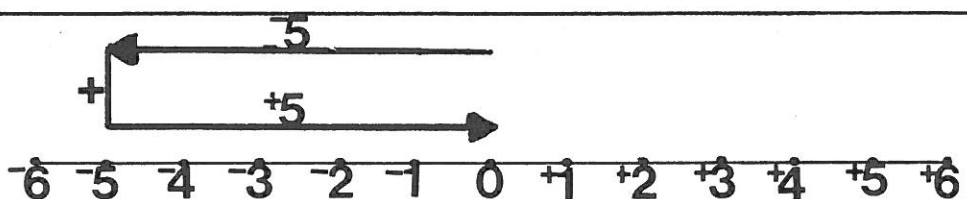
5.



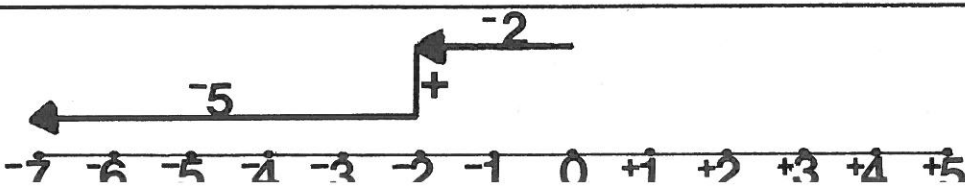
6.



7.



8.



Put on the shifts and complete the sums:—

9.



$$+2 + +6 = +8$$

10.



$$+2 + -5 = -3$$

11.



$$-4 + +3 = \square$$

12.



$$-4 + -2 = \square$$

13.



$$-1 + +7 = \square$$

14.



$$+7 + -1 = \square$$

15.



$$-3 + +3 = \square$$

16.



$$-3 + +4 + -5 = \square$$

17.



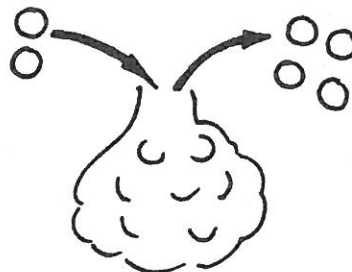
$$-2 + +6 + -3 = \square$$

Marbles

Denis and Ronnie have bags of marbles.



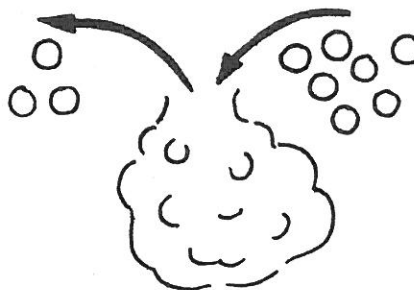
I've won 2 marbles, but
I've lost 4 marbles.
I now have 2 less.



Result: 2 less



I've lost 3 marbles, but
I've won 7.
I now have 4 more.



Result: 4 more

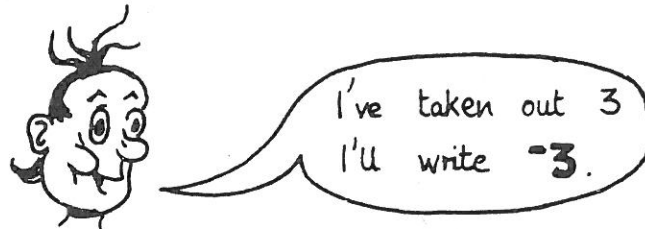
Here are the results of several games:

Copy and complete the chart.

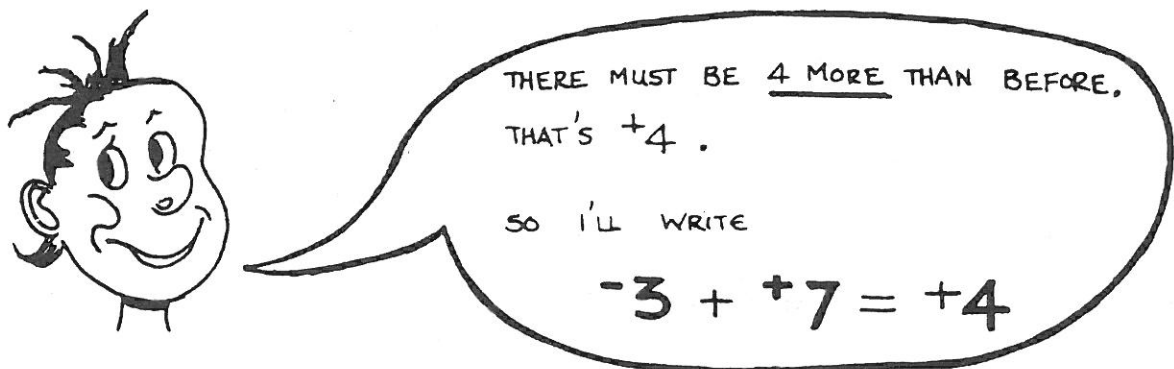
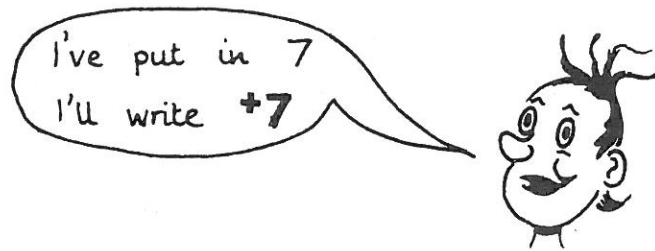
Number put in bag	6	2	3	7	2	4	4	8	0	18	21	10	12	4
Number taken out	2	6	7	3	4	2	4	3	5	20	25	15	7	19
Change in number	4 more	4 less												

— Turn over —

Denis has a bag of marbles.
He takes out three marbles.



He puts in 7 marbles.



Use Denis' method to copy and complete:

(1) $-2 + -4 =$ (2) $+3 + -2 =$ (3) $+7 + -5 =$

(4) $+6 + -5 =$ (5) $-4 + +3 =$ (6) $+3 + -4 =$

(7) $-2 + -7 =$ (8) $-7 + -2 =$ (9) $-6 + +5 =$

(10) $+5 + -6 =$ (11) $-6 + -7 =$ (12) $+2 + -2 =$

(13) $-2 + +2 =$

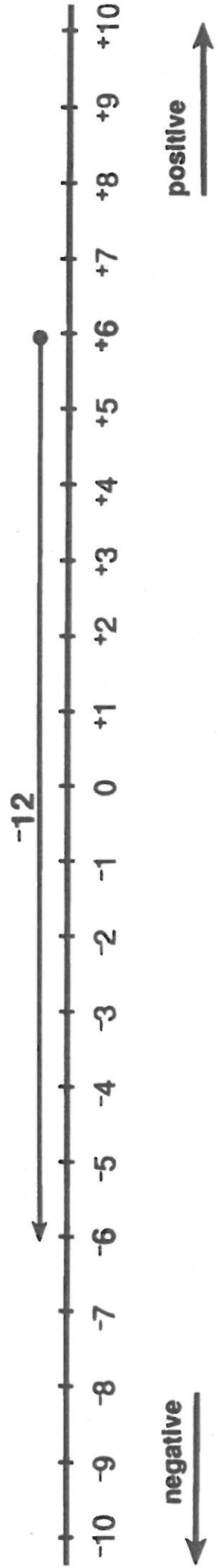
(14) $-5 + -5 =$

Adding Directed Numbers

What is
6 minus 12?

It's impossible!

No, it isn't. The number
line extends below zero.
Start at plus 6 and
move 12 in the negative
direction.
This can be written as
 $+6 + -12 = -6$

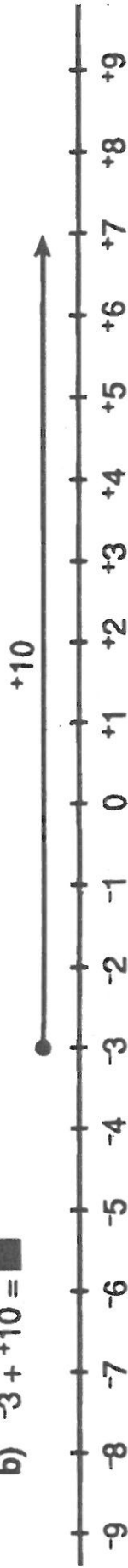


Use the number lines to answer these additions:

a) $+7 + -4 =$



b) $-3 + +10 =$



c) $-5 + +3 =$



1. Use a number line, starting at +2, to answer these additions:

a) $+2 + +3 =$ b) $+2 + -3 =$ c) $+2 + -5 =$ d) $+2 + +6 =$ e) $+2 + -4 =$



2. Use a number line, starting at -3, to answer these additions:

a) $-3 + +5 =$ b) $-3 + -2 =$ c) $-3 + +2 =$ d) $-3 + -4 =$ e) $-3 + +3 =$

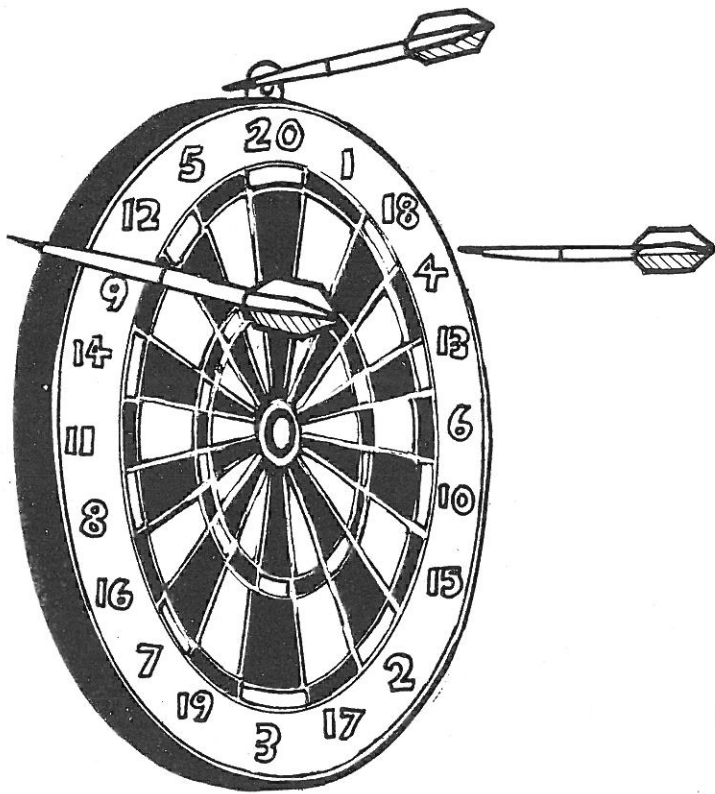


Positive or Negative

Work through the five tables in this booklet.
They are all similar to the table you have
probably met on 0242 "Odds and Evens":-

+	EVEN	ODD
EVEN	E	O
ODD	O	E

Can you discover the similarity as you work?



Good or Bad?

When a new darts player joins a team, she could be a "good player" or a "bad player". If a good player joins, that's good!

	JOINS	LEAVES
GOOD PLAYER	GOOD	BAD
BAD PLAYER	BAD	

What would you think if a bad player leaves?

Friends and Enemies

A friend of an enemy would be an enemy too!

	FRIEND	ENEMY
FRIEND		ENEMY
ENEMY		

Copy and complete the table for
 a friend of a friend
 an enemy of a friend
 an enemy of a enemy





Up or Down?

To change the overall weight of a balloon you can either add or remove sandbags or gas.

If you add gas the "weight" decreases and the balloon goes up. (Do you know why?)

Copy and complete.

	SANDBAGS	GAS
ADD		UP
REMOVE		

Friends and Enemies

A friend of an enemy would be an enemy too!

	FRIEND	ENEMY
FRIEND		ENEMY
ENEMY		

Copy and complete the table for

- a friend of a friend
- an enemy of a friend
- an enemy of a enemy

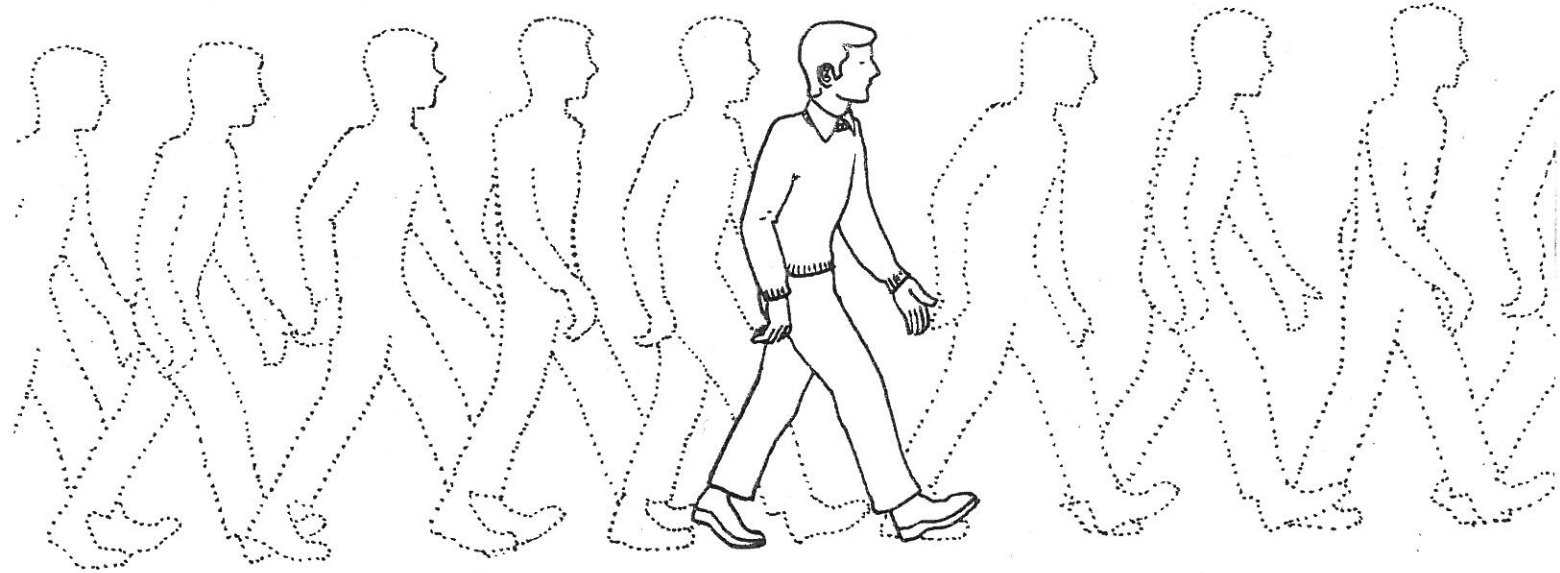


Forward or Backward?

There are 2 films: one shows a man walking forward, the other shows a man walking backwards.

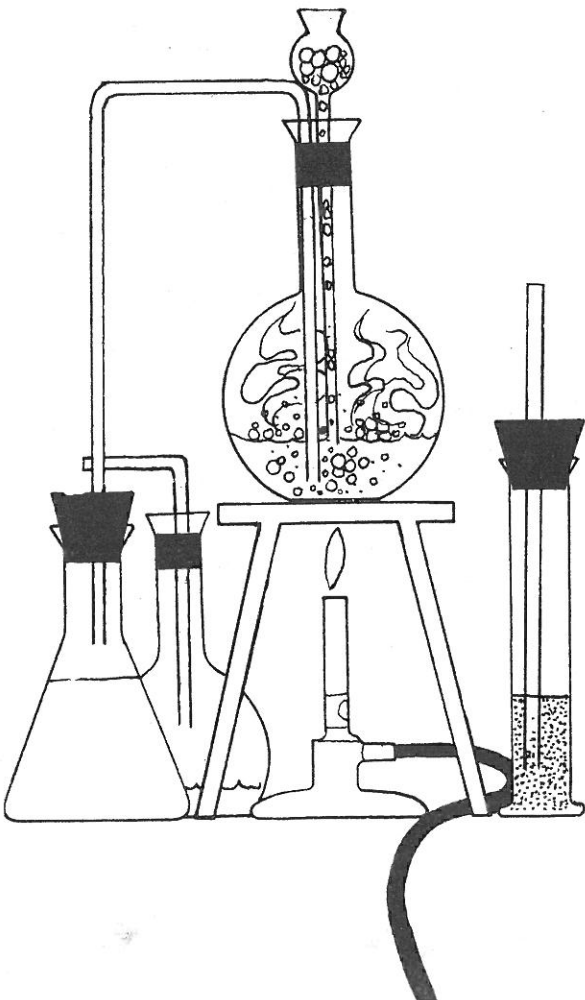
What would you see if these films were shown with the projector in reverse?

	WALKING FORWARD	WALKING BACKWARD
PROJECTOR FORWARD	FORWARD	BACKWARD
PROJECTOR BACKWARD		



Increase or Decrease?

In a science experiment we can add or remove either "hot cubes" or "cold cubes". The water temperature, initially at room temperature, will either increase or decrease.



	HOT	COLD
ADD		
REMOVE		

What do you notice about all five tables?

What do you notice about the bottom right-hand corners?

Compare the five tables with these six:
 Which one summarises the previous five tables best?
 Give reasons for your answer.

	+	-
+	+	-
-	-	+

	-	+
-	+	-
+	-	+

	-	+
+	+	-
-	-	+

	+	-
-	+	-
+	-	+

	-	+
+	+	-
-	+	-

	+	-
+	-	+
-	-	+

Can you think of another situation which would give a similar result?

Subtracting Directed Numbers

■ Copy and complete the following patterns:

Pattern 1 Adding to +4

$$\begin{aligned}
 +4 + -4 &= 0 \\
 +4 + -3 &= +1 \\
 +4 + -2 &= \blacksquare \\
 +4 + -1 &= \blacksquare \\
 +4 + 0 &= +4 \\
 +4 + +1 &= \blacksquare \\
 +4 + +2 &= +6 \\
 +4 + +3 &= \blacksquare
 \end{aligned}$$

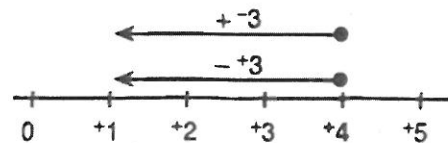
Pattern 2 Subtracting from +4

$$\begin{aligned}
 +4 - +4 &= 0 \\
 +4 - +3 &= +1 \\
 +4 - +2 &= \blacksquare \\
 +4 - +1 &= \blacksquare \\
 +4 - 0 &= +4 \\
 +4 - -1 &= \blacksquare \\
 +4 - -2 &= +6 \\
 +4 - -3 &= \blacksquare
 \end{aligned}$$

From **Pattern 1** $+4 + -3 = +1$

From **Pattern 2** $+4 - +3 = +1$

Adding -3 is the same as subtracting +3.



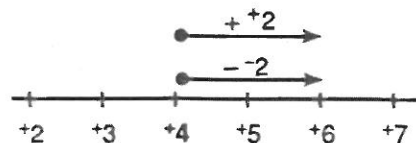
■ Give an example to show adding -4 is the same as subtracting +4.

Summary For any numbers n and m , $n + -m$ is the same as $n - +m$.

From **Pattern 1** $+4 + +2 = +6$

From **Pattern 2** $+4 - -2 = +6$

Adding +2 is the same as subtracting -2.



■ Give an example to show adding +3 is the same as subtracting -3.

Summary For any numbers n and m , $n + +m$ is the same as $n - -m$.



Harder Negative Sequences

The first five terms in a sequence are 0, -1, -3, -6, -10,

The pattern can be seen by looking at the differences.
0, -1, -3, -6, -10,
-1 -2 -3 -4

The rule is 'subtract one more each time' (or 'add one less each time').

Using this rule the next three terms are 0, -1, -3, -6, -10, -15, -21, -28

● Follow the pattern to find the next three terms in each of these sequences. Check that the last term follows the pattern and write down the rule.

1) 6, 4, 0, -6, -14, ■, ■, ■, -66 The rule is _____
-2 -4 ■ ■

2) 13, 11, 10, 10, 11, ■, ■, ■, 25 The rule is _____
■ ■ 0 -1

3) 14, 10, 7, 5, 4, ■, ■, ■, 10 The rule is _____

4) 23, 13, 5, -1, -5, ■, ■, ■, -1 The rule is _____

5) 12, 13, 13, 12, 10, ■, ■, ■, -8 The rule is _____

6) 3, 7, 10, 12, 13, ■, ■, ■, 7 The rule is _____

7) 1, 0, -2, -6, -14, ■, ■, ■, -254 The rule is _____

8) -13, -10, -8, -7, -7, ■, ■, ■, -17 The rule is _____

9) 130, 66, 34, 18, 10, ■, ■, ■, 2.5 The rule is _____

10) 16, 12, 4, -12, -44, ■, ■, ■, -1004 The rule is _____

Multiplying Directed Numbers

	-4	-3	-2	-1	0	+1	+2	+3	+4
+4	4 x 4	4 x 3	4 x 2	4 x 1	4 x 0 0	4 x 1	4 x 2	4 x 3	4 x 4
+3	3 x 4	3 x 3	3 x 2	3 x 1	3 x 0 0	3 x 1	3 x 2	3 x 3	3 x 4
+2	2 x 4	2 x 3	2 x 2	2 x 1	2 x 0 0	2 x 1	2 x 2	2 x 3	2 x 4
+1	1 x 4	1 x 3	1 x 2	1 x 1	1 x 0 0	1 x 1	1 x 2	1 x 3	1 x 4
0	0 x 4 0	0 x 3 0	0 x 2 0	0 x 1 0	0 x 0 0	0 x 1 0	0 x 2 0	0 x 3 0	0 x 4 0
-1	-1 x 4	-1 x 3	-1 x 2	-1 x 1	-1 x 0 0	-1 x 1	-1 x 2	-1 x 3	-1 x 4
-2	-2 x 4	-2 x 3	-2 x 2	-2 x 1	-2 x 0 0	-2 x 1	-2 x 2	-2 x 3	-2 x 4
-3	-3 x 4	-3 x 3	-3 x 2	-3 x 1	-3 x 0 0	-3 x 1	-3 x 2	-3 x 3	-3 x 4
-4	-4 x 4	-4 x 3	-4 x 2	-4 x 1	-4 x 0 0	-4 x 1	-4 x 2	-4 x 3	-4 x 4

Multiplying Directed Numbers

	-4	-3	-2	-1	0	+1	+2	+3	+4
+4	4 x 4	4 x 3	4 x 2	4 x 1	4 x 0 0	4 x 1	4 x 2	4 x 3	4 x 4
+3	3 x 4	3 x 3	3 x 2	3 x 1	3 x 0 0	3 x 1	3 x 2	3 x 3	3 x 4
+2	2 x 4	2 x 3	2 x 2	2 x 1	2 x 0 0	2 x 1	2 x 2	2 x 3	2 x 4
+1	1 x 4	1 x 3	1 x 2	1 x 1	1 x 0 0	1 x 1	1 x 2	1 x 3	1 x 4
0	0 x 4 0	0 x 3 0	0 x 2 0	0 x 1 0	0 x 0 0	0 x 1 0	0 x 2 0	0 x 3 0	0 x 4 0
-1	-1 x 4	-1 x 3	-1 x 2	-1 x 1	-1 x 0 0	-1 x 1	-1 x 2	-1 x 3	-1 x 4
-2	-2 x 4	-2 x 3	-2 x 2	-2 x 1	-2 x 0 0	-2 x 1	-2 x 2	-2 x 3	-2 x 4
-3	-3 x 4	-3 x 3	-3 x 2	-3 x 1	-3 x 0 0	-3 x 1	-3 x 2	-3 x 3	-3 x 4
-4	-4 x 4	-4 x 3	-4 x 2	-4 x 1	-4 x 0 0	-4 x 1	-4 x 2	-4 x 3	-4 x 4

Dividing by Directed Numbers

Division is the inverse of multiplication.

$$-6 \div +2 = \text{■}$$

$$\text{■} \times +2 = -6$$

$$-6 \div +2 = -3$$

$$-3 \times +2 = -6$$

Multiplication Summary

a positive number	\times	a positive number	=	a positive number
a positive number	\times	a negative number	=	a negative number
a negative number	\times	a positive number	=	a negative number
a negative number	\times	a negative number	=	a positive number
zero	\times	a positive number	=	zero
zero	\times	a negative number	=	zero
a positive number	\times	zero	=	zero
a negative number	\times	zero	=	zero

1. a) Use the multiplication summary to help you solve these multiplications and find answers to the divisions.

- i) $\text{■} \times -3 = -6$ $-6 \div -3 = \text{■}$
- ii) $\text{■} \times -4 = +16$ $+16 \div -4 = \text{■}$
- iii) $\text{■} \times +3 = -9$ $-9 \div +3 = \text{■}$
- iv) $\text{■} \times -4 = -12$ $-12 \div -4 = \text{■}$
- v) $\text{■} \times +3 = 0$ $0 \div +3 = \text{■}$
- vi) $\text{■} \times +2 = +8$ $+8 \div +2 = \text{■}$
- vii) $\text{■} \times -2 = -2$ $-2 \div -2 = \text{■}$
- viii) $\text{■} \times +3 = -3$ $-3 \div +3 = \text{■}$

b) The equation $\text{■} \times 0 = +2$ has no solution.

Try $2 \div +0 = \text{■}$ on your calculator. You will probably get E i.e. no solution.

Try dividing other positive and negative numbers by zero. What does this tell you about dividing by zero?



$$-4 \times -7 = +28$$

$$-4 \times +7 = -28$$

$$+4 \times -7 = -28$$

$$+4 \times +7 = +28$$

to help you to write the values of:

- a) $+28 + +7 =$ b) $-28 + -7 =$ c) $-28 + +7 =$ d) $+28 + -7 =$

3. Find the values of:

- a) $+40 + +10 =$ b) $-18 + -6 =$ c) $+15 + +5 =$ d) $-24 + -8 =$

4. Copy and complete this division summary:

a positive number	÷	a positive number	=	a positive number
a positive number	÷	a negative number	=	
a negative number	÷	a positive number	=	
a negative number	÷	a negative number	=	
zero	÷	a positive number	=	zero
zero	÷	a negative number	=	
a positive number	÷	zero	=	no solution
a negative number	÷	zero	=	

Use the division summary to help you solve these.

- a) $-12 + +6 =$ b) $-10 + -5 =$ c) $+14 + -7 =$ d) $+5 + +2 =$
 e) $-8 + +4 =$ f) $-9 + -2 =$ g) $+27 + +3 =$ h) $+11 + -4 =$
 i) $-42 + +6 =$ j) $+33 + -11 =$ k) $-5 + -3 =$ l) $0 + +5 =$
 m) $-10 + +4 =$ n) $-9 + +6 =$ o) $-100 + +10 =$