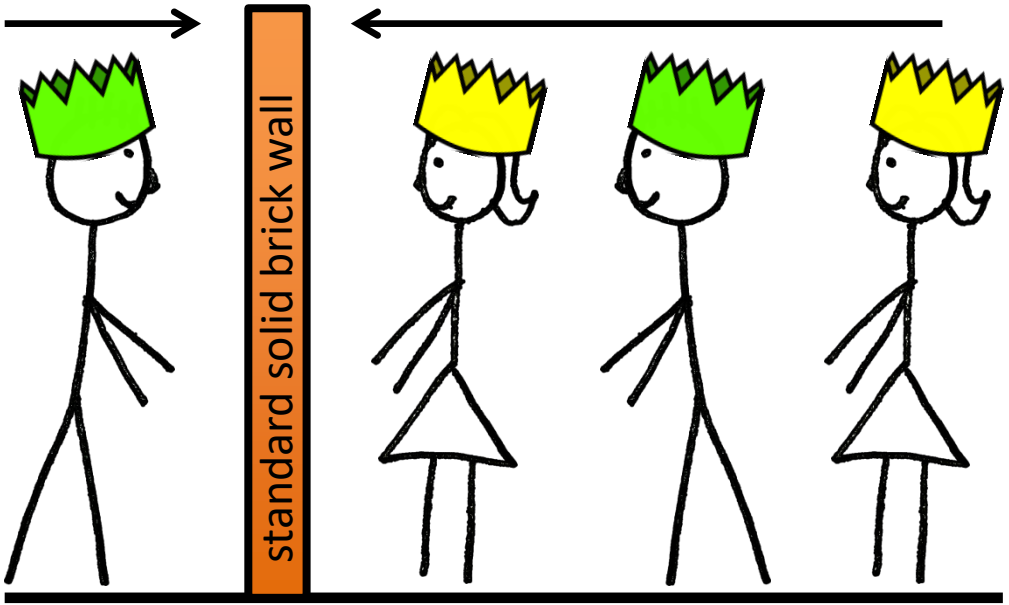
1089

2



These four people know that there are two of each colour hat but they don't know what colour they are wearing. They can only see what's in front of them, they aren't allowed to talk to each other and (rather obviously) can't see through the wall. After a minute or two, one of them indicates that they know the colour of their hat and are completely sure of it.

How come?

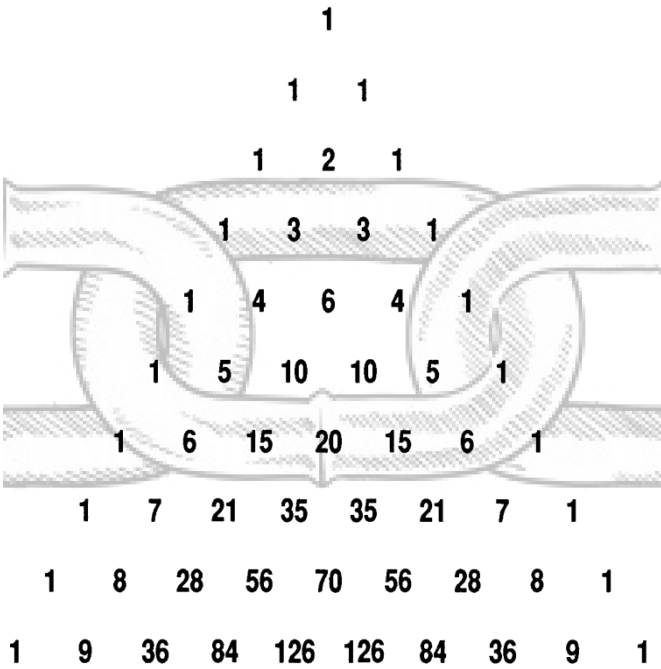
3

Use all of

3 3 8 8

and any of + − × ÷ to make 24

What's the link?



$11^1 = 11$

$11^2 = 121$

$11^3 = 1331$

$11^4 = 14641$

$11^5 = ?$

$11^6 = ?$

$11^7 = ?$

5

$2 = 1$

Let $a = 1$ and $b = 1$

$$a = b$$

multiply both sides by a

$$a^2 = ab$$

subtract b^2 from both sides

$$a^2 - b^2 = ab - b^2$$

factorise both sides

$$(a + b)(a - b) = b(a - b)$$

divide both sides by $(a - b)$

$$a + b = b$$

But $a = 1$ and $b = 1$ so

$$2 = 1$$

What's gone wrong?

6

1 2 5 10

Four people, in various states of fitness, have been trekking all day and come upon a rope bridge that must be crossed to reach home.

The bridge only holds two people. It is dark and they have just one torch so their only option is to lead each other across, back and forth, until they are all across.

The fittest person claims they can cross the bridge in 1 minute, the next person in 2 minutes, the next in 5 minutes and the last, who is really unfit, will take 10 minutes.

As each pair crosses they go at the slower persons speed.

How long does it take them to cross the bridge?
(19 minutes is not good enough)

7

$1^3 = 1$

$2^3 = 8$

$3^3 = 27$

$4^3 = 64$

$5^3 = 125$

$6^3 = 216$

$7^3 = 343$

$8^3 = 512$

$9^3 = 729$

$10^3 = 1000$


9 781841 157917

9

$$
\begin{array}{rr}
 & 2454 \\
\hline
 & 456 \\
 & 123 \\
+ & 876 \\
 & 212 \\
 & 787 \\
\hline
\end{array}
$$

32	33	34	35
36	37	38	39
40	41	42	43
44	45	46	47
48	49	50	51
52	53	54	55
56	57	58	59
60	61	62	63

16	17	18	19
20	21	22	23
24	25	26	27
28	29	30	31
48	49	50	51
52	53	54	55
56	57	58	59
60	61	62	63

8	9	10	11
12	13	14	15
24	25	26	27
28	29	30	31
40	41	42	43
44	45	46	47
56	57	58	59
60	61	62	63

4	5	6	7
12	13	14	15
20	21	22	23
28	29	30	31
36	37	38	39
44	45	46	47
52	53	54	55
60	61	62	63

2	3	6	7
10	11	14	15
18	19	22	23
26	27	30	31
34	35	38	39
42	43	46	47
50	51	54	55
58	59	62	63

1	3	5	7
9	11	13	15
17	19	21	23
25	27	29	31
33	35	37	39
41	43	45	47
49	51	53	55
57	59	61	63

11

Use all of

1 3 4 6

and any of

$+$ $-$ $\times$ $\div$

to make

24

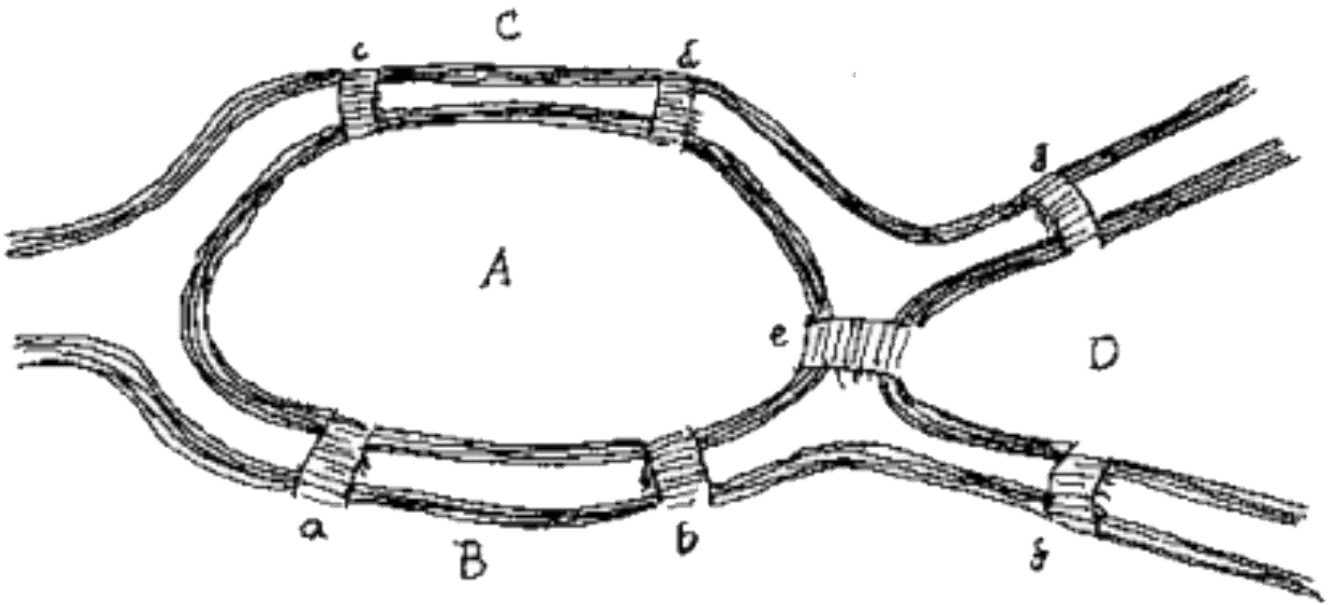
12

Three people share the cost of a £30 meal by paying £10 each to the waiter. As he returns to the kitchen the waiter realises that the bill should've been £25 so fetches some change to give back to the customers. As the waiter gives the customers their change they give him £2 of it as a tip, keeping £1 each.

Having each paid £10 and got £1 change, the customers then realise that they've paid £27 between them, the waiter has £2 and this totals £29 instead of £30. They accuse the waiter of stealing from them and vow never to return to the restaurant.

Were they correct to do this?

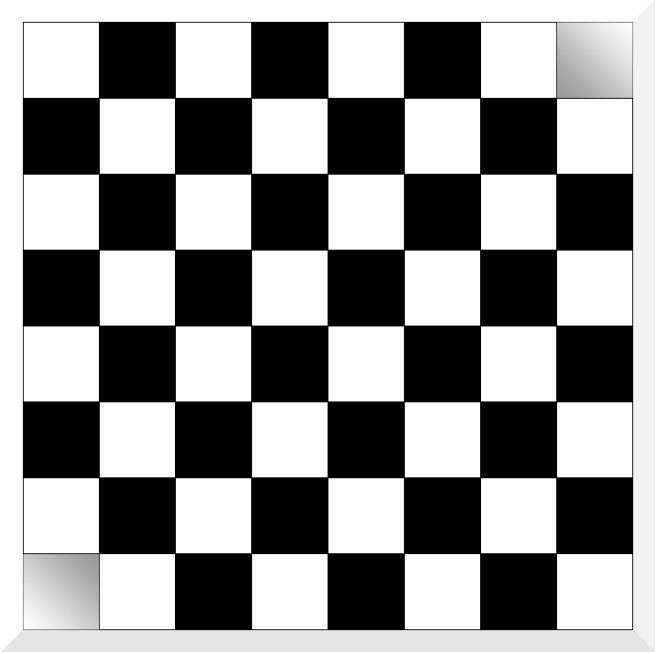
The Bridges of Konigsberg



Can you travel across every bridge and visit every area without crossing any bridges more than once?

If so, how? If not, why not?

14



The chessboard above has had the two black corner squares removed.

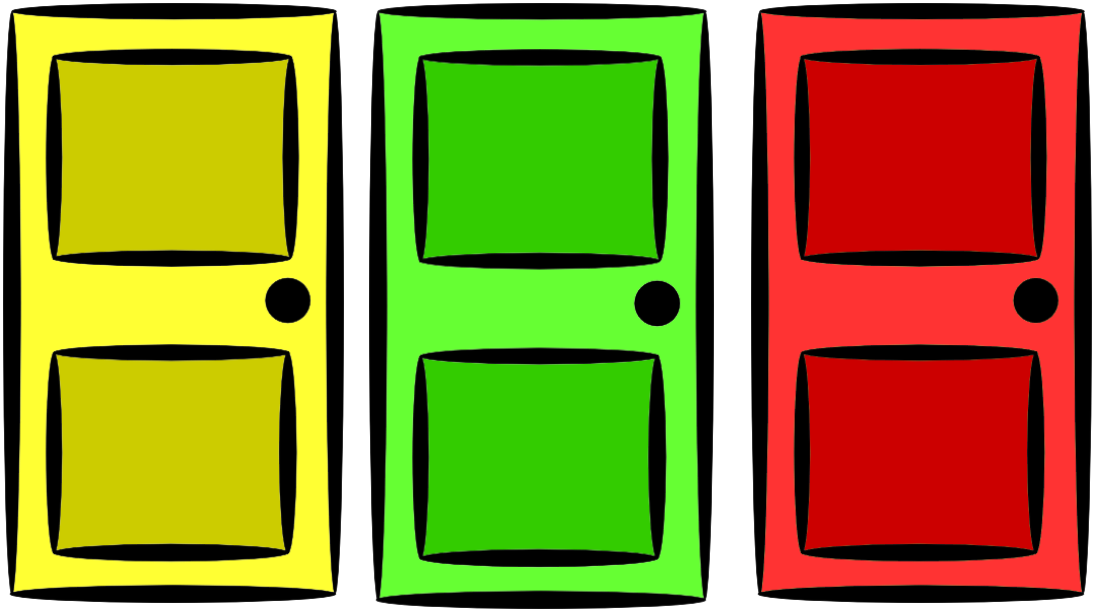
Is it possible to place dominoes on the board, one domino per two squares, to cover the board exactly?

If so how? If not, why not?

15

123,123

16



You're on a game show, in the final round. The host offers you the choice of three doors behind two of which are goats and the other is the star prize. Having chosen one door but not opened it, the host, who knows what's behind each of the doors, opens another to reveal one of the goats. You're then given the option to *stick with your current choice* or to *switch to the other remaining door that is closed*.

Should you stick, switch or does it not matter?

Two digit multiples of 11

$27 \times 11 =$

2	2+7	7
2	9	7

297

$48 \times 11 =$

4	4+8	8
4	2	8
1		

528

Does this always work? How come? Can you prove it?

Squaring a Two Digit Number Ending in 1.

$31^2 =$

$$\begin{array}{rl} 900 & 30 \times 30 \\ + \quad 60 & 2 \times 30 \\ \quad 1 & 1 \times 1 \\ \hline 961 & \end{array}$$

$71^2 =$

$$\begin{array}{rl} 4900 & 70 \times 70 \\ + \quad 140 & 2 \times 70 \\ \quad 1 & 1 \times 1 \\ \hline 5041 & \end{array}$$

Why does this work?

Find a method for squaring two digit numbers ending in 5.

Extend to find a method for squaring any two digit number.

19

Make that Number

Choose a target number (or use the number 50, as below).

The game is to take turns adding any number between one and five (inclusive) until one of you reach the target number.

The winner is the person who says the target number.

How could you generalise the game?

Electricity

Water

Gas

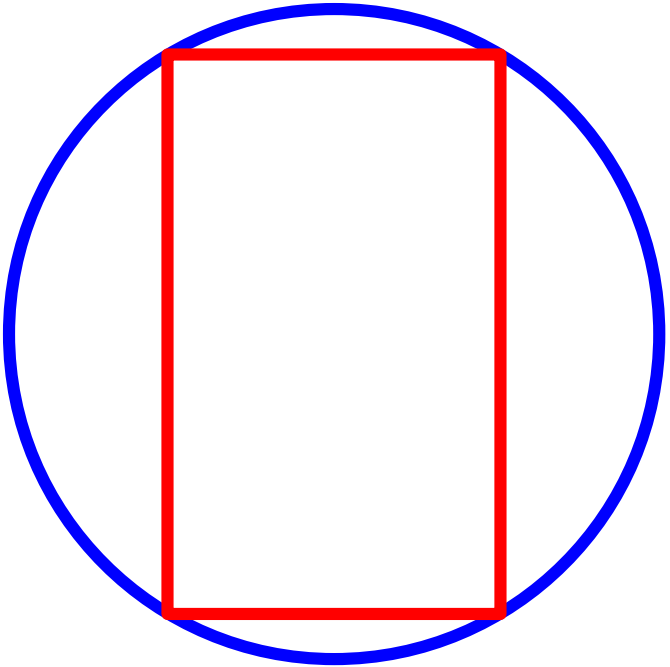
$$p^2 - 1 = 24m$$

Take any prime number greater than 3, square it and subtract 1.
Is the answer a multiple of 24?
Try again, and again, and again.

Why is that?

22

The circle in the diagram has radius 6 cm.
The rectangle has a perimeter of 28 cm.



Find the area of the rectangle.

23

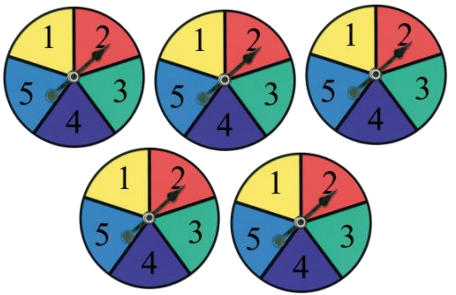
A school summer fayre has a stall offering two games.

£1 per go

Flip all 10 coins,
if you get 10 heads,
win an ipad (value £400).

£1 per go

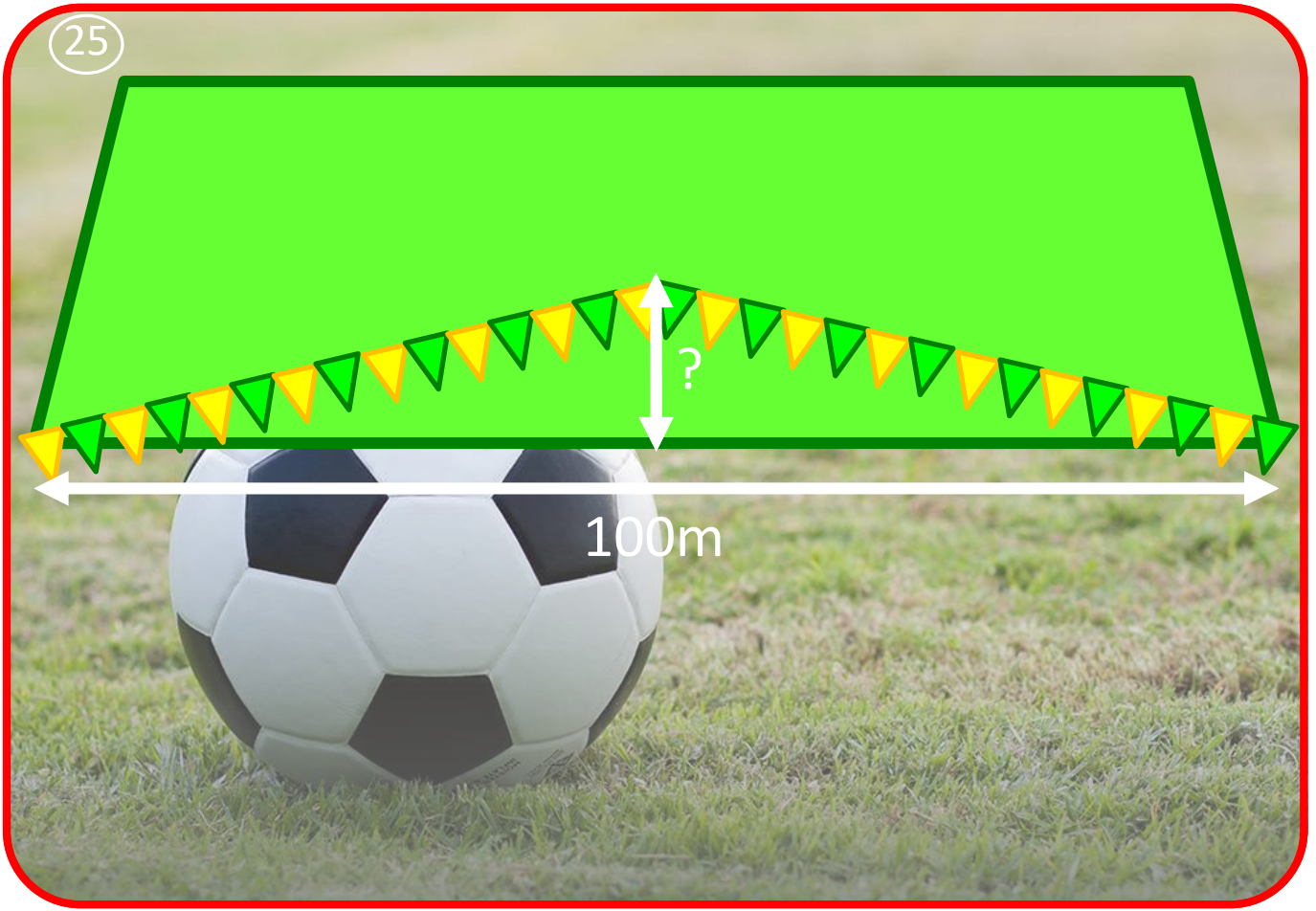
Spin all 5 spinners,
if you get 5 fives,
win a Macbook (value £1000).



Which game are you most likely to win?
Which game should the school encourage you to play?

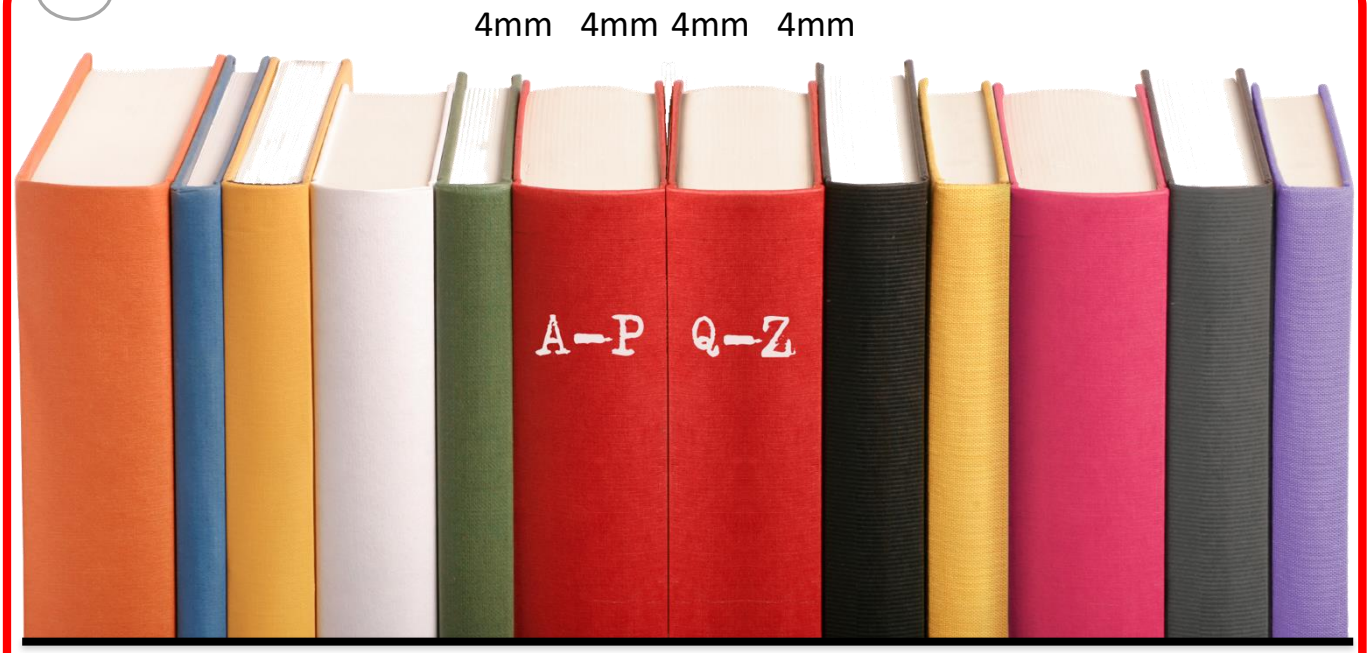
```
3
      5
3 +   5   =  8
      5   +  8   = 13
             8   + 13  = 21
                 13  + 21  = 34
                       21  + 34  = 55
                             34  + 55  = 89
                                   55  + 89  = 144
                                         89  + 144 = 233
```

25



$$\frac{XXX}{X+X+X}=?$$

27



How far apart are the entries for Aardvark and Zebra?

28

$$3^{444} + 4^{333}$$

Multiple of 5?

29

A camel crosses a desert 1000 km wide. It can carry a maximum of 1000 bananas and eats 1 banana for every kilometre that it walks. There are 3000 bananas in total.

What is the maximum that can be carried to the end?

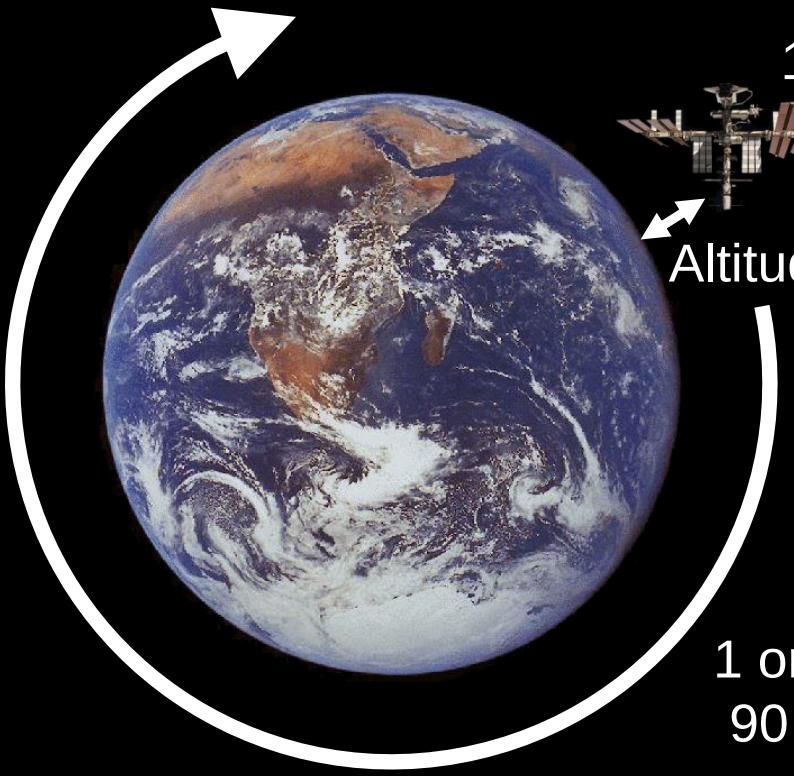
30

What way round would the queens head be if we rolled the left hand coin around the other?
At what angle would the queens head be if we rolled the left hand coin **behind** the other?

What is the biggest product that you can make using numbers which sum to 10?

32

What is the Circumference of the Earth?



17,500 mph

Altitude 250 miles

1 orbit every
90 minutes

1	2	3	4	5	6	7	8	9	10

What is the lowest common multiple of the numbers 1-10?

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

What is the lowest common multiple of the numbers 1-20?

Lowest common multiple of 1-100?


That's all Folks!