

What is the smallest 4-digit positive integer which has 4 different digits?

The leading digit must be 1 (smallest non-zero digit)

The next smallest digits are 0, 2, 3 so the answer is **1023**

What is half of 1.01?

We have $1.01 = 1 + \frac{1}{100}$

$$\text{So } 1.01 \div 2 = 0.5 + \frac{0.5}{100}$$

$$= 0.5 + \frac{5}{1000}$$

$$= \mathbf{0.505}$$

Which of the following has exactly one factor other than 1 and itself?

A) 6 B) 8 C) 13 D) 19 E) 25

6 has Factors 1, 2, 3, 6

8 has Factors 1, 2, 4, 8

13 and 19 are both prime

25 has Factors 1, 5, 25 so the answer is **25**

Beatrix looks at the word JUNIOR in a mirror. How many of the reflected letters never look the same as the original, no matter how Beatrix holds the mirror?

J, N and R don't (no lines of symmetry)

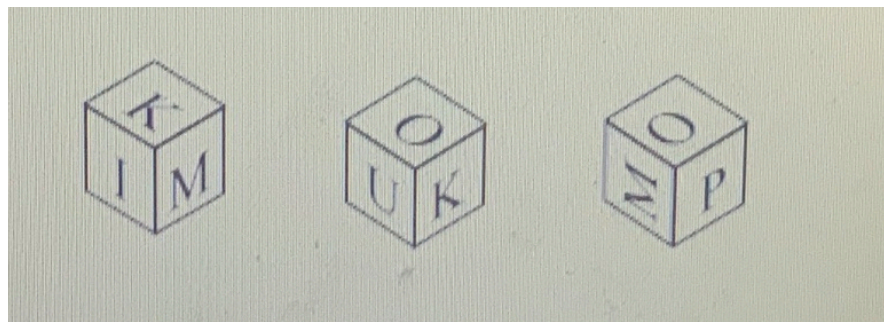
So the answer is **3**

How many years before 2012 was 1850?

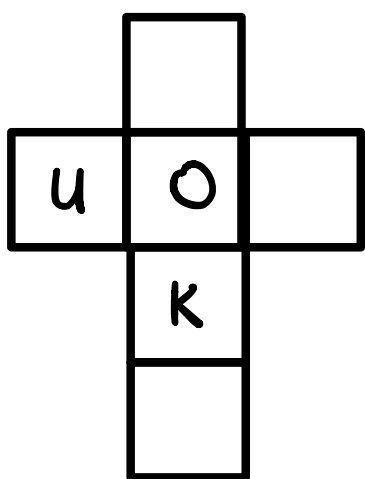
There are 150 years from 1850 to 2000 and 12 years from 2000 to 2012 so the answer is

$$150 + 12 = 162$$

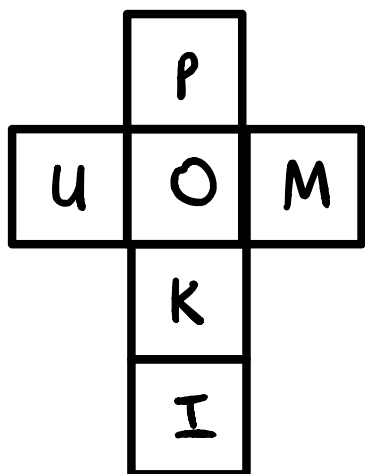
The diagrams show three different views of the same cube. Which letter is opposite U?



Draw up a net:



O is adjacent to K and U, which are adjacent to each other.



O is adjacent to M and P, which are adjacent to each other. Furthermore, M is adjacent to K. There is only 1 place left for I. So the letter opposite U is **M**

A small ink cartridge has enough ink to print 600 pages. Three small cartridges can print as many pages as two medium cartridges. Three medium cartridges can print as many pages as two large cartridges. How many pages can be printed using a large cartridge?

$$\begin{aligned} 2 \text{ large} &= 3 \text{ medium} \\ \Rightarrow 1 \text{ large} &= \frac{3}{2} \text{ medium} \end{aligned}$$

$$\begin{aligned} 2 \text{ medium} &= 3 \text{ small} \\ \Rightarrow 1 \text{ medium} &= \frac{3}{2} \text{ small} \\ \Rightarrow \frac{3}{2} \text{ medium} &= \frac{9}{4} \text{ small} \end{aligned}$$

So 1 large cartridge can print

$$\frac{9}{4} \times 600 = 1350 \text{ pages}$$

A tank holds 480 mL when it is one-quarter empty. How much does it hold when it is one quarter Full?

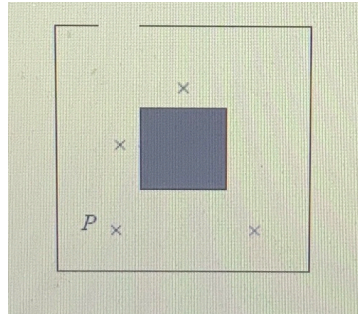
Let x be the capacity of the tank.

We have

$$\frac{3}{4} x = 480$$

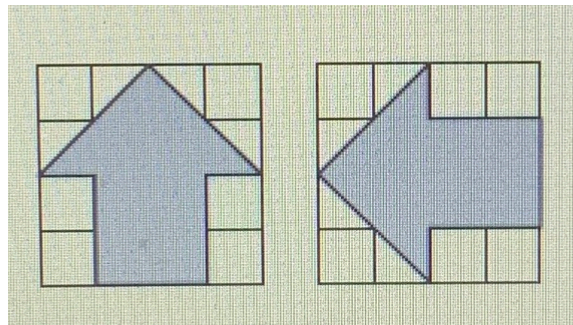
$$\Rightarrow \frac{1}{4} x = \frac{480}{3} = 160 \text{ mL}$$

The diagram shows the positions of 4 people in an Art Gallery. In the middle of the room is a stone column. Ali can see none of the other 3 people. Bea can only see Caz. Caz can see Bea and Dan. Dan can only see Caz. Who is at position P?

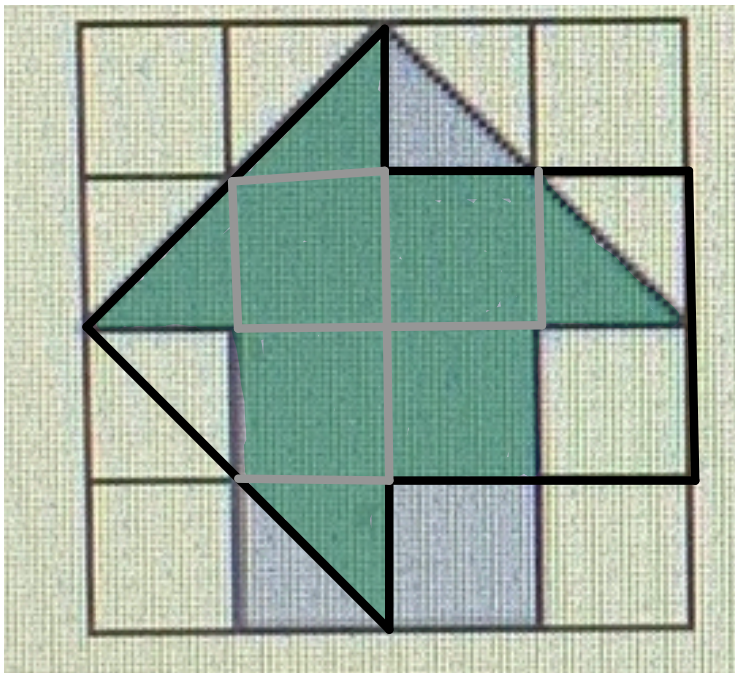


P is the only person who can see two others so it must be **Caz**

The diagram shows two arrows drawn on 4cm by 4cm grids. One arrow points North and the other points West. When the two arrows are drawn on the same grid (still pointing North and West) they overlap. What is the area of the overlap?



Draw the outline of one on the other and shade the overlap. It is four Full squares and Four half squares, for a total area of



$$4 + 2 = 6 \text{ cm}^2$$

In the following expression, each $\square$ is to be replaced with either $+$ or $-$ in such a way that the result is 100. The number of $+$ signs used is p and the number of $-$ signs used is m . What is $p-m$?

$$123 \square 45 \square 67 \square 89$$

We have

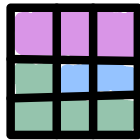
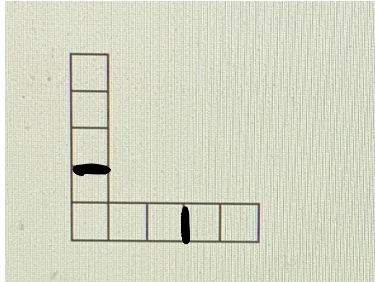
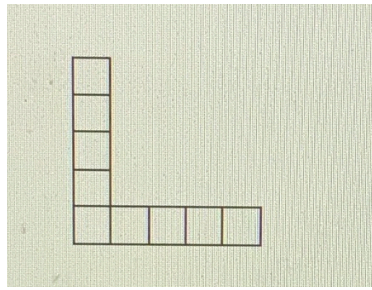
$$123 - 45 - 67 + 89 = 100$$

(to Find this quickly, look at the units digits)

$$\text{So } p=1, m=2 \text{ and } p-m = -1$$

Laura wishes to cut this shape, which is made up of 9 small squares, into pieces which she can rearrange to make a 3×3 square. What is the smallest number of pieces she needs to cut the

Shape into to do this?



It can be done with
3 pieces

It can't be done with 2 pieces since that would use only 1 cut, but in that case it is impossible to avoid pieces with length greater than 3. So the answer is 3

In this multiplication grid, the input Factors are missing and only some of the products in the table have been given. What is $A + B + C + D + E$?

×					
	A	10		20	
	15	B	40		
	18		C	60	
		20		D	24
			56		E

Since 15 and 18 are in the same column, the input must be a common Factor, that is, 1 or 3.
Since 15 and 40 are in the same row, the input must be 1 or 5.

The only way to obtain a product of 15 is if those inputs are 3 and 5 respectively.

Using that we can fill in:

$\times$	3	5	8	10	6
2	A	10		20	
5	15	B	40		
6	18		C	60	
4		20		D	24
7			56		E

$$\text{So } C = 6 \times 8 = 48$$

$$A = 2 \times 3 = 6$$

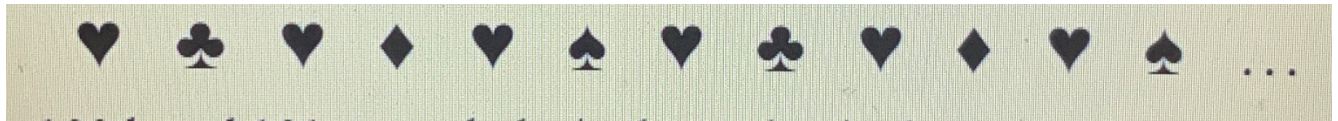
$$B = 5 \times 5 = 25$$

$$D = 4 \times 10 = 40$$

$$E = 7 \times 6 = 42$$

$$\text{Hence } A + B + C + D + E = 161$$

A pattern that repeats every 6 symbols starts as shown. Which are the 100th and 101st symbols in the pattern?



$$\text{We have } 100 = 16 \times 6 + 4$$

$$101 = 16 \times 6 + 5$$

So the 100th and 101st symbols will be the 4th and 5th in the pattern block:



I plant 60 tulip bulbs. When they flower, half are yellow, one third of those which aren't yellow are red, one quarter of those which are neither yellow or red are pink. The rest are white.

What Fraction of the tulips are white?

$$\text{Yellow} = \frac{1}{2} \times 60 = 30$$

$$\text{Red} = \frac{1}{3} (60 - 30)$$

$$= \frac{1}{3} \times 30$$

$$= 10$$

$$\text{Pink} = \frac{1}{4} (60 - 30 - 10)$$

$$= \frac{1}{4} \times 20$$

$$= 5$$

$$\text{White} = 60 - 30 - 10 - 5$$

$$= 15$$

So the Fraction which are white is

$$\frac{15}{60} = \frac{1}{4}$$

Beth, Carolyn and George read their favourite bedtime story together. They take it in turns to read a page, always in the order Beth then Carolyn then George. All 20 pages of the story are read on each occasion. One evening Beth is away but the other two still read the same story and take it in turns to read a page, with Carolyn reading the First. In total, how many pages are usually read by the person who usually reads that page?

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

So the answer is 6

There are 6 more girls than boys in a class of 24. What is the ratio of girls to boys?

Let the number of boys be n . Then there are $n+6$ girls and

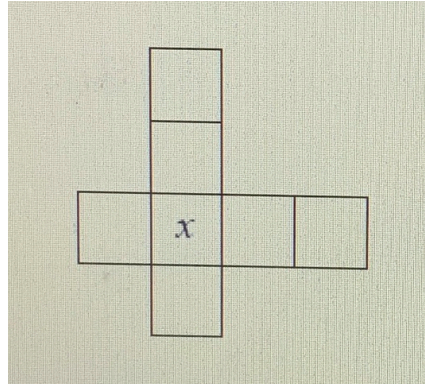
$$n + (n+6) = 24$$

$$\Rightarrow 2n = 18$$

$$\Rightarrow n = 9$$

So there are 15 girls to 9 boys, giving a ratio of 5:3

The numbers 2, 3, 4, 5, 6, 7, 8 are to be placed, one per square, in the diagram so that the four numbers in the horizontal row add up to 21 and the four numbers in the vertical column also add up to 21. Which number should replace x ?



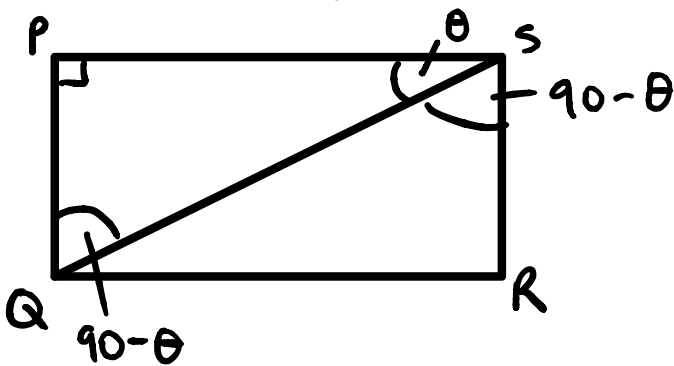
Calculate the sum of both lines:

$$(2 + \dots + 8) + x = 2 \times 21 \quad \left[x \text{ is counted twice} \right. \\ \left. \text{as it's in both} \right]$$

$$\Rightarrow x = 42 - 35 = 7$$

In rectangle PQRS, the ratio of $\angle PSQ$ to $\angle PQS$ is 1:5. What is the size of $\angle QSR$?

Draw a diagram:



Let $\angle PSQ = \theta$.

By angle sum of a triangle in right-angled triangle

$$\triangle PSQ: \angle PQS = 90 - \theta$$

$$\text{So we have } \frac{90 - \theta}{\theta} = 5 \Rightarrow 90 - \theta = 5\theta$$

$$\Rightarrow 6\theta = 90$$

$$\Rightarrow \theta = 15$$

By complementary angles

$$\angle QSR = 90 - \theta = 75^\circ$$

Aroon says his age is 50 years, 50 months, 50 weeks and 50 days old. What age will he be on his next birthday?

$$\begin{aligned} 50 \text{ months} &= 48 + 2 \text{ months} \\ &= 4 \text{ years } 2 \text{ months} \end{aligned}$$

$$\begin{aligned} 50 \text{ days} &= 49 + 1 \text{ days} \\ &= 7 \text{ weeks } 1 \text{ day} \end{aligned}$$

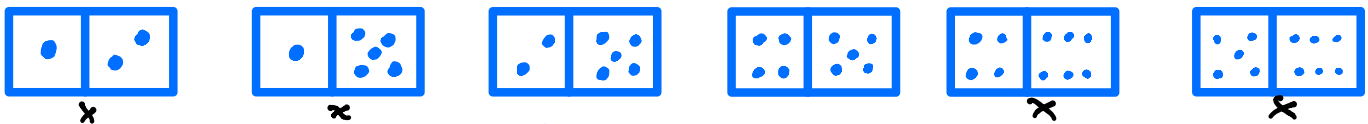
So his age is 50 + 4 years, 2 months, 50 + 7 weeks, 1 day.

Now 57 weeks = 1 year 5 weeks

So his age is

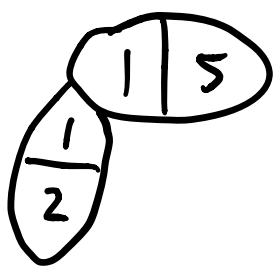
55 years, 2 months, 5 weeks, 1 day

and therefore on his next birthday he will be **56**

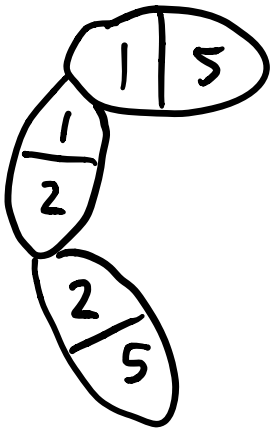


Dominic wants to place the 6 dominoes above in a hexagonal ring so that for every pair of adjacent dominoes the number of pips match. In a completed ring, how many of the other 5 dominoes can he definitely not place adjacent to  ?

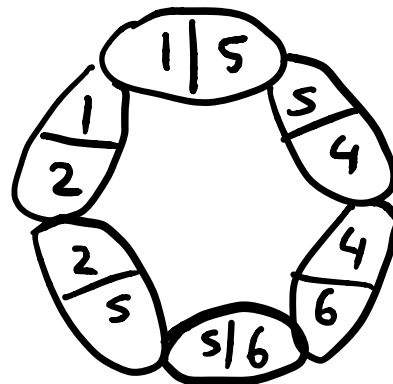
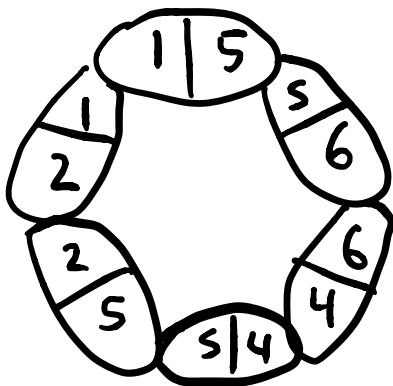
Definitely not the 4/6 domino since neither end matches. Start making the ring. The only other tile with the number 1 is 1/2 so it must be adjacent to the start tile as shown:



Now the only tile with a 2 is 2|5
so it must come next:

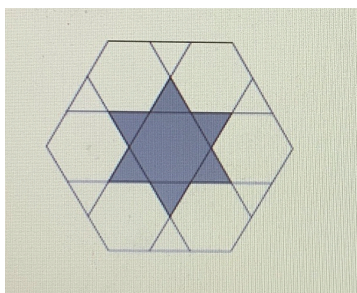


Now there are two tiles which could
be adjacent to the start tile, 5|6
and 4|5 :



So the tiles which could definitely not be adjacent
to 1|5 are 2|5 and 4|6, so the answer is **2**

The diagram shows a design formed by drawing 6 lines
in a regular hexagon. The lines divide each edge of
the hexagon into 3 equal parts. What Fraction of the
hexagon is shaded?



The area of a small hexagon is
6 times the area of a triangle.

There are 7 small hexagons and 12
triangles in total, which is equivalent
to the area of 9 small hexagons.

The shaded area is 1 small hexagon and 6 triangles, which is equivalent to 2 small hexagons.

So the Fraction of the large hexagon which is shaded is

$$\frac{2}{9}$$

Peter wrote a list of all the numbers that could be produced by changing one digit of the number 200. How many of the numbers on Peter's list are prime?

If we change the hundreds or tens digit the number will be a multiple of 10 and hence composite.

If we change the Units digit to 5 or an even number, the number will be composite.

Test the remaining numbers:

201 : sum of digits is 3 $\Rightarrow$ composite

203 : $7 \times 29 \Rightarrow$ composite

207 : sum of digits is 9 $\Rightarrow$ composite

209 : $11 \times 19 \Rightarrow$ composite

So the answer is 0

After playing 500 games, my success rate at Spider Solitaire is 49%. Assuming I win every game from now on, how many extra games do I need to play in order to increase my success rate to 50%?

So far I've won $49 \times 5 = 245$ games

Suppose my success rate increases to 50% after n more games. Then

$$\frac{245 + n}{500 + n} = \frac{1}{2}$$

$$\Rightarrow 2(245 + n) = 500 + n$$

$$\Rightarrow 490 + 2n = 500 + n$$

$$\Rightarrow n = 10$$

The interior angles of a triangle are $(5x + 3y)$, $(3x + 20)$ and $(10y + 30)$ where x, y are positive integers. What is $x + y$?

By angle sum of a triangle:

$$5x + 3y + 3x + 20 + 10y + 30 = 180$$

$$\Rightarrow 8x + 13y = 130$$

Write out the positive multiples of 13 up to 130:

y	13y	130 - 13y	Multiple of 8?
1	13	117	x
2	26	104	✓ 104 = 8 × 13
3	39	91	x
4	52	78	x
5	65	65	x
6	78	52	x
7	91	39	x
8	104	26	x
9	117	13	x

So the only solution is

$$130 = 104 + 26$$

$$= 8 \times 13 + 13 \times 2$$

$$\Rightarrow x = 13, y = 2$$

$$\Rightarrow x + y = 13 + 2 = 15$$

Quicker solution: $8x + 13y = 130$

$\uparrow \quad \quad \uparrow$
mult of 13

So $8x$ must also be a multiple of 13, and hence x is a multiple of 13.

Now $8 \times 26 = 208 > 130$ so the only option is $x = 13$.

$$\text{Then } 13y = 130 - 8 \times 13 = 26 \Rightarrow y = 2$$