

Which of the Following has the largest value?

A) $1-0.1$ B) $1-0.01$ C) $1-0.001$ D) $1-0.0001$ E) $1-0.00001$

Since $0.00001 < 0.001 < 0.01 < 0.1$, the answer is **E** (obtain the largest quantity by subtracting the smallest amount from 1)

Heidi is 2.1m tall. Lola is 1.4m tall. What is their average height?

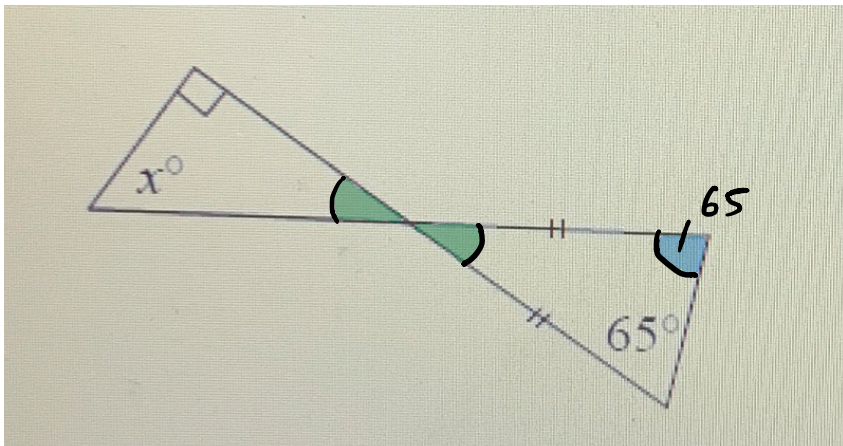
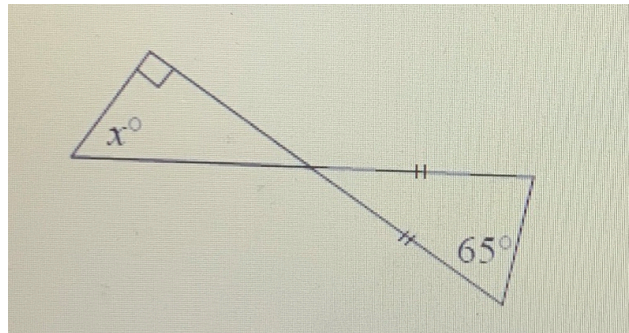
$$\text{Average} = \frac{210\text{cm} + 140\text{cm}}{2}$$

$$= \frac{350\text{cm}}{2}$$

$$= 175\text{cm}$$

$$= 1.75\text{m}$$

What is x ?



Since equal angles are opposite equal sides, the blue angle is 65°

By angle sum of a triangle and vertically opposite angles, the

$$\text{green angle is } 180 - 2 \times 65 = 50^\circ$$

By Complementary angles, $x = 90 - 50 = 40^\circ$

Grill went For a Five hour walk. Her average speed was between 3 km/h and 4 km/h. Which of the Following could be the distance she walked?

A) 12km B) 14km C) 19km D) 24 km E) 35 km

$$\text{distance} = \text{speed} \times \text{time}$$

So her distance travelled was between

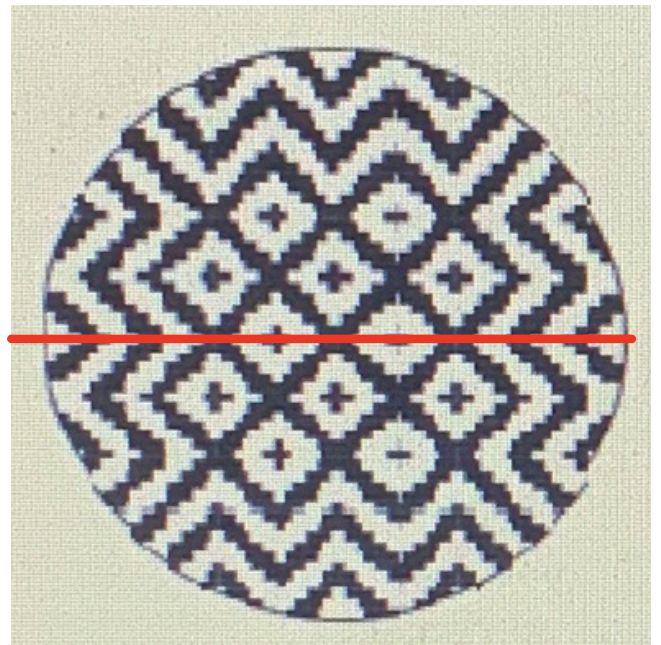
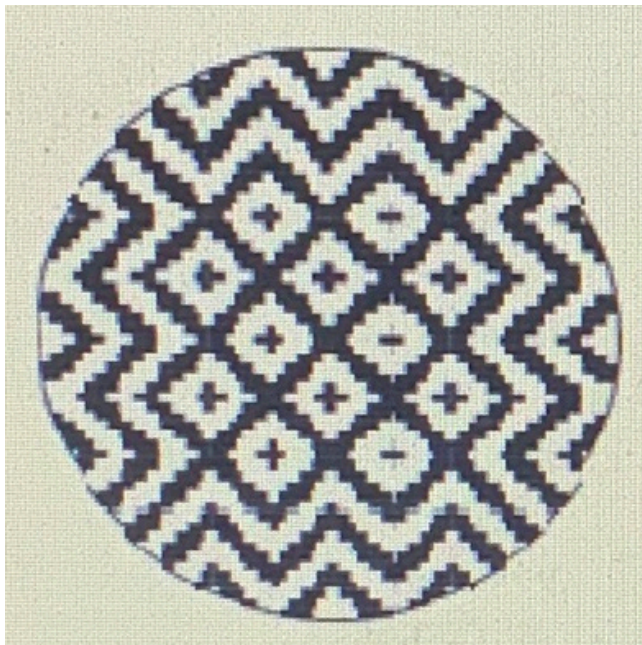
$$5 \times 3 = 15 \text{ km}$$

and

$$5 \times 4 = 20 \text{ km}$$

The only such option on the list is 19km

The diagram shows a weaver's design. How many lines of symmetry does it have?



There is 1 line of symmetry as shown above.

What is the value of $[(1-1)-1] - [1-(1-1)]$?

$$\begin{aligned} \text{We have } [(1-1)-1] - [1-(1-1)] &= [0-1] - [1-0] \\ &= -1-1 \end{aligned}$$

$$= -2$$

After tennis training, Andy collects twice as many balls as Roger and Five more than Maria. They collect 35 balls in total. How many balls does Andy collect?

Suppose Roger collects n balls.

Then Andy collects $2n$ balls and Maria collects $2n-5$ balls.

We have

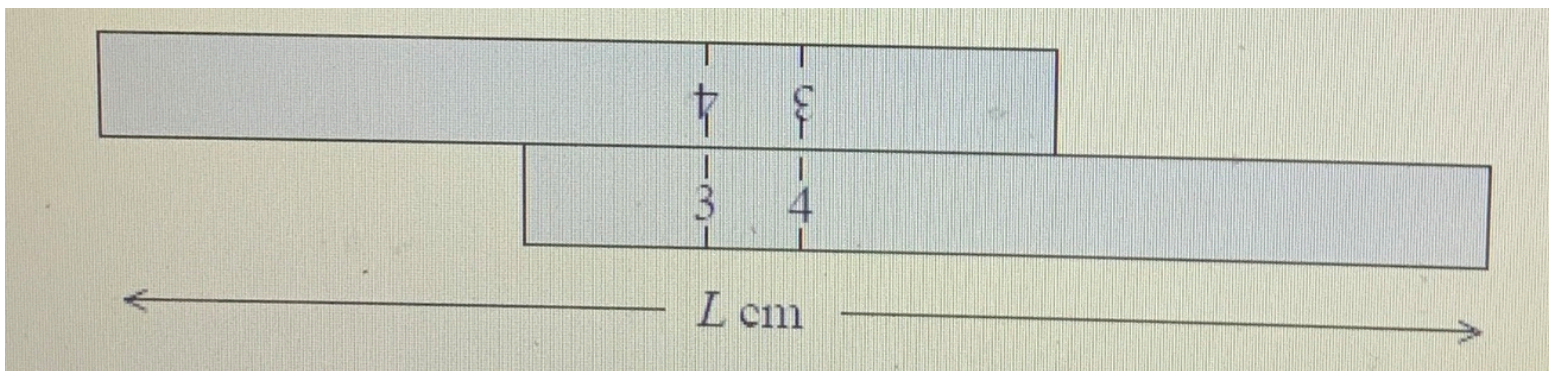
$$2n + n + 2n - 5 = 35$$

$$\Rightarrow 5n = 40$$

$$\Rightarrow n = 8$$

So Andy collects **16** balls

Two identical rulers are placed together as shown. Each ruler is exactly 10cm long and marked in cm from 0 to 10. The 3cm mark on each ruler is aligned with the 4cm mark on the other. The overall length is L cm. What is L ?

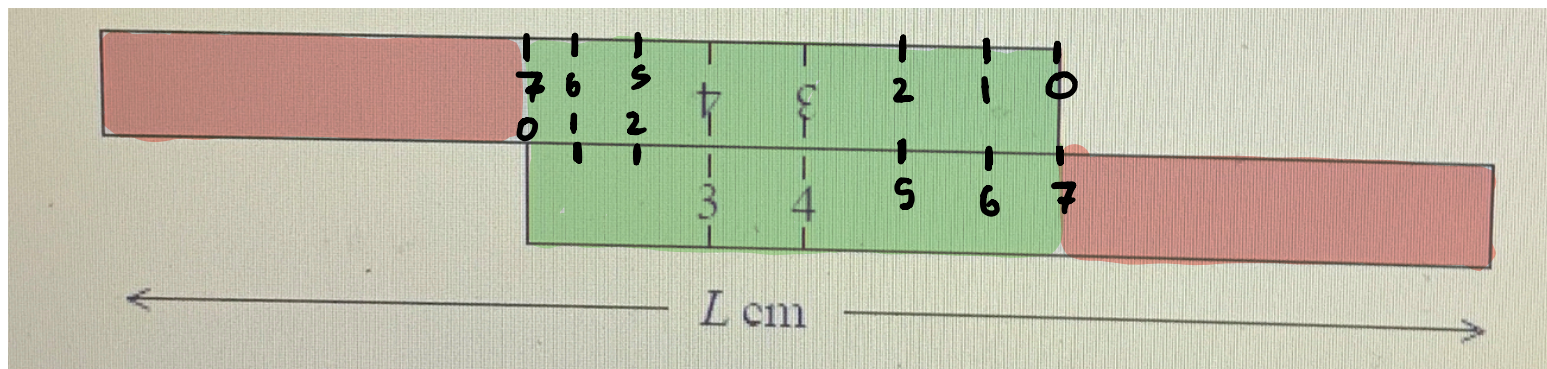


Fill in the markings as shown below.

The red sections measure 3 cm each ($10-7$)

The green section measures 7 cm

$$\text{So } L = 3 + 7 + 3 = \mathbf{13 \text{ cm}}$$



Peter has three times as many sisters as brothers.
 His sister Louise has twice as many sisters as brothers.
 How many children are there in the Family?

Suppose the Family has g girls and b boys in total.
 Peter:

$$3(b-1) = g$$

Louise:

$$2b = g-1$$

$$\begin{aligned} \text{So } g &= 2b+1 \Rightarrow 3b-3 = 2b+1 \\ &\Rightarrow b = 4 \\ &\Rightarrow g = 9 \end{aligned}$$

Hence the total number of children is $4+9 = 13$

On standard dice the total number of pips on each pair of opposite Faces is 7. Two standard dice are placed in a stack so that the total number of pips on the two touching Faces is 5. What is the total number of pips on the top and bottom Faces of the stack?

There are two ways to obtain a total of 5 on the touching Faces: $1+4$ or $2+3$

If the touching Faces are 1 and 4 then the top

and bottom Faces will be 6 and 3 - their total is 9.
 If the touching Faces are 2 and 3 then the top and bottom Faces will be 5 and 4 - their total is 9.

So in both cases the answer is **9**

Usain runs twice as Fast as his mum. His mum runs Five times as Fast as his pet tortoise Turbo. They all set off together For a run down the same straight path. When Usain has run 100m, how Far apart are his mum and Turbo the tortoise?

When Usain has run 100m, his mum has run 50m.

When his mum has run 50m, Turbo has run 10m.

So his mum and Turbo are $50 - 10 = 40\text{m}$ apart

How many hexagons are there in the diagram?



Sides marked with purple

Number of hexagons which include those sides (not including previously listed ones)



5



3



2



1



1

So the total number of hexagons is $5 + 3 + 2 + 1 + 1 = 12$

When painting the lounge, I used half of a 3L can to complete the First coat of paint. I then used two-thirds of what was left to complete the second coat. How much was left after both coats were complete?

First coat: $\frac{3}{2} L$

Second coat: $\frac{2}{3} \times \frac{3}{2} L = 1 L$

Remaining = $3 - 1.5 - 1 = 0.5 L$

Each side of an isosceles triangle is a whole number of centimetres. Its perimeter has length 20cm. How many possibilities are there for the lengths of its sides?

The side lengths are n, n and $20 - 2n$

For the triangle inequality to hold, we require

$$20 - 2n < n + n$$

$$\Rightarrow 20 < 4n$$

$$\Rightarrow n > 5$$

For all side lengths to be positive we require

$$n > 0 \quad \text{and} \quad 20 - 2n > 0$$

$$\Rightarrow 2n < 20$$

$$\Rightarrow n < 10$$

So the possible triangles are $(6, 6, 8)$, $(7, 7, 6)$, $(8, 8, 4)$ and $(9, 9, 2)$

Hence the answer is **4**

The Grand Old Duke of York had 10000 men. He lost 10% of them on the way to the top of the hill and he lost 15% of the rest as he marched them back down the hill. What percentage of the 10000 men were still there when they reached the bottom of the hill?

On the way up he lost 1000 so he had 9000 remaining. On the way down he lost

$$\frac{15}{100} \times 9000 = 15 \times 90 \\ = 1350$$

so he had $9000 - 1350 = 7650$ remaining.

This is $76\frac{1}{2}\%$ of the original number.

Ulysses, Kim, Mei and Tanika have their 12th, 14th, 15th and 15th birthdays today. In what year will their ages first total 100?

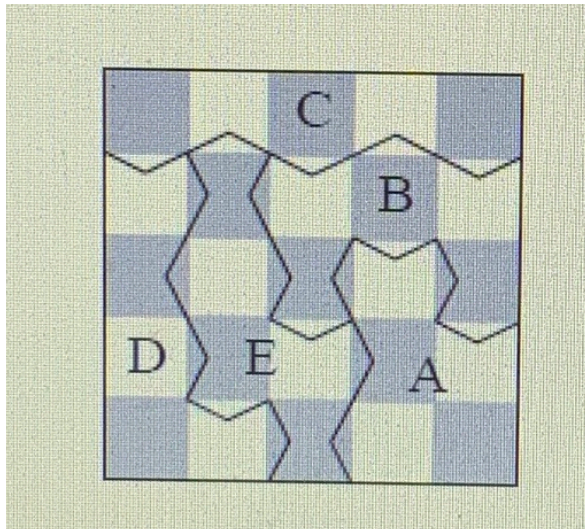
In n years' time, the total of their ages will be

$$12 + n + 14 + n + 15 + n + 15 + n \\ = 56 + 4n$$

$$\text{So } 56 + 4n = 100 \Rightarrow 4n = 44$$

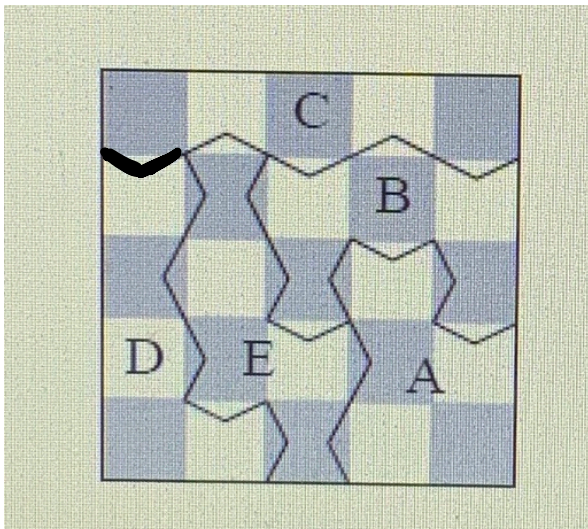
$$\Rightarrow n = 11$$

A $5\text{cm} \times 5\text{cm}$ square is cut into five pieces as shown. Each cut is a sequence of identical copies of the same shape but pointing up, down, left or right. Which piece has the longest perimeter?



Let x be the length of the indicated shape.

By comparing to the side of a small square, we see that $x > 1$.



Piece

A

B

C

D

E

Length

$6x + 4$

$10x + 2$

$5x + 7$

$6x + 6$

$11x + 1$

Clearly A is shorter than D.

For the remaining lengths:

$$x > 1 \Rightarrow 6x + 6 > 5x + 7$$

$$x > 1 \Rightarrow 4x > 4$$

$$\Rightarrow 10x + 2 > 6x + 6$$

$$x > 1 \Rightarrow 11x + 1 > 10x + 2$$

So the piece with the longest perimeter is **E**

Weighing the baby at the clinic was a problem. The baby would not keep still and caused the scales to wobble. So I held the baby and stood on the scales while the nurse read off 78kg. Then the nurse held the baby while I read off 69kg. Finally I held the nurse while the baby read off 137kg. What was the combined weight of all 3?

Let m be my weight, n be the nurse's weight, b be the baby's weight. We have

$$m + b = 78 \quad (1)$$

$$n + b = 69 \quad (2)$$

$$m + n = 137 \quad (3)$$

Perform $(1) + (2) + (3)$:

$$2(m + n + b) = 284$$

$$\Rightarrow m + n + b = 142 \text{ kg}$$

A swimming club has 3 categories of members: junior, senior, veteran. The ratio of junior to senior members is 3:2 and the ratio of senior members to veterans is 5:2. Which of the following could be the total number of members in the swimming club?

A) 30 B) 35 C) 48 D) 58 E) 60

Suppose there are $10n$ senior members. Then there are $15n$ junior members and $4n$ veterans so the total number of members is

$$10n + 15n + 4n = 29n$$

Of the options listed, only 58 is a multiple of 29 so it must be the answer.

A "long knight" moves on a square grid. A single move consists of moving 3 squares horizontally or vertically then one square at right angles to the first direction. What is the smallest number of moves a long knight requires to go from one corner of an 8x8 board to the diagonally opposite corner?

The journey requires 7 horizontal and 7 vertical moves. We need to make at least 3 moves because $3+3+1$ makes 7 using the least number of copies of 1 and 3. But in that case, we would only move $1+1+3 = 5$ jumps in the other direction. So 3 moves is impossible. It is impossible to reach a total of 7 using just 4 copies of 1's and 3's:

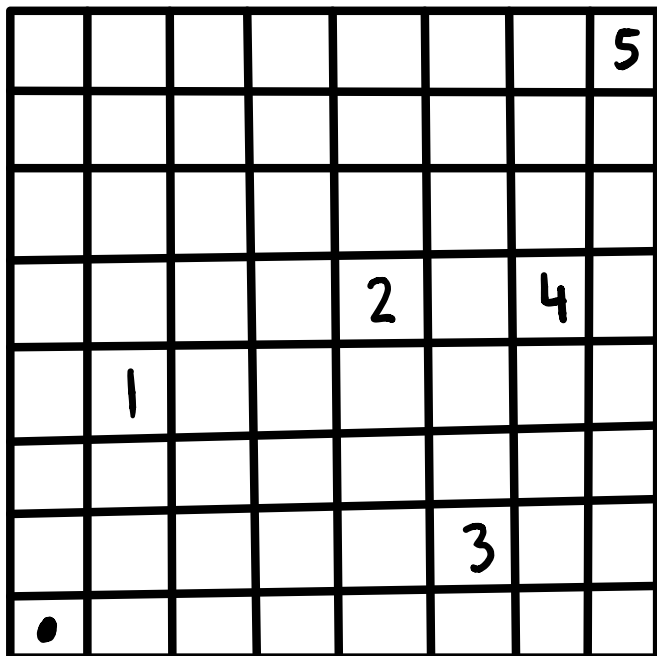
$$1+1+1+1 = 4 \quad \times$$

$$1+1+1+3 = 6 \quad \times$$

$$1+1+3+3 = 8 \quad \times$$

So 4 moves is impossible.

It is doable in 5 moves:



So the answer is 5

The 5×4 grid is divided into blocks. Each block is a square or a rectangle and contains the number of cells indicated by the integer within it. Which integer will be in the same block as the shaded cell?

	5			
		4		
2			6	
	3			

Since 5 is a prime, it must be in a single line of cells (the whole top row).

	5			
		4		
2			6	
	3			

If the 6 block had 2 rows and 3 columns, then it would be impossible to finish since the 4 would need to use the square directly to its left. But then there is no way to complete the 3 block.

So the 6 block must be as shown, and then it's easy to fill in the rest of the grid.

	5			
		4		
2			6	
	3			

Hence the answer is 4

Two numbers in the 4x4 grid can be swapped to create a Magic Square (all columns, rows and both main diagonals add to the same total). What is the sum of these two numbers?

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

The grid includes the numbers 1 to 16.

The "magic number" should therefore be

$$\begin{aligned}\frac{1 + \dots + 16}{4} &= \frac{1}{4} \times \frac{1}{2} \times 16 \times 17 \\ &= 2 \times 17 \\ &= 34\end{aligned}$$

Current totals are:

9	6	3	16	34
4	13	10	5	32
14	1	8	11	34
7	12	15	2	36
34	32	36	34	32

Swap the highlighted numbers (intersections of lines with incorrect totals)

So the answer is

$$13 + 15 = 28$$

In a school netball league, a team gains a certain whole number of points if it wins a game, a lower whole number of points if it draws and no points if it loses. After 10 games my team has won 7, drawn 3 and gained 44 points. My sister's team has won 5 games, drawn 2 and lost 3. How many points has her team gained?

Let w be the points scored for winning and d the points scored for a draw.

We have

$$7w + 3d = 44$$

w	$7w$	$44 - 7w$	Multiple of 3?
1	7	37	No
2	14	30	Yes - $d=10$
3	21	23	No
4	28	16	No
5	35	9	Yes - $d=3$
6	42	2	No

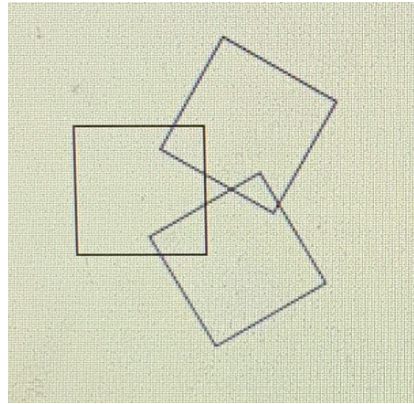
Note that we need $w > d$ so the only solution is $w=5, d=3$

So the sister's team scored

$$\begin{aligned}
 5 \times 5 + 2 \times 3 &= 25 + 6 \\
 &= 31
 \end{aligned}$$

Three congruent squares overlap as shown. The

areas of the three overlapping sections are 2cm^2 , 5cm^2 and 8cm^2 respectively. The total area of the non-overlapping parts of the squares is 117cm^2 . What is the side length of each square?



If the 3 squares were separate, their combined area would be

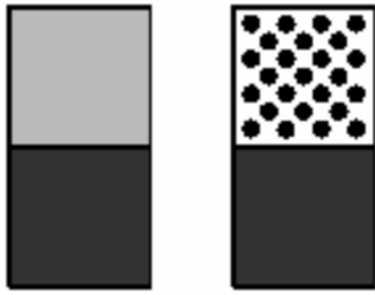
$$117 + 2 \times (2 + 5 + 8) = 147$$

So the area of one square is

$$147 \div 3 = 49$$

and therefore its side length is 7cm

For Beatrix's latest art installation, she has fixed a 2×2 square sheet of steel to a wall. She has two 1×2 magnetic tiles, both of which she attaches to the steel sheet in any orientation so that none of the sheet is visible and the line separating the two tiles cannot be seen. As shown, one has a black cell and a grey cell, the other has a black cell and a spotted cell. How many different looking installations can Beatrix obtain?



There are 4 possible locations in the 2×2 grid to place the spotted tile.

For each of those, it is possible to Find an arrangement with the grey tile in any of the 3 remaining locations.

So the total number of arrangements is

$$4 \times 3 = 12$$