



APSMO

WEDNESDAY 7 MAY 2025

MATHS GAMES JUNIOR

*Suggested Time: **30 Minutes**. Calculators NOT Permitted.*

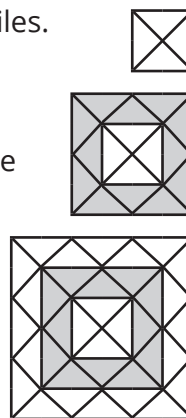
- 1A.** Scarlett and Keren are sharing a box of twenty collectable cards.
Scarlett takes eight more cards than Keren.
How many cards does Keren get?

*Write your
answers in
the boxes on
the back.*

- 1B.** A clown performs tricks for children's birthday parties.
He has a trick where the answer is the child's age.
For this trick, he begins by saying: "Think of your age. Double it. Add 20.
Halve your answer. Now subtract ..."
What should be subtracted, so that the answer is the child's age?

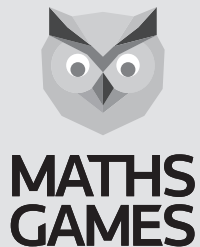
←
*Keep your
answers
hidden by
folding
backwards
on this line.*

- 1C.** Joey is building a pattern with identically sized triangular tiles.
He begins by arranging four white tiles into a square.
He surrounds this square with a border of 12 grey tiles.
He surrounds the grey tiles with another border of 20 white tiles.
Joey continues to alternate between grey and white borders.
How many tiles will Joey need for the next grey border?



- 1D.** Water bottles come in two sizes, small (150 mL) and large (250 mL).
I have ten bottles, which can hold a total of 2.2 litres of water.
How many small bottles do I have?

- 1E.** Chocolate bars come in boxes of 6 and 10.
If Sara wanted to buy exactly 22 chocolate bars, there is only one way
she could do it: she would have to buy two boxes of 6, and one box of 10.
In how many different ways can Sara buy exactly 56 chocolate bars?



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1A.

Student Name:

1B.

1C.

1D.

1E.

Fold here. Keep your answers hidden.



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*Suggested Time: **30 Minutes**. Calculators NOT Permitted.*

- 1A.** Scarlett and Keren are sharing a box of twenty collectable cards.
Scarlett takes eight more cards than Keren.
How many cards does Keren get?

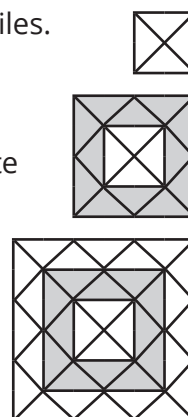
Hint: You could guess a number of cards for Scarlett. A table might help to track your guesses.

- 1B.** A clown performs tricks for children's birthday parties.
He has a trick where the answer is the child's age.
For this trick, he begins by saying: "Think of your age. Double it. Add 20.
Halve your answer. Now subtract ..."
What should be subtracted, so that the answer is the child's age?

Hint: You could try the question with your own age. Would it also work if you were a year older?

- 1C.** Joey is building a pattern with identically sized triangular tiles.
He begins by arranging four white tiles into a square.
He surrounds this square with a border of 12 grey tiles.
He surrounds the grey tiles with another border of 20 white tiles.
Joey continues to alternate between grey and white borders.
How many tiles will Joey need for the next grey border?

Hint: Is there a pattern in how the number of tiles grows for each new border?



- 1D.** Water bottles come in two sizes, small (150 mL) and large (250 mL).
I have ten bottles, which can hold a total of 2.2 litres of water.
How many small bottles do I have?

Hint: How much water would the bottles hold, if they were all the small size?

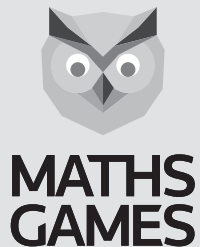
- 1E.** Chocolate bars come in boxes of 6 and 10.
If Sara wanted to buy exactly 22 chocolate bars, there is only one way she could do it: she would have to buy two boxes of 6, and one box of 10.
In how many different ways can Sara buy exactly 56 chocolate bars?

Hint: What is the largest possible number of boxes that contain 10 chocolate bars?

*Write your
answers in
the boxes on
the back.*



*Keep your
answers
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folding
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1A.

Student Name:

1B.

1C.

1D.

1E.

Fold here. Keep your answers hidden.



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Solutions and Answers

(Items in parentheses are not required)

1A: 6

1B: 10

1C: 28

1D: 3

1E: 2

1A. How many cards does Keren get?

Strategy 1: Build a Table, and Find a Pattern

There are 20 cards in the box.

Suppose Scarlett and Keren took $20 \div 2 = 10$ cards each.

Scarlett would then have $10 - 10 = 0$ cards more than Keren.

Scarlett	10				
Keren	10				
Difference	0				

If Scarlett takes 11 cards, then Keren would take $20 - 11 = 9$.

Scarlett would then have $11 - 9 = 2$ cards more than Keren.

We can see that increasing Scarlett's cards by 1 increases the difference by 2.

Following the pattern, we find that when Scarlett takes 8 more cards than Keren, Keren will have 6 cards.

		+1	+1	+1	+1
Scarlett	10	11	12	13	14
Keren	10	9	8	7	6
Difference	0	2	4	6	8
		+2	+2	+2	+2

Strategy 2: Build a Table, and Find a Pattern (Alternative Approach)

Suppose Scarlett took 10 cards.

She got 8 more than Keren, so Keren got $10 - 8 = 2$ cards.

In total, they distributed $10 + 2 = 12$ cards.

Scarlett	10				
Keren	2				
Total	12				

If Scarlett took 11 cards, then Keren took $11 - 8 = 3$.

Between them, they would have $11 + 3 = 14$ cards.

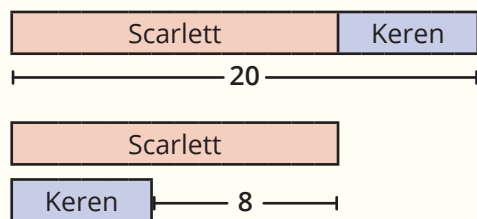
We can see that increasing Scarlett's cards by 1 increases the total by 2.

Following the pattern, we find that when there are 20 cards in total, Keren will have 6 cards.

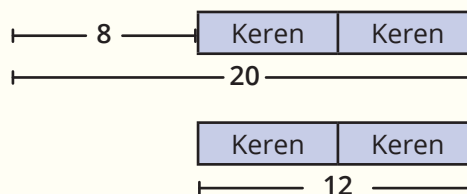
		+1	+1	+1	+1
Scarlett	10	11	12	13	14
Keren	2	3	4	5	6
Total	12	14	16	18	20
		+2	+2	+2	+2

Strategy 3: Draw a Diagram, and Reason Logically

Scarlett and Keren shared 20 cards.
Scarlett got 8 cards more than Keren.



We can replace the bar representing Scarlett's cards, with (Keren + 8).



This is the same as noticing that, if we take 8 of Scarlett's cards away, Scarlett and Keren would each have the same number of cards.

Keren has $12 \div 2 = 6$ cards.

Follow-Up: Keren then swapped one card for two of Scarlett's cards. How many more cards does Scarlett have than Keren? [6]



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1B. What should be subtracted, so that the answer is the child's age?

Strategy 1: Build a Table, and Find a Pattern

Suppose the child is 7 years old. We can play out what happens during the trick.

Clown says	Child thinks
Think of your age.	7
Double it.	14
Add 20.	34
Halve your answer.	17
Subtract ...	

If the final answer should be the child's age (7), the child should now subtract $17 - 7 = 10$.

Clown says	Child thinks
Think of your age.	7
Double it.	14
Add 20.	34
Halve your answer.	17
Subtract 10.	7

We can try the trick again for a child who is 8 years old.

Clown says	Child thinks
Think of your age.	7 8
Double it.	14 16
Add 20.	34 36
Halve your answer.	17 18
Subtract 10.	7 8

Would it work for a 2 year old? What about a 100 year old person?

Clown says	Child thinks
Think of your age.	7 8 2 100
Double it.	14 16 4 200
Add 20.	34 36 24 220
Halve your answer.	17 18 12 110
Subtract 10.	7 8 2 100

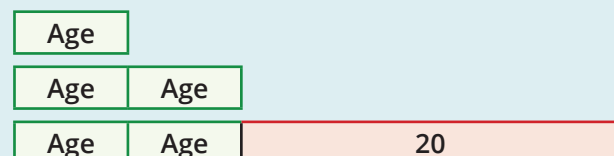
To end up with their age as the answer, the clown should ask the child to subtract 10.

Strategy 2: Draw a Diagram

We can use a bar to represent the child's age.

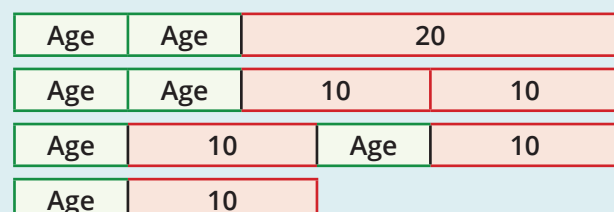
The clown says: Double it.

The clown says: Add 20.



The clown says: Halve your answer.

After doing so, the result is Age + 10.



If the child then subtracts 10, the result will be their age.

Follow-Up: If the clown had said "Add 30" instead of "Add 20", what number would you need to subtract at the end? [15]



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1C. How many tiles will Joey need for the next grey border?

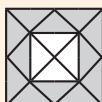
Strategy 1: Draw a Diagram

Joey begins by arranging four white tiles into a square.



Layers	1		
Tiles	4		

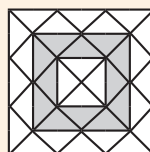
He surrounds the square with a border of 12 grey tiles.



Layers	1	2	
Tiles	4	12	

+1
+8

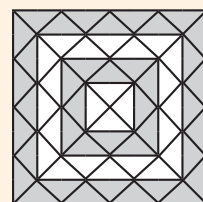
He surrounds the grey tiles with a border of 20 white tiles.



Layers	1	2	3
Tiles	4	12	20

+1 +1
+8 +8

We can now work out the number of tiles in the next grey border.

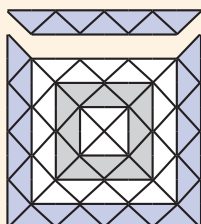


Layers	1	2	3	4
Tiles	4	12	20	

+1 +1 +1
+8 +8 ?

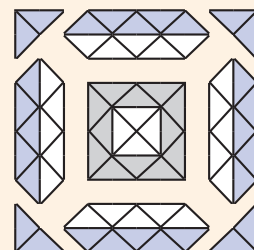
One way is to count the tiles along one side, and multiply it by 4.

There are $4 \times 7 = 28$ tiles in the next grey border.



We can also see that the outside border has the same number of tiles as the one immediately within, plus 8 extra tiles in the corners.

There are $20 + 8 = 28$ tiles in the next grey border.



Strategy 2: Find a Pattern, and Draw a Diagram

The first square has 4 tiles.

The second square contains $4 + 12 = 16$ tiles.

The third square contains $16 + 20 = 36$ tiles.

The number of tiles in each case is a square number.

Square	No. of Tiles
1st	$4 = 2^2$
2nd	$16 = 4^2$
3rd	$36 = 6^2$

We could reasonably guess that there would be $8^2 = 64$ tiles in the 4th square.

After recognising the square pattern, we might also notice that each triangle can be cut in half and re-assembled as a square.

We can use this idea to construct patterns from square tiles, that are the same size and have the same number of tiles as Joey is using.

After adding the next grey border, the 4th square will contain $8^2 = 64$ tiles.

The next grey border uses $64 - 36 = 28$ tiles.



Joey's tiles	Square tiles

Follow-Up: What colour is the border that uses 44 tiles? [Grey]



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1D. How many small bottles do I have?

Strategy 1: Build a Table, and Find a Pattern

In the question, the capacity of a water bottle is stated in millilitres, but the total amount of water is given in litres.

To avoid confusion, we will convert the total amount of water into a quantity measured in millilitres.

In total, the bottles have a capacity of 2200 mL.

Litres	Millilitres
1	1000
2	2000
2.2	2200

Small bottles hold 150 mL.

If all 10 bottles were small, then the total capacity would be $10 \times 150 \text{ mL} = 1500 \text{ mL}$.

Small bottles	10				
Large bottles	0				
Total water (mL)	1500				

With 9 small and 1 large bottle, the total capacity would be $9 \times 150 + 1 \times 250 = 1600 \text{ mL}$.

With 8 small and 2 large bottles, the total capacity would be $8 \times 150 + 2 \times 250 = 1700 \text{ mL}$.

Exchanging a single 150 mL bottle for a 250 mL bottle increases the total capacity by 100 mL.

(Why is this?)

Small bottles	10	9	8		
Large bottles	0	1	2		
Total water (mL)	1500	1600	1700		

Arrows above the table: from 10 to 9 (-1), from 0 to 1 (-1).
Arrows below the table: from 1500 to 1600 (+100), from 1600 to 1700 (+100).

The total capacity of my bottles is 2200 mL.

This is $2200 - 1700 = 500 \text{ mL}$ more than we have when there are 8 small bottles.

We need to exchange a further $500 \div 100 = 5$ small bottles for large bottles.

I have $8 - 5 = 3$ small bottles in total.

Small bottles	10	9	8	...	3
Large bottles	0	1	2	...	7
Total water (mL)	1500	1600	1700	...	2200

Arrows above the table: from 8 to ... (-1), from 2 to ... (-1), from ... to 3 (-5 x 1).
Arrows below the table: from 1700 to ... (+100), from ... to 2200 (+100), from ... to 2200 (+5 x 100).

Strategy 2: Draw a Diagram

Let's begin by assuming that all of the bottles have a capacity of 250 mL.

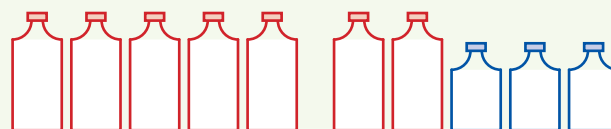
In total, they will hold $10 \times 250 \text{ mL} = 2500 \text{ mL}$.



Exchanging a 250 mL for a 150 mL bottle will reduce the total capacity by $250 - 150 = 100 \text{ mL}$.

We need to reduce the total capacity by $2500 - 2200 = 300 \text{ mL}$.

$300 \text{ mL} = 3 \times 100 \text{ mL}$, so we should exchange 3 bottles.



In total, I have 7 large bottles, and 3 small bottles.

Follow-Up: If I had 20 bottles that together have a capacity of 3.1 litres, how many small bottles would there be? [19]



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1E. In how many different ways can Sara buy exactly 56 chocolate bars?

Strategy 1: Build a Table

Sara buys exactly 56 chocolate bars, in boxes of 6 or 10.

Since $56 \div 10 = 5$ remainder 6, the largest possible number of boxes of 10 bars is 5.

If Sara buys $5 \times 10 = 50$ bars, she will need $56 - 50 = 6$ more bars to make up the total.

She can do this by buying one box of 6 bars.

No. of boxes of 10 bars	5					
No. of boxes of 6 bars	1					
Total bars	56					
No. of boxes in total	6					

If Sara buys $4 \times 10 = 40$ bars, she will need $56 - 40 = 16$ more bars to make up the total.

If Sara buys $3 \times 10 = 30$ bars, she will need $56 - 30 = 26$ more bars to make up the total.

Neither 16 nor 26 is divisible by 6.

No. of boxes of 10 bars	5	4	3			
No. of boxes of 6 bars	1					
Total bars	56					
No. of boxes in total	6					

If Sara buys $2 \times 10 = 20$ bars, she will need $56 - 20 = 36$ more bars to make up the total.

36 is divisible by 6.

Sara can buy $36 \div 6 = 6$ boxes of 6 bars.

No. of boxes of 10 bars	5	4	3	2	1	0
No. of boxes of 6 bars	1			6		
Total bars	56			56		
No. of boxes in total	6			8		

Continuing the table, we can see that there are no other ways to buy exactly 56 chocolate bars.

There are 2 different ways for Sara to buy exactly 56 chocolate bars.

Strategy 2: Reason Arithmetically

Chocolate bars come in boxes of 6 or 10.

Multiples of 6 are:

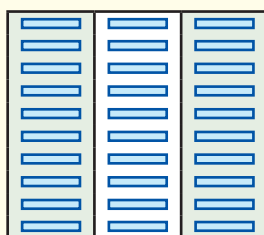
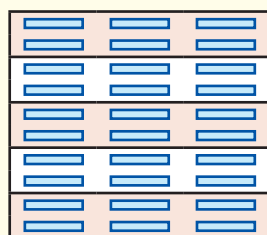
6, 12, 18, 24, 30, 36, 42, 48, 54, 60

Multiples of 10 are:

10, 20, 30, 40, 50, 60, 70, 80, 90, 100

The lowest common multiple here is 30.

Multiples of 30 are multiples of both 6 and 10.

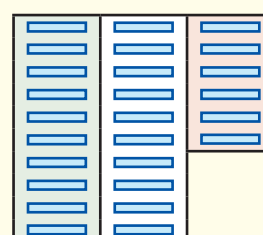


56 chocolate bars can be arranged as one group of 30, with $56 - 30 = 26$ chocolate bars remaining.

To buy exactly 26 chocolate bars, Sara would need to buy two boxes of 10, and one box of 6.

There are then 2 different ways that she could buy the other 30 bars.

In total, there are 2 ways that Sara could buy exactly 56 bars.



Follow-Up: In how many different ways could Sara buy exactly 70 chocolate bars? [$3: 7 \times 10, 4 \times 10 + 5 \times 6, 1 \times 10 + 10 \times 6$]