APSMO

MATHS GAMES

WEDNESDAY 23 MARCH 2022

MATHS GAMES
JUNIOR
1

Suggested Time: ***30 Minutes***

Write your answers in the boxes on the back.

←

Keep your answers hidden by folding backwards on this line.

1A. Peter made marmalade sandwiches and vegemite sandwiches.

He made 8 more marmalade sandwiches than vegemite sandwiches.

He made 30 sandwiches in total.

How many marmalade sandwiches did Peter make?

Hint: You could guess a number of marmalade sandwiches, and see if it works.

1B. Four girls were comparing the lengths of their jelly snakes.

Amy's snake wasn't the shortest or the longest.

Cassie's snake was longer than Julia's snake.

Riley's snake had a length that was between that of Julia's snake and Amy's snake.

Who had the second longest snake?

Hint: You could draw four snakes in order of length. Which snake can't belong to Julia?

1C. Jeff, Katelyn and Lucy are motorcycle pizza delivery drivers.

Together, Jeff and Katelyn can carry 18 pizzas in total, in the carriers on their motorcycles.

Katelyn and Lucy can carry 19 pizzas in total.

Jeff and Lucy can carry 13 pizzas in total.

How many pizzas can Katelyn carry on her motorcycle by herself?

Hint: Does Katelyn's motorcycle carry more or less than Jeff's motorcycle? How do you know?

1D. Ice is sold in 5kg bags and 2kg bags.

During a power outage, Dan bought all of the ice at his local store.

He ended up with 32kg of ice in 10 bags.

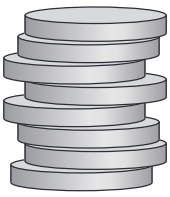
How many 5kg bags of ice did Dan buy?

Hint: How many kilograms of ice would Dan have if he only bought 2kg bags?

1E. Tessa has 20 counters.

She puts the counters in 5 piles so there is a different number of counters in each pile.

What is the smallest possible number of counters she could have in the largest pile?



Hint: What is the smallest number of counters required to make five differently sized piles?

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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: 19	**1B:** Amy	**1C:** 12	**1D:** 4	**1E:** 6

1A. The question is, How many marmalade sandwiches did Peter make?

Strategy 1: **Guess, Check and Refine**

Let's guess that Peter made **10** marmalade sandwiches.

He's made **8** more marmalade than vegemite, so he's also made **10 – 8 = 2** vegemite sandwiches.

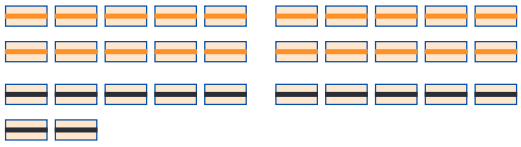
All together, Peter would have **10 + 2 = 12** sandwiches.

If Peter made **20** marmalade sandwiches,

then he's also made **20 – 8 = 12** vegemite sandwiches.

All together, Peter would have **20 + 12 = 32** sandwiches.

That's too many, but it's pretty close.

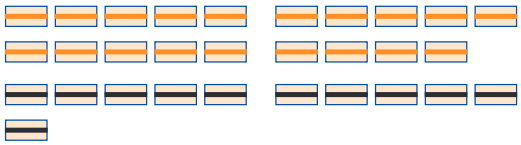


If Peter made **19** marmalade sandwiches,

then he's also made **19 – 8 = 11** vegemite sandwiches.

All together, Peter would have **19 + 11 = 30** sandwiches.

That matches the question.



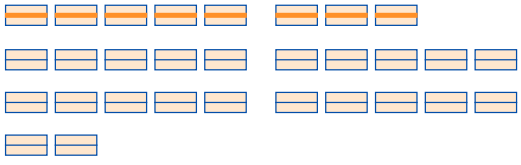
Peter made **19** marmalade sandwiches.

Strategy 2: **Draw a Diagram**

Peter made **8** more marmalade sandwiches than vegemite sandwiches.

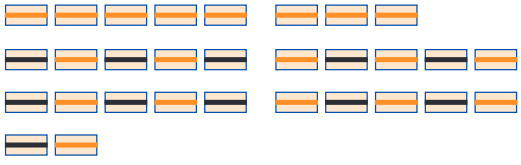
Let's suppose he made those **8** marmalade sandwiches first.

He then set out the bread, ready to make the other **30 – 8 = 22** sandwiches.



If Peter now makes equal numbers of vegemite and marmalade sandwiches, he will continue to have **8** more marmalade sandwiches than vegemite sandwiches.

He might do this by making the sandwiches in pairs.



In his sandwich pairs, Peter has made **22 ÷ 2 = 11** marmalade and **22 ÷ 2 = 11** vegemite sandwiches.

In total, Peter made **8 + 11 = 19** marmalade sandwiches.

Follow-Up: *Peter ate one of the marmalade sandwiches for breakfast, and one of the vegemite sandwiches for lunch, every day. One day, he was about to get his breakfast when he realised that exactly one-third of his remaining sandwiches were vegemite. How many sandwiches had he eaten?* [6]

1B. The question is, Who had the second longest snake?

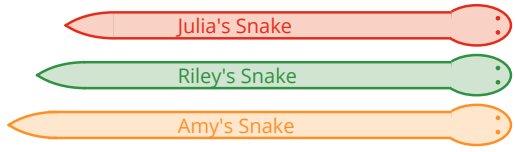
Strategy 1: **Draw a Diagram, and Reason Logically**

Since the length of Riley's snake is between that of Julia's and Amy's snakes, there are two possible options.

Option 1: Julia's snake is longer than Riley's, and Amy's snake is shorter than Riley's.

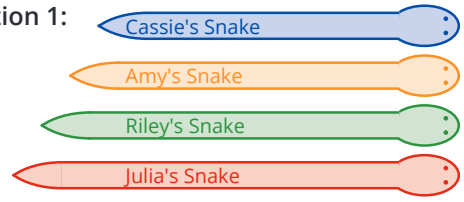
OR

Option 2: Julia's snake is shorter than Riley's, and Amy's snake is longer than Riley's.



We know that Amy's snake wasn't the shortest or the longest.
This means that there are two possibilities for the last snake, which belongs to Cassie.

Option 1:



OR

Option 2:

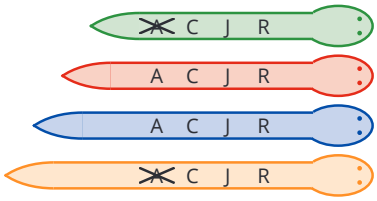
Since Cassie's snake was longer than Julia's snake, only **Option 2** satisfies all of the conditions.

Therefore, the second longest snake belongs to **Amy**.

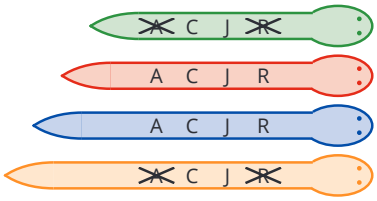
Strategy 2: **Draw a Diagram, and Reason Logically (2)**

Let's draw the four jelly snakes.

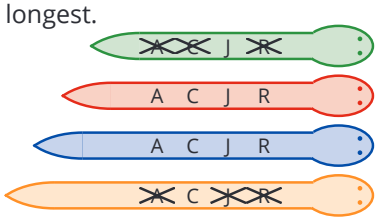
Amy's snake is not the shortest or the longest.



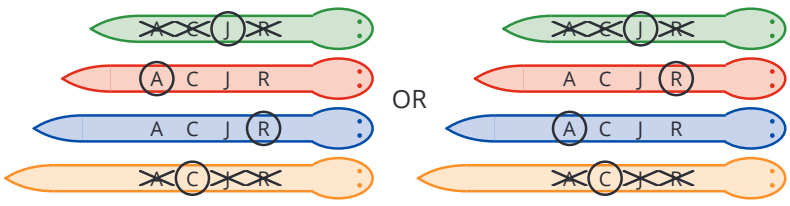
Riley's snake is between Julia's snake and Amy's snake, so it's not shortest or longest either.



Cassie's snake is longer than Julia's, so Cassie's not the shortest, and Julia's not the longest.



We now know which snake is Julia's, and which snake is Cassie's. So the two middle-sized snakes must belong to Amy and Riley.



Riley's snake is between Julia's and Amy's, so it would have to be the solution on the right.

The second longest snake must belong to **Amy**.

Follow-Up: *Cassie ate the end of her jelly snake, and now it is shorter than Julia's. Who has the second longest snake now?* [RIley]

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1C. The question is, How many pizzas can Katelyn carry on her motorcycle by herself?

Strategy 1: **Guess, Check and Refine**

Suppose Katelyn can carry 10 pizzas on her motorcycle.
With Jeff, she can carry 18. So Jeff can carry 18 – 10 = 8 pizzas.
With Lucy, she can carry 19. So Lucy can carry 19 – 10 = 9 pizzas.
Together, Jeff and Lucy can carry 8 + 9 = 17 pizzas.

Katelyn's Pizzas	10				
Jeff's Pizzas	8				
Lucy's Pizzas	9				
Jeff + Lucy	17				

Suppose Katelyn can carry 11 pizzas on her motorcycle.
With Jeff, she can carry 18. So Jeff can carry 18 – 11 = 7 pizzas.
With Lucy, she can carry 19. So Lucy can carry 19 – 11 = 8 pizzas.
Together, Jeff and Lucy can carry 7 + 8 = 15 pizzas.

Katelyn's Pizzas	10	11			
Jeff's Pizzas	8	7			
Lucy's Pizzas	9	8			
Jeff + Lucy	17	15			

We're getting close - We want a solution where Jeff and Lucy together can carry 13 pizzas.

Let's increase our guess for Katelyn even further.

Suppose Katelyn can carry 12 pizzas on her motorcycle.
With Jeff, she can carry 18. So Jeff can carry 18 – 12 = 6 pizzas.
With Lucy, she can carry 19. So Lucy can carry 19 – 12 = 7 pizzas.
Together, Jeff and Lucy can carry 6 + 7 = 13 pizzas.

Katelyn's Pizzas	10	11	12		
Jeff's Pizzas	8	7	6		
Lucy's Pizzas	9	8	7		
Jeff + Lucy	17	15	13		

That matches the question, so we can see that Katelyn can carry **12** pizzas on her motorcycle.

Strategy 2: **Reason Logically**

Let's think of pairs of motorcycle delivery drivers, working on three separate deliveries.

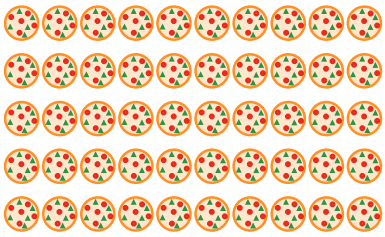
For Delivery 1, Jeff and Katelyn delivered **18** pizzas.

For Delivery 2, Katelyn and Lucy delivered **19** pizzas.

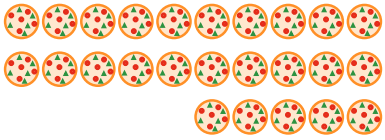
For Delivery 3, Jeff and Lucy delivered **13** pizzas.

In those three deliveries:

- Each driver carried their maximum load.
- 18 + 19 + 13 = **50** pizzas were delivered.
- Each driver went out twice.

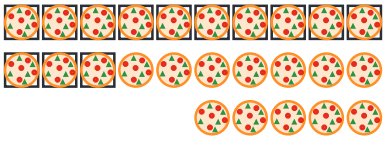


This means that, if each driver only went out once, then together they would have delivered **50** ÷ **2** = **25** pizzas.



Working together, Jeff and Lucy are able to deliver **13** pizzas.

So Katelyn must be able to carry **25** – **13** = **12** pizzas on her motorcycle.



Follow-Up: *Morgan starts work as another motorcycle pizza delivery driver. Together, Morgan and Jeff can carry 16 pizzas. Working together, how many pizzas can Morgan and Lucy carry on their motorcycles?* [17]

1D. The question is, How many 5 kg bags of ice did Dan buy?

***Strategy 1:* Guess, Check and Refine**

Let's guess that Dan bought **5** bags containing **5** kg of ice.
He would have **5** × **5** kg = **25** kg of ice in **5** kg bags.
Dan would then have **10** – **5** = **5** bags containing **2** kg of ice.
That's **5** × **2** kg = **10** kg of ice in **2** kg bags.
In total, Dan would have **25** kg + **10** kg = **35** kg of ice.

No. of 5 kg bags	5			
Ice in 5 kg bags (kg)	25			
No. of 2 kg bags	5			
Ice in 2 kg bags (kg)	10			
Total ice (kg)	35			

That's too much. The question says that Dan ended up with **32** kg of ice.

To end up with less ice, we might swap one of the **5** kg bags for a **2** kg bag.

Suppose Dan bought **4** bags containing **5** kg of ice.
He would have **4** × **5** kg = **20** kg of ice in **5** kg bags.
There would be **10** – **4** = **6** bags containing **2** kg of ice,
for a total of **6** × **2** kg = **12** kg of ice in **2** kg bags.
In total, Dan would have **20** kg + **12** kg = **32** kg of ice.

No. of 5 kg bags	5	4		
Ice in 5 kg bags (kg)	25	20		
No. of 2 kg bags	5	6		
Ice in 2 kg bags (kg)	10	12		
Total ice (kg)	35	32		

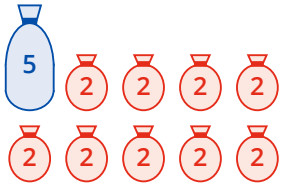
That matches the question, so we can see that Dan bought **4** bags each containing **5** kg of ice.

***Strategy 2:* Draw a Diagram, and Reason Logically**

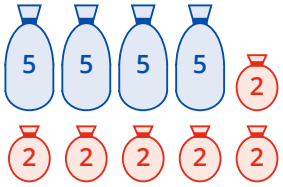
If each of the bags contained **2** kg of ice, Dan would have **10** × **2** kg = **20** kg of ice.

This is **32** kg – **20** kg = **12** kg less than what he actually has.

By swapping a **2** kg bag for a **5** kg bag, Dan increases the amount of ice by **5** kg – **2** kg = **3** kg.



To increase the amount of ice by **12** kg, he would need to do this swap **12** kg ÷ **3** kg = **4** times.

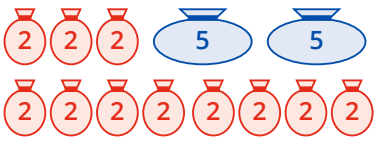


Dan bought **four** **5** kg bags.

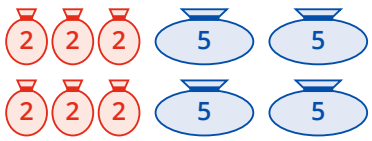
***Strategy 3:* Draw a Diagram, and Reason Logically**

If Dan bought **32** kg in **2** kg bags, then he would have **32** kg ÷ **2** kg = **16** bags.

If he swaps five **2** kg bags for two **5** kg bags, he would have **13** bags.



If he swaps another five **2** kg bags for two **5** kg bags, he would have **10** bags.



Since Dan bought **10** bags of ice, **4** of them must have been **5** kg bags.

Follow-Up: *Harry wants to buy 20 kg of ice. In how many different ways can he do this, if ice is only sold in 2kg and 5kg bags?*
[3 ways: Four 5kg bags, two 5kg bags + five 2kg bags, or ten 2kg bags]

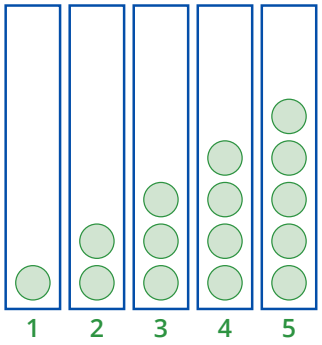
1E. The question is, What is the smallest possible number of counters Tessa could have in the largest pile?

***Strategy 1:* Draw a Diagram, and Reason Logically**

It doesn't make sense to have a pile of **0** counters, so the smallest number of counters in a pile is **1**.

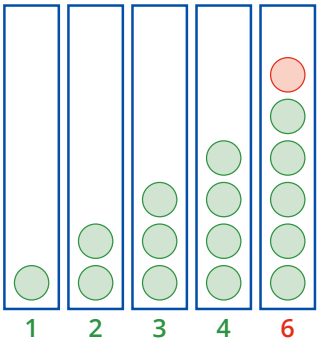
Every pile has a different number of counters, so the next smallest piles would have **2**, **3**, **4** and **5**.

So far, there are **1 + 2 + 3 + 4 + 5 = 15** counters in the five piles.



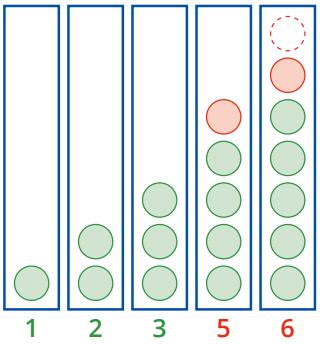
Tessa needs to place the 16th counter.

Each pile has a different number of counters, so her only option is to add it to the largest pile.



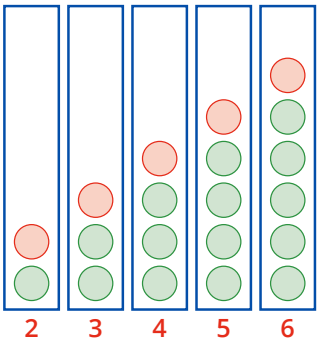
Both of the largest piles are now possible for the 17th counter.

To keep the largest pile as small as possible, Tessa can put the 17th counter in the second-largest pile.



Using similar reasoning, the 18th, 19th and 20th counters can be placed in the three smaller piles.

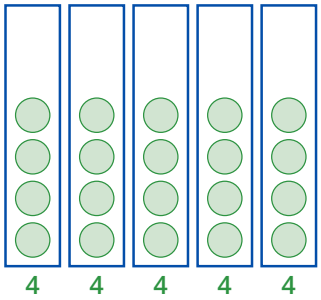
Tessa must have at least **6** counters in the largest pile.



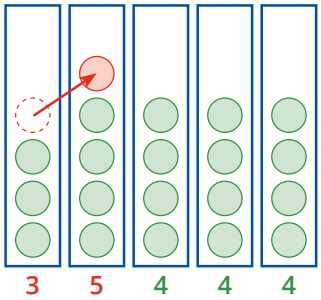
***Strategy 2:* Draw a Diagram, and Reason Logically (2)**

Suppose Tessa starts with the counters as evenly distributed as possible.

With **20** counters in **5** piles, she could have **20 ÷ 5 = 4** counters in each pile.

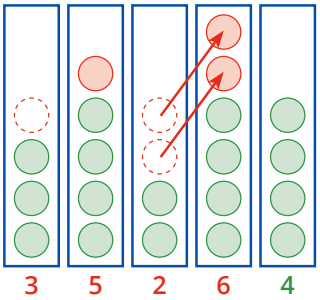


If Tessa moves a counter from one pile to another, she still has **20** counters, but the number of counters in both of those piles will change.



If Tessa does this again, she'll end up with piles that are the same size as the ones she created last time.

However, if she moves two counters from one pile to another, she will end up with more differently-sized piles.



Tessa's largest pile must contain at least **6** counters.

Follow-Up: *What is the largest number of counters that Tessa could have in the smallest pile?* [2]