APSMO
PREPARATION PAPER

MATHS GAMES
JUNIOR

Suggested Time: ***30 Minutes***

A. What is the value of the following?

$$(7 \times 6) + (3 \times 6) + (7 \times 4) + (3 \times 4)$$

B. Barry is 8 years older than Harry.
The sum of their ages is 34.
How old is Harry?

C. Tim's wallet has four cards in a stack.
His ID card is above his library card.
He has his library card between his bank card and his travel pass.
His travel pass is between his ID card and his bank card.
Which card is at the bottom of the stack?

D. Jemima, Beatrix and Kahlee all brought muesli bars for a camping trip.
Jemima brought half as many as Beatrix.
Kahlee brought three more than Beatrix.
All together, they brought 23 muesli bars.
How many muesli bars did Jemima bring?

E. It takes three strokes to write a letter H.
It takes two strokes to write a letter T.

Gwen tossed a coin 20 times.
She wrote H every time the coin landed with Heads up, and T every time the coin landed with Tails up.
She ended up with 47 strokes on the paper.
How many times did the coin land with Heads showing?

Write your answers in the boxes on the back.

←

Keep your answers hidden by folding backwards on this line.

APSMO
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A.

B.

C.

D.

E.

Student Name:

Fold here. Keep your answers hidden.

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Suggested Time: ***30 Minutes***

A. What is the value of the following?

$$(7 \times 6) + (3 \times 6) + (7 \times 4) + (3 \times 4)$$

Hint: How might you represent 7 × 6 as a diagram?

B. Barry is 8 years older than Harry.
The sum of their ages is 34.
How old is Harry?

Hint: Try guessing an age for Harry, and seeing if it works.

C. Tim's wallet has four cards in a stack.
His ID card is above his library card.
He has his library card between his bank card and his travel pass.
His travel pass is between his ID card and his bank card.
Which card is at the bottom of the stack?

Hint: Draw a diagram to show a possible order for Tim's cards, and then check to see if it works.

D. Jemima, Beatrix and Kahlee all brought muesli bars for a camping trip.
Jemima brought half as many as Beatrix.
Kahlee brought three more than Beatrix.
All together, they brought 23 muesli bars.
How many muesli bars did Jemima bring?

Hint: You could guess a number of muesli bars for Jemima.

E. It takes three strokes to write a letter H.
It takes two strokes to write a letter T.

Gwen tossed a coin 20 times.
She wrote H every time the coin landed with Heads up, and T every time the coin landed with Tails up.
She ended up with 47 strokes on the paper.
How many times did the coin land with Heads showing?

Hint: How many strokes would Gwen have written, if the coin had landed Tails up every time?

Write your answers in the boxes on the back.

←

Keep your answers hidden by folding backwards on this line.

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A.

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Fold here. Keep your answers hidden.

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Solutions and Answers

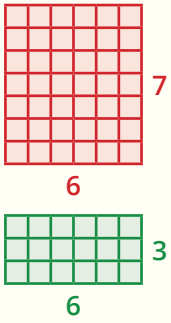
(Items in parentheses are not required)

A: 100	**B:** 13	**C:** Bank Card	**D:** 4	**E:** 7

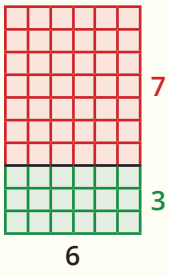
A. The question is, What is the value of (7 × 6) + (3 × 6) + (7 × 4) + (3 × 4)?

Strategy 1: **Draw a Diagram**

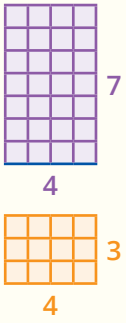
We can use area diagrams to represent (7 × 6) and (3 × 6).



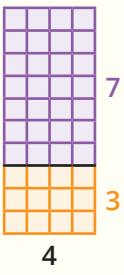
Putting these diagrams together, we can see that (7 × 6) + (3 × 6) = 10 × 6.



We can also use area diagrams to represent (7 × 4) and (3 × 4).



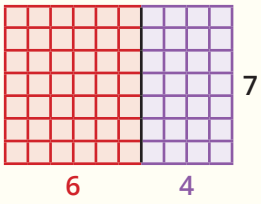
Putting these diagrams together, we can see that (7 × 4) + (3 × 4) = 10 × 4.



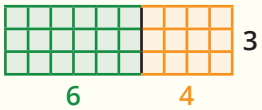
We can see that (7 × 6) + (3 × 6) + (7 × 4) + (3 × 4) = (10 × 6) + (10 × 4) = 60 + 40 = **100**.

Strategy 2: **Draw a Diagram (Alternative Approach)**

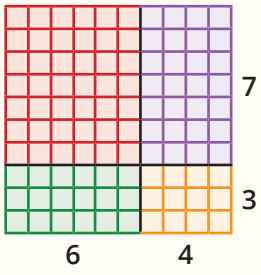
With area diagrams to represent (7 × 6) and (7 × 4),



and (3 × 6) and (3 × 4),



we can produce a single diagram that represents (7 × 6) + (3 × 6) + (7 × 4) + (3 × 4).

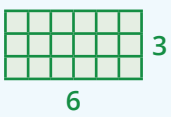


(7 × 6) + (3 × 6) + (7 × 4) + (3 × 4) = 10 × 10 = **100**.

Strategy 3: **Perform the calculation**

7 × 6 = 42.

3 × 6 = 18.



7 × 4 = 28.

3 × 4 = 12.

We can now add all of the values together.

(7 × 6) + (3 × 6) + (7 × 4) + (3 × 4)

= 42 + 18 + 28 + 12

= 100.

$$\begin{array}{r} {\scriptstyle 2} \\ 42 \\ 18 \\ 28 \\ +\,12 \\ \hline 100 \end{array}$$

Follow-Up: *What is the value of (2 × 5) + (3 × 5) + (5 × 5) + (2 × 4) + (3 × 4) + (5 × 4)?* [90]

B. The question is, How old is Harry?

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

Let's guess that Harry is 10 years old.
Barry is 8 years older, so Barry is 10 + 8 = 18 years old.
The sum of their ages would be 10 + 18 = 28.
The question says that the sum of their ages should be 34.

Harry's age	10				
Barry's age	18				
Sum of ages	28				

Suppose Harry is 12 years old.
Barry is 8 years older, so Barry is 12 + 8 = 20 years old.
The sum of their ages would be 12 + 20 = 32.
This is very close to our target sum of 34.

Harry's age	10	12			
Barry's age	18	20			
Sum of ages	28	32			

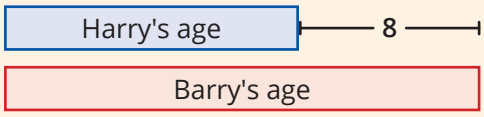
Suppose Harry is 13 years old.
Barry is 8 years older, so Barry is 13 + 8 = 21 years old.
The sum of their ages would be 13 + 21 = 34.
This matches the question.

Harry's age	10	12	13		
Barry's age	18	20	21		
Sum of ages	28	32	34		

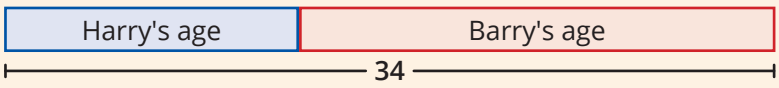
Harry is **13** years old.

Strategy 2: **Draw a Diagram**

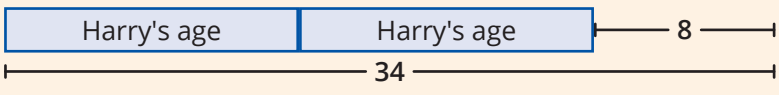
We can draw a bar to represent Harry's age.
Barry is 8 years older than Harry.



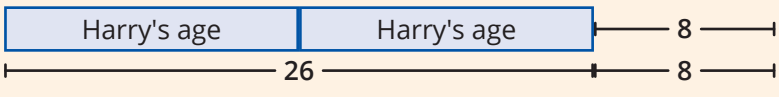
The sum of their ages is 34.



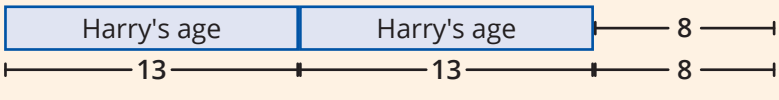
We can replace the bar representing Barry's age, with Harry's age plus 8 years.



By doing this, we can see that 34 – 8 = 26 is double Harry's age.



Harry must therefore be 26 ÷ 2 = **13** years old.



Follow-Up: *Harry is 20 cm shorter than Barry. The sum of their heights is 3 metres 40 cm. How tall is Barry?* [180 cm, or 1 m 80 cm]

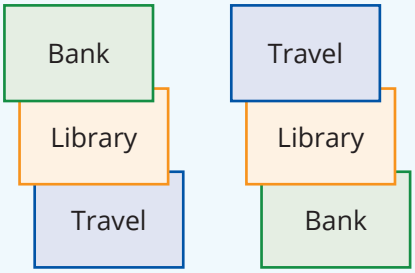
C. The question is, Which card is at the bottom of the stack?

Strategy 1: **Draw a Diagram**

Tim's ID card is above his library card.

His library card is between his bank card and his travel pass.

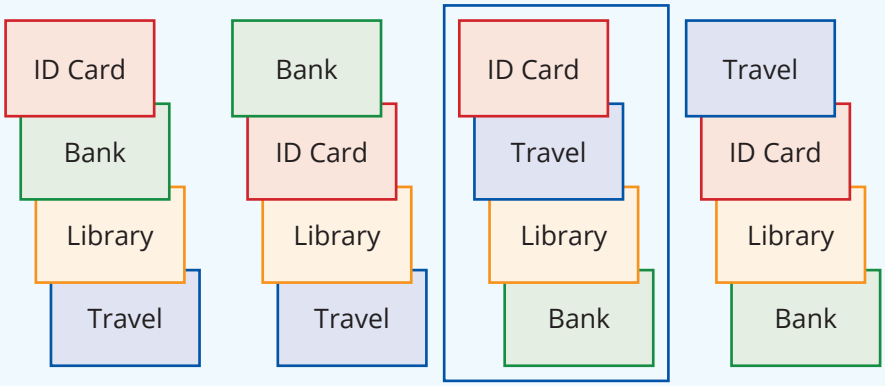
There are two different ways that this can happen.



With the ID card above the library card, there are four different ways that the cards can be arranged.

Of these, there is only one arrangement where Tim's travel pass is between his ID card and his bank card.

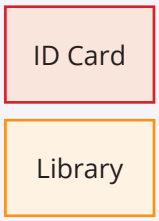
The card at the bottom is the **bank card**.



Strategy 2: **Eliminate All But One Possibility**

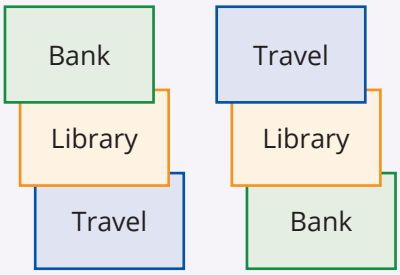
We want to find the card at the bottom of the stack.

Tim's ID card is above his library card, so it won't be his ID card.



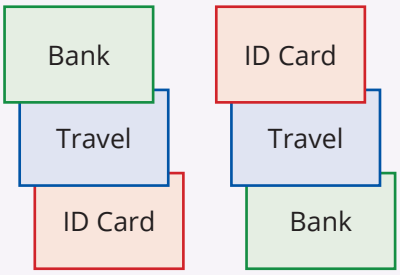
His library card is between his bank card and his travel pass.

This means that his library card cannot be on the bottom of the stack either.



His travel pass is between his ID card and his bank card.

This means that his travel pass won't be on the bottom of the stack.



The only card that we have not eliminated is Tim's bank card.

The **bank card** must be the card at the bottom of the stack.

Follow-Up: *Tim adds a loyalty card from a cafe to the stack of cards in his wallet. He put it between his ID card and his library card. In how many places could he insert this card?* [2]

D. The question is, How many muesli bars did Jemima bring?

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

Let's guess that Jemima brought 5 muesli bars.
She brought half as many as Beatrix, so Beatrix would have 2 × 5 = 10.
Kahlee brought 3 more than Beatrix, so Kahlee brought 10 + 3 = 13.
All together, they would have brought 5 + 10 + 13 = 28 muesli bars.
The question says that the three girls brought 23 muesli bars in total.

Jemima	5				
Beatrix	10				
Kahlee	13				
Total	28				

Let's guess that Jemima brought 3 muesli bars.
She brought half as many as Beatrix, so Beatrix would have 2 × 3 = 6.
Kahlee brought 3 more than Beatrix, so Kahlee brought 6 + 3 = 9.
All together, they would have brought 3 + 6 + 9 = 18 muesli bars.
18 is too few.

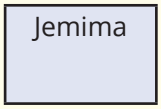
Jemima	5	3			
Beatrix	10	6			
Kahlee	13	9			
Total	28	18			

Jemima brought more than 3, and fewer than 5, muesli bars.
If Jemima brought 4, then Beatrix would have 2 × 4 = 8.
Kahlee brought 3 more than Beatrix, so Kahlee brought 8 + 3 = 11.
All together, they would have brought 4 + 8 + 11 = 23 muesli bars.
That matches the question. Jemima brought **23** muesli bars.

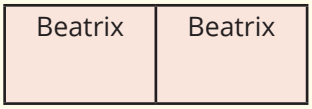
Jemima	5	3	4		
Beatrix	10	6	8		
Kahlee	13	9	11		
Total	28	18	23		

***Strategy 2:* Draw a Diagram**

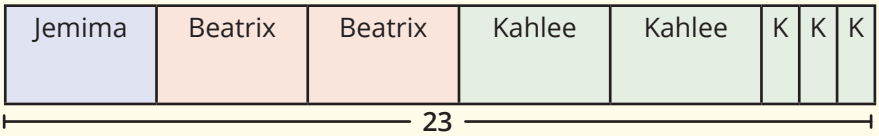
Suppose we lay all of Jemima's muesli bars side by side, and they take up this much space.



Jemima has half as many as Beatrix, so Beatrix's muesli bars would take up twice as much space as Jemima's.

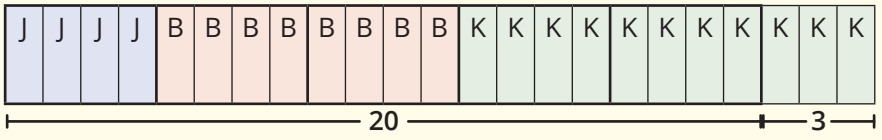


Kahlee brought 3 more than Beatrix.
All together, there were 23 muesli bars.



If we take away 3 of Kahlee's muesli bars, there will be 5 times as many muesli bars as Jemima brought.

Jemima brought 20 ÷ 5 = 4 muesli bars.



Follow-Up: *Beatrix and Kahlee each eat one of their muesli bars every day. After how many days will Beatrix have half as many muesli bars as Kahlee?* [5]

E. The question is, How many times did the coin land with Heads showing?

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

Gwen tossed the coin **20** times.

Let's guess that the coin landed Heads up **10** times and Tails up **10** times.

If so, Gwen would have drawn **(10 × 3) + (10 × 2) = 30 + 20 = 50** strokes.

Heads	10				
Tails	10				
Strokes	50				

If the coin landed Heads up **11** times and Tails up **9** times, Gwen would have **(11 × 3) + (9 × 2) = 33 + 18 = 51** strokes on her paper.

That's getting further away from the result we want.

Let's try for fewer Heads.

Heads	10	11			
Tails	10	9			
Strokes	50	51			

If the coin landed Heads up **8** times and Tails up **12** times, Gwen would have **(8 × 3) + (12 × 2) = 24 + 24 = 48** strokes on her paper.

We need to reduce by one more stroke.

Heads	10	11	8		
Tails	10	9	12		
Strokes	50	51	48		

If the coin landed Heads up **7** times and Tails up **13** times, Gwen would have **(7 × 3) + (13 × 2) = 21 + 26 = 47** strokes on her paper.

This matches the question.

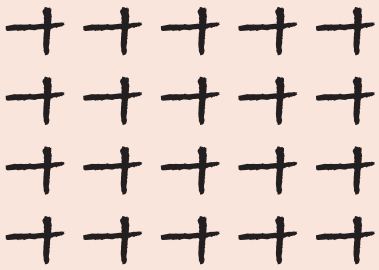
There were **7** times when Gwen's coin landed Heads up.

Heads	10	11	8	7	
Tails	10	9	12	13	
Strokes	50	51	48	47	

Strategy 2: **Draw a Diagram**

Every time Gwen tosses the coin, she will put at least two strokes on her piece of paper.

After **20** coin tosses, Gwen will have at least **20 × 2 = 40** strokes on the paper.



Gwen had **47** strokes on the paper.

The extra **7** strokes can be distributed among the **20** ***T***s to turn them into ***H***s.

For our purposes, it doesn't matter which of the ***T***s get turned into ***H***s.

Gwen's coin landed Heads up **7** times.

Follow-Up: *Gwen kept tossing her coin and drew another 47 strokes. What is the smallest number of extra coin tosses she could have done?* [16]