





## **MPORTANT**

The information contained in this file is ONLY for the use of registered participants of the 2024 APSMO Maths Games.

All questions and solutions are copyright © 2024 by Australasian Problem Solving Mathematical Olympiads (APSMO) Inc. All rights reserved.

This file and/or its contents must NOT be distributed by any means, including electronically, without written consent from Australasian Problem Solving Mathematical Olympiads (APSMO) Inc.

This file and/or its contents must NOT be made available on the internet in any format. This includes school websites.





# APSMO 2024 MATHS GAMES

#### **ORGANISATION AND PROCEDURES** For full details, see the Members' Area

• Maths Games papers are to be conducted under test conditions.

DO	DO NOT		
<ul> <li>Supervise students at all times.</li> <li>Maintain silence.</li> <li>Provide blank working paper.</li> <li>Collect, mark and retain the papers.</li> </ul>	<ul> <li>Print the papers prior to the scheduled date.</li> <li>Read the questions aloud to the students.</li> <li>Interpret the questions for students.</li> <li>Permit any discussion or movement around the room.</li> </ul>		
	• Permit the use of calculators or other electronic devices.		

- Papers should be scored by the PICO using the *Solutions and Answers* sheet provided.
- Original student answer sheets should be retained by the PICO until the end of the year.

### Absent Students

- A student who is legitimately absent on the date of the Maths Games paper, may sit the paper on their return to school.
- If an absent student does not sit the paper on their return to school they should be marked as 'absent'.
- Note: This policy differs from the Maths Olympiads Absent Student Policy which has additional requirements.

Conv Art	APSAGA WEDNESDAY 12 JUNE 2024	MATHS GAMES JUNIOR
	Suggested Time: <b>30 Minutes</b>	
2A.	On April 1, Zach found out that he would be getting a puppy on June 12. To count down the days until the puppy arrives, he drew a calendar with all of the dates from April 1 until June 12. How many times would Zach write the digit 3 on his calendar? Hint: You could draw Zach's calendar.	Write your answers in the boxes on the back. Keen your
2B.	In this addition problem, a single digit goes in each box. What four-digit number would $A B C D$ represent? Hint: What is the only possible value for the box marked D? A 1 6 5	Keep your answers hidden by folding backwards on this line.
2C.	Jane bought boxes of sushi for a staffroom lunch. Each box of sushi came with six packets of soy sauce. During the lunch, Jane's team used fourteen packets of soy sauce. Jane put half of the remaining packets of soy sauce in the staffroom kitchen, and took the last eight packets home. How many boxes of sushi did Jane buy? Hint: How many packets of soy sauce did Jane leave in the staffroom kitchen?	
2D. 2E.	Luca grows zucchinis. So far, he has picked 10 zucchinis, with an average mass of 100g. He then found a huge zucchini at the back of the patch. This took the average mass of Luca's zucchinis up to 150g. What was the mass of the huge zucchini, in grams? Hint: What would be the total mass of all of the zucchinis, including the huge zucchini? Tina is putting lettuce, tomato. cheese. and a burger patty on a bread	
££.	roll. She won't put the tomato and the cheese next to each other. In how many ways can Tina assemble the roll? Hint: In how many ways can Tina assemble the roll, if she puts the lettuce on first?	

A PS A PS A PS A PS A PS A PS A PS A PS	MATHS GAMES	<b>APSMO</b> WEDNESDAY 12 JUNE 2024	MATHS GAMES JUNIOR
<b>2A.</b>	Student Name:		
2B.	Fold here. Keep		
2C.	your answers hidden.		
2D.			
<b>2E.</b>			

WARD AND PROBLEM WARD AND PROBLEM WARD AND AND AND AND AND AND AND AND AND AN	APS WEDNESDAY 12	<b>MO</b> 2 JUNE 2024	MATHS GAMES JUNIOR			
	Solutions and Answe (Items in parentheses are not requin	<b>rs</b> red)				
<b>2A:</b> 10 <b>2B:</b> 843	37 <b>2C:</b> 5	<b>2D:</b> 650 (g)	<b>2E:</b> 12			
<b>A.</b> The question is, How many tim	es would Zach write the digit 3	on his calendar?				
Strategy 1: Build a Table						
Zach's calendar begins on AprThere are 30 days in April.April12345677Zach's calendar continues thr	Zach's calendar begins on April 1.         There are 30 days in April.         April 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30         Zach's calendar continues through May.					
May       1       2       3       4       5       6       7       3         Finally, Zach's calendar contin	May       1       2       3       4       5       6       7       8       9       10       11       12       13       14       15       16       17       18       19       20       21       22       23       24       25       26       27       28       29       30       31					
June 1 2 3 4 5 6 7 8	June     1     2     3     4     5     6     7     8     9     10     11     12					
The calendar includes the follo	owing instances of the digit <b>3</b> .					
April       1       2       3       4       5       6       7       8       9       10       11       12       13       14       15       16       17       18       19       20       21       22       23       24       25       26       27       28       29       30         May       1       2       3       4       5       6       7       8       9       10       11       12       13       14       15       16       17       18       19       20       21       22       23       24       25       26       27       28       29       30         May       1       2       3       4       5       6       7       8       9       10       11       12       13       14       15       16       17       18       19       20       21       22       23       24       25       26       27       28       29       30       31         June       1       2       3       4       5       6       7       8       9       10       11       12       14       15       16       17						
Strategy 2: Make an Organised List						
A month may have as little as 28 days, and as many as 31 days. In any full month, there will be 3 dates with 3 in the ones place: the 3rd, 13th, and 23rd of the month.	A month may also have dates tens place: the <b>30</b> th, and the <b>3</b> With <b>30</b> days in April, there are of the digit <b>3</b> . With <b>31</b> days in May, there are of the digit <b>3</b> .	that have a 3 in the 31st of the month. a 3 + 1 = 4 instances a 3 + 2 = 5 instances	Zach's calendar ends on June <b>12</b> . In June, there is just 1 instance of the digit <b>3</b> , for the <b>3</b> rd of June.			

Zach would write the digit **3** on his calendar, **4** + **5** + **1** = **10** times.

*Follow-Up:* Suppose Zach wanted to draw a calendar with every date for the whole year. For the 15th of February he would write 15/2, for the 6th of August he would write 6/8, and so on. How many times would Zach write the digit 3? [85]





#### Strategy 2: Build a Table

If there was only <b>1</b> box of sushi, there would not be enough for them to have <b>14</b> packets at lunch.	Boxes of sushi (guess)	Packets of soy sauce	Packets of soy sauce after lunch	Packets of soy sauce after leaving half in kitchen
	1	1 × 6 = <b>6</b>		

Boxes of sushi (guess)	Packets of soy sauce	Packets of soy sauce after lunch	Packets of soy sauce after leaving half in kitchen
1	1 × 6 = <b>6</b>		
2	2 × 6 = <b>12</b>		
3	3 × 6 = <b>18</b>	18 – 14 = <b>4</b>	4 ÷ 2 = <b>2</b>
4	4 × 6 = <b>24</b>	24 - 14 = <b>10</b>	10 ÷ 2 = <b>5</b>
5	5 × 6 = <b>30</b>	30 - 14 = <b>16</b>	16 ÷ 2 = <b>8</b>
	Boxes of sushi (guess) 1 2 3 4 4 5	Boxes of sushi (guess)Packets of soy sauce1 $1 \times 6 = 6$ 2 $2 \times 6 = 12$ 3 $3 \times 6 = 18$ 4 $4 \times 6 = 24$ 5 $5 \times 6 = 30$	Boxes of sushi (guess)Packets of soy saucePackets of soy sauce after lunch1 $1 \times 6 = 6$ 2 $2 \times 6 = 12$ 3 $3 \times 6 = 18$ $18 - 14 = 4$ 4 $4 \times 6 = 24$ $24 - 14 = 10$ 5 $5 \times 6 = 30$ $30 - 14 = 16$

*Follow-Up:* Suppose, for the same problem, Jane had taken 20 packets of soy sauce home. How many boxes of sushi would she have bought? [9]





As shown in Strategy 1, there are **6** ways to assemble the roll if lettuce goes on first, and tomato and cheese **can be** 

together. There are likewise **6** ways to assemble the roll if the burger goes on first, and so on.

In total, there are  $4 \times 6 = 24$  ways to assemble the roll.

We can now count the number of ways to assemble a roll where cheese and tomato **are** together.

Suppose the cheese and tomato **are** together, with the tomato on top of the cheese. There are then **6** ways to assemble the roll.

There are also **6** ways with the cheese directly on top of the tomato.

Therefore, there are 24 - 6 - 6 = 12 ways to assemble the roll, where the cheese and tomato **are not** together.



Follow-Up: In how many ways can Tina assemble the roll, if she also wants the lettuce and burger patty to be together? [4]

Copyright © 2024 Australasian Problem Solving Mathematical Olympiads (APSMO) Inc. All rights reserved.