

ANNUAL MATHLYMPICS

FOR ALL SINGAPORE PRIMARY SCHOOLS

Vault Section 2022

1 hour 30 minutes

Instructions to Mathlympians

1. Do not open the booklet until you are told to do so.
2. Attempt ALL 28 questions.
3. Diagrams are not drawn to scale.
4. Write your answers neatly on the ANSWER SHEET provided.
5. Marks are awarded for correct answers only.
6. Questions are NOT arranged in increasing levels of difficulty.
7. **No calculators may be used.**

Questions in Section A carry 2 marks each, questions in Section B carry 4 marks each and questions in Section C carry 5 marks each.

Organised by:



*Supporting Children battling with Cancer, through
SingHealth Duke-NUS Paediatric Academic Clinical
Programme – CCF Psychosocial and Supportive
Care for Paediatric Oncology Programme*

Section A

Each of the questions 1 to 10 carries 2 marks.

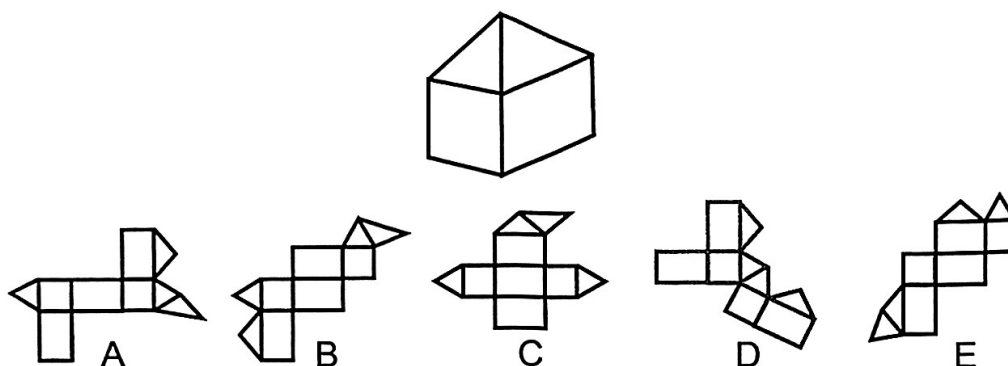
1. Helen thinks of a 3-digit number.
She rearranges the digits to form a smaller 3-digit number.
She then subtracts the two numbers and her answer is another 3-digit number with the same digits. What is the number Helen thought of at first?

2. Bloom, Musa, Aisha, Stella and Flora are sharing \$135.
Bloom gets as much more than Musa as Stella gets more than Flora, and Stella gets as much less than Aisha as Aisha gets less than Musa. How much does Aisha get?

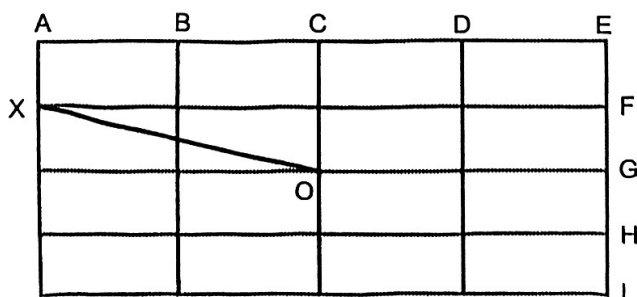
3. Mr Pang had a total of 270 duck and chicken eggs to sell. He sold 40 duck eggs and 40% of the chicken eggs. After that, the ratio of the number of duck eggs to chicken eggs he had was 1 : 4. If Mr Pang had sold twice as many chicken eggs as duck eggs, how many more chicken eggs than duck eggs did he have at the beginning?

4. Mr and Mrs Lim are selling tickets for a Charity concert. Each of Mr Lim's tickets is worth \$200 and each of Mrs Lim's tickets is worth \$50. Mr Lim has twice as many tickets to sell as Mrs Lim. If Mr Lim exchanges 8 of his \$200-tickets for 1 of Mrs Lim's \$50-tickets, then Mrs Lim will have 4 times as much worth of tickets as Mr Lim. How many \$200-tickets do they have together?

5. How many 5-digit numbers are multiples of both 24 and 35?
6. What is the least sum of 7 positive whole numbers which are not multiples of one another?
7. Which of the shapes, when folded up can form the 3D solid shown?



8. A cut is made from the centre of a rectangular grid, O, to X, a point at the edge. One quarter of the rectangular grid can be removed with another cut, also from the centre O to another point on the edge. What is this other point on the edge? Choose from points A to I.



9. A wizard has a bag of 9 magical precious stones. There are 3 each of Moonstones, Bloodstones and Sunstones. To qualify to be his apprentice, you have to follow the instructions given below to take out from the bag, 3 of the stones, one at a time, in the correct order.

Instructions:

1. A Sunstone cannot be taken out later than a Moonstone, and a Moonstone cannot be taken out later than a Sunstone.
2. A Moonstone cannot be taken out earlier than a Bloodstone, and a Bloodstone cannot be taken out earlier than a Moonstone.
3. If a Bloodstone is taken, not more than one of each of the other two stones can be taken.
4. The first stone taken out must be different from the other two stones.

What are the 3 stones to be taken out in order?

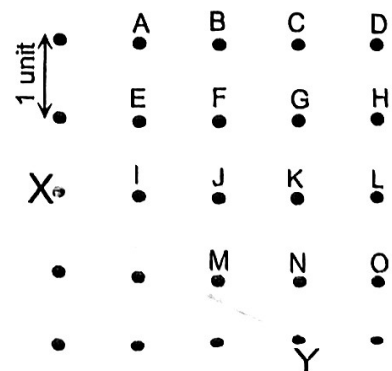
10. In the equation $\frac{A}{4} - \frac{B}{5} = \frac{A}{5} - \frac{C}{4}$, all the fractions are proper fractions, and the letters A, B and C represent different digits, what is the **largest** value of $A + B + C$?

Section B

Each of the questions 11 to 20 carries 4 marks.

11. Mr X and Mr Y both sell potatoes.
 Mr X gives a free apple for every 20 potatoes bought by his customers.
 Mr Y gives a free apple for every 10 potatoes bought by his customers.
 Both men start with an equal number of potatoes and an equal number of apples.
 At the end of the day, one of them has no apples left but still has 50 potatoes while the other has no potatoes left but still has 5 apples left.
 If each of Mr X's customers bought 20 potatoes and each of Mr Y's customers bought 10 potatoes, how many apples did each of the two men have at first?

12. A square number is the product of a number multiplied by itself.
 The smallest square number which is the sum of 2 other square numbers is 25, where $25 = 9 + 16$.
 The sum of these three square numbers is 50, that is $9 + 16 + 25 = 50$.
 The sum of another set of three square numbers (where one is the sum of the other two), is 338. What is the smallest square number in this set of three square numbers?
13. A is a 2-digit number. The two digits are different.
 A' is a 2-digit number which is made up of the digits of A in reverse order.
 The square of A is a number, X.
 The square of A' is a number, X' which is made up of the digits of X in reverse order.
 B is another 2-digit number with the same properties of A.
 What is the **largest** possible value of $A^2 + B^2$?
14. A quadrilateral made up of points X, Y and two other points has only 1 line of symmetry and has an area of 4 unit^2 . What are the other two points?



15. A landscaper wants to design a circuit pathway within a park. The pathway goes straight for x km, then makes a 45° right turn and continues for another x km, repeats another 45° right turn, and continues in the same manner until it returned to its starting point. If the entire circuit pathway is 5 km, what is the value of x in meters?
16. Mr Lee realised that the length of fence he had bought could just surround 3 sides of his rectangular garden. If each side of his garden is a whole number of metres and he had bought 43 m of fence, what is the greatest possible area of his garden?
17. You are given 6 white straws. There are 2 each of 3 different lengths. You are told to join 5 of the straws to form a 5-sided ring in such a way that no adjacent sides are of the same length. How many different 5-sided rings are possible? (Note that because it is a ring, clockwise and anticlockwise orders are considered the same.)
18. Four ladies are helping to pack food to be delivered to several nursing homes for the aged.
Molly can finish packing 1 box of food in 10 seconds.
Nancy can finish packing 2 boxes of food in 30 seconds.
Polly can finish packing 3 boxes of food in 40 seconds.
Quinny can finish packing 4 boxes of food in 50 seconds.
If they work separately at their respective rates, how many boxes of food can they complete packing in the first minute?

19. A very generous person wants to donate money to several charity organisations. He made a list of these organisations and planned to give \$5000 to the first organisation in the list. Each organisation that follows in the list would get \$100 more than the organisation listed before it. The formula below allows the person to know the total amount he is donating if x represents the number of organisations in his list.

Formula: $Ax^2 + Bx$

What is the value of $B - A$?

20. Each of three junior soccer teams, Teams A, B and C, had played two matches with each of the other two teams. The total number of goals scored in these six matches was 11.

Team A scored the highest number of goals, Team B scored 4 goals and Team C did not score any goals. Team B did not lose in any of their matches.

No two matches had the same combination of goals.

(For example, 2 vs 0 is the same combination as 0 vs 2)

In the two matches between Teams A and B, how many goals did Team A score altogether?

Section C

Each of the questions 21 to 28 carries 5 marks.

21. A group of people were asked if they had watched three movies, A, B and C.
 $\frac{1}{3}$ of those who had watched Movie A had also watched Movie C.

$\frac{1}{2}$ of the people who had watched Movie B had also watched Movie C.

$\frac{1}{4}$ of those who had watched Movie C had also watched either one of the other two movies.

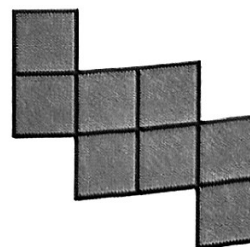
No one had watched both Movies A and B.

The combined number of all who had watched Movie A and all who had watched Movie B is equal to $\frac{2}{3}$ of all who had watched Movie C.

Find the ratio of all who had watched Movie A to all who had watched Movie B.

22. Don is helping to distribute rice to victims of a flood. He has a 1 kg bag of rice. He gives the first group $\frac{1}{2}$ of what he has; the next group gets $\frac{1}{3}$ of the remainder; the next group gets $\frac{1}{4}$ of the remainder after that; the next group gets $\frac{1}{5}$ of the remainder after that; and so on, till he has 100 g of rice left, which he gives to the last group. To how many groups has Don distributed the rice?
23. Stan noticed that for a pair of 2-digit numbers, 16 and 64, one is a multiple of the other. He also noticed that the digit 6 appears in both numbers and then if you removed the common digit, the ratio of the remaining digit is 1 : 4, which is the same ratio as 16 : 64 which is 1 : 4.
- a) Stan also noticed the same properties for another pair of 2-digit numbers. They are in the ratio 1 : 5. These numbers do not have the digit 0. What is the sum of these two numbers?
- b) Stan also noticed the same properties for yet another pair of numbers. They are in the ratio 1 : 2. These numbers do not have the digits 0, 1 and 2. What is the sum of these two numbers?

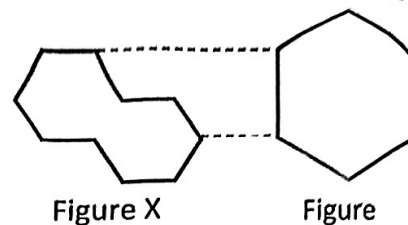
24. The figure is made up of 8 squares. Two straight lines can be drawn to divide the figure into 4 parts, equal in area and shape.



The acute angle between these two lines is approximately

- a) 30°
- b) 45°
- c) 60°
- d) 85°

25. Each of the edges of Figure X is equal to the others.
Figure Y is a regular hexagon.
Find the ratio of the area of Figure X to Figure Y.



26. Blacksmith A and Blacksmith B were each given ten 4-link chains as shown. They were told to join the chains into a closed-looped 40-link chain. The chains can only be linked by cutting open a link, connecting the chains, and welding the link shut, one link at a time.



Both blacksmiths took the same amount of time to cut open a single link and the same amount of time to weld shut a single link. Blacksmith A cut and then welded back 10 links but Blacksmith B was able to finish the task more efficiently, completing 12 minutes sooner than Blacksmith A.

How long did it take either of them to cut open and then weld together a link?

27. There are 25 rows of 30 seats in an auditorium. 684 people are seated in the auditorium. At most, how many rows can have a unique number of occupied seats?

28. The puzzle grid below is commonly known as Minesweeper. Each number reveals the number of mines in the squares surrounding it, sharing a side or a corner. No mines are in the same square as a number.

Here are two examples on how to determine the maximum number of mines in a given area:

Grid A can have a maximum of 3 mines, whereas Grid B can have a maximum of 6 mines.

	1			2	

Grid A

one possibility



	-	-		-	-
-	1	-		2	-
-	-	-	-	-	-

maximum 3 mines

	1		2		

Grid B

one possibility



	-	-		-	
-	1	-	2	-	
-	-	-		-	

maximum 6 mines

In the grid below, find the maximum number of mines possibly hidden in the grid.

		1						
1	1			2		2		
	1	2				1	1	
				1		1		

End of Paper