ANNUAL MATHLYMPICS

FOR ALL SINGAPORE PRIMARY SCHOOLS

2018
Vault Section
(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 ALL your answers neatly on the answer sheet provided.

5. Marks are awarded for correct answers only.

6. You may use the Casio calculator provided.

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.

**This paper consists of Questions 1 to 28
on pages 1 to 10.**

Section A
Each of the questions 1 to 10 carries 2 marks.

1. The sum of 9 out of 10 consecutive numbers is 2018. Which number is left out?

2. The fishing village of Capernaum has exactly 375 families. Every family has either 1, 2 or 3 chiller boxes to store the fish they catch. The majority of the families have 2 chiller boxes. Half of the remaining families have 1. How many chiller boxes are there among the families in Capernaum?

chiller box

3. The sum of 50 whole numbers chosen from 1 to 100 is 3000. What is the least number of even numbers that are possible among the 50 numbers?

4. What is the difference of the largest prime factors of 961 and 289?

5. The seven pieces of a 12-cm Tangram set (Figure A)
    were arranged to form a figure with a square
    hole in the middle (Figure B).

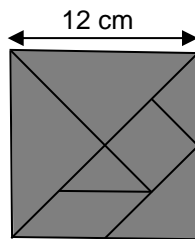   What is the area of the square hole?
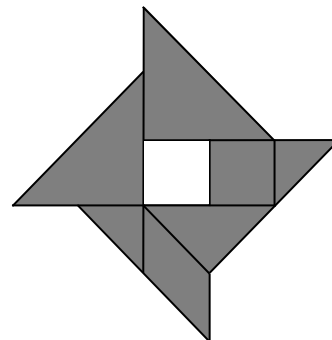

12 cm

Figure A

Figure B

6. Travelling in a taxi, I realised that it took 6 seconds to move between 8 lampposts. If the
    lampposts are equally spaced 10 metres apart, how fast was the taxi travelling?
    Give your answer in km/h.

7. Four of my neighbours own dogs. How many different ways can all my neighbours' dogs run
    into homes which are not their own?

8. Contestant A and Contestant B took part in a 15-minute quiz. Contestant B started 1 minute late but answered 4 questions more than Contestant A every minute. If the number of questions Contestant A answered per minute was x, express the total number of questions both contestants answered in x.

9. The scales of a beam balance are perfectly balanced with identical red marbles on the left and identical green marbles on the right. The red and green marbles have different mass.

    If I move a red marble to the right and 2 green marbles to the left, I have to add 40g to the right scale, to balance the scales.

    However, if I move 2 red marbles to the right and a green marble to the left, I have to add 10g to the left scale, to balance the scales.

    What is the combined mass of a red and a green marble?

10. A shop sells jelly beans in two types of packets. The large packets each had 81 jelly beans inside while the small packets each had 27 jelly beans inside. The shop had x packets altogether. If $\frac{2}{3}$ of the large packets were sold, how many jelly beans are there left in the remaining packets? Give your answer in terms of x.

Section B
Each of the questions 11 to 20 carries 4 marks.

11. A group of tourists bought 50 tickets for a concert. A regular ticket cost $65 and a student ticket cost $45. The group pays an average of $49 per ticket. How many of the tickets bought were student tickets?

12. The numbers 157, 367 and 255 each leave the same remainder when divided by a certain number. What is the largest possible value of this number?

13. The product of two numbers is 1 000 000. Neither of these two numbers has the digit 0. What are these two numbers?

14. Given that the product of four consecutive numbers is 421 200, what is the sum of these four consecutive numbers?

15. A 4-cm by 4-cm by 6-cm cuboid has been painted on all 6 faces. John decides to further slice the cuboid into 2-cm cubes. How many faces of these 2-cm cubes does John have to paint so that all the cubes are painted on all faces?

16. PQRS is a square. X and Y are points outside the square such that triangles PQX and PRY are both equilateral triangles. Given that XY = PQ, find ∠XYQ.
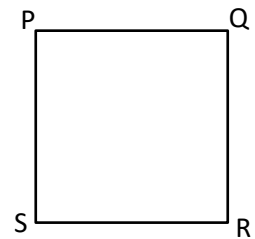
17. Work out all the blanks in the long division shown below. What is the quotient?

   Write the quotient in the Answer Booklet.
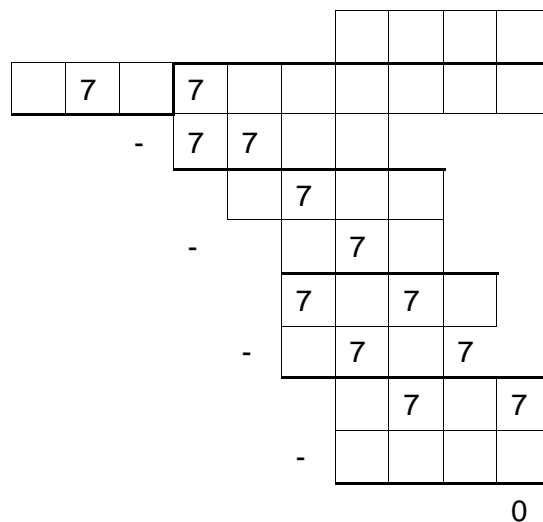
18. Edrick is climbing up the slide in the playground. There are 8 steps to the top and Edrick is tall enough to take up to 2 steps at a time. How many different ways can he climb up to the top of the slide?

19. Becky multiplied the month and the day of her birth date by 12 and 31 respectively. The sum of these two products is 308. What is the date of Becky's birthday?

20. The first two terms of a sequence are x and y respectively.
The 3rd term is the sum of the 1st and 2nd term.
The 4th term is the difference of the 2nd and 3rd term.
The 5th term is the sum of the 3rd and 4th term and the 6th term is the difference of the 4th and 5th term, and so on.

What is the sum of the first 12 terms of the sequence?

Section C
Each of the questions 21 to 28 carries 5 marks.

21. A large cube is assembled using 25 blue cubes and some green cubes. All the blue cubes are positioned such that they mark out the 4 internal diagonals of the large cube. How many green cubes are used?
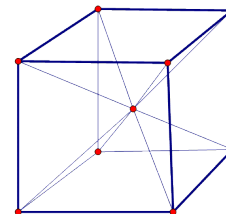
22. In a game show, contestants were required to link giant jigsaw pieces, each with a number from 1 to 10, in such a way that for each pair of adjacent numbers, one of the numbers must be a multiple of the other.

    a) What is the greatest number of jigsaw pieces the contestants can link in a continuous straight chain?

    b) How many different such chains are possible?

23. A string of numbers is formed out of the digits of square numbers: 1491625364964…
   What is the 610th digit from the left?

24. The lengths of the different sides of a rectangular box are different whole numbers of cm. If the total surface area of the box is a 3-digit number, what is the largest possible volume of the box?

25. The perimeter of a right-angled triangle is numerically equal to its area. If all the sides of the triangle are whole numbers of cm, what is the smallest possible perimeter of the triangle?

26. While water is being pumped into a tank, it is being drained away by 3 similar pipes. Starting with a full tank, all the water is completely emptied in 45 minutes. If an additional 4th similar pipe drains the tank, the full tank is emptied in 15 minutes instead. How long will it take for the 3 pipes to drain the full tank if water is not being pumped in?
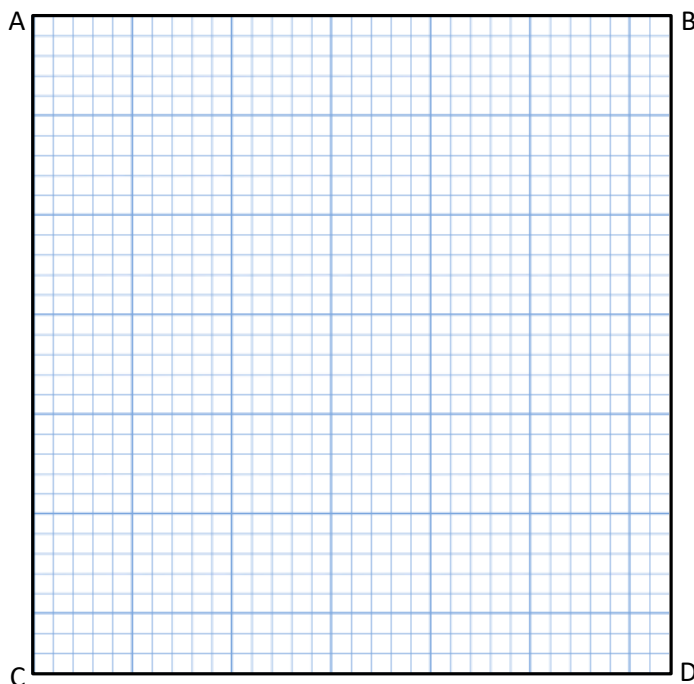(Use fractions to express your answer in minutes.)
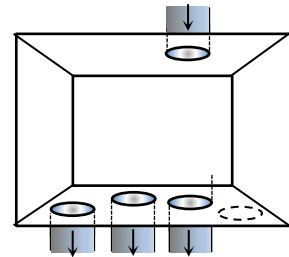
27. When a tyre is used at the front of the bicycle, it wears out after 6000 km. When it is used at the back, it wears out after 4000 km. What is the greatest distance a cyclist can ride his bicycle on a single pair of tyres?

tyres
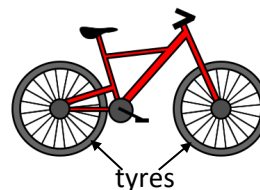
28. The given rectangle ABCD is 32 by 33 units.
Divide the rectangle into nine squares of perimeters 4, 16, 28, 32, 36, 40, 56, 60 and 72 units.

Draw your answer in the Answer Booklet.

A _____ B

C _____ D

End of Paper