

SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the
SOUTH AFRICAN MATHEMATICS FOUNDATION

2016 SECOND ROUND JUNIOR SECTION: GRADE 8 & 9

11 May 2016

Time: 120 minutes

Number of questions: 20

Instructions

1. The answers to all questions are integers from 0 to 999. Each question has only one correct answer.
2. Scoring rules:
 - 2.1. Each correct answer is worth 4 marks in Part A, 5 marks in Part B and 6 marks in Part C.
 - 2.2. There is no penalty for an incorrect answer or any unanswered question.
3. You must use an HB pencil. Rough work paper, a ruler and an eraser are permitted. **Calculators and geometry instruments are not permitted.**
4. Figures are not necessarily drawn to scale.
5. Indicate your answers on the sheet provided.
6. Start when the invigilator tells you to do so.
7. Answers and solutions will be available at www.samf.ac.za

***Do not turn the page until you are told to do so.
Draai die boekie om vir die Afrikaanse vraestel.***

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Organisations involved: AMESA, SA Mathematical Society,
SA Akademie vir Wetenskap en Kuns



HOW TO COMPLETE THE ANSWER SHEET

The answers to all questions are integers from 0 to 999. Consider the following **example question**:

21. If $3x - 216 = 0$, determine the value of x .

The answer is 72, so you must complete the block for question 21 on the answer sheet as follows: shade 0 in the hundreds row, 7 in the tens row, and 2 in the units row:

21	H / H	0	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	T / T	7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	U / E	2	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

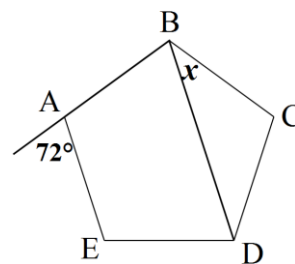
Write the digits of your answer in the blank blocks on the left of the respective rows, as shown in the example; hundreds, tens and units from top to bottom.

The three digits that you write down will not be marked, since it is only for your convenience - only the shaded circles will be marked.

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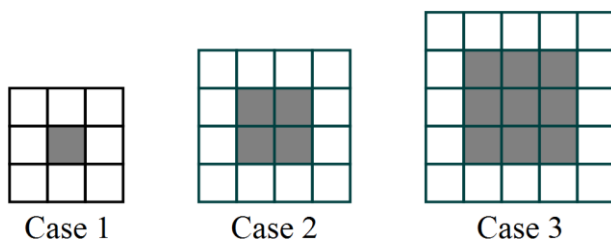
Part A: Four marks each

- Find the value of $2 + 2 \times 3^2$
- Determine the value of $\frac{1 \times 13 \times 13 \times 12}{1 + 13 + 13 + 12}$
- Jess is standing in a queue of people. She is 18th from the front and 35th from the back. How many people are in the queue?
- p , q and r represent the numbers 2, 3, 4 in some order. What is the greatest possible value of $p^q \times r$?
- ABCDE is a regular pentagon with an exterior angle of 72° . What is the size of the angle marked x , in degrees?



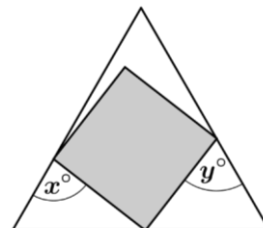
Part B: Five marks each

6.



The beginning of a sequence of expanding grids is shown.
Case 3 has a grey central area of 9 square units and a white border of 16 square units.
If the pattern of squares continues in the same way, how many **white squares** will there be in Case 10?

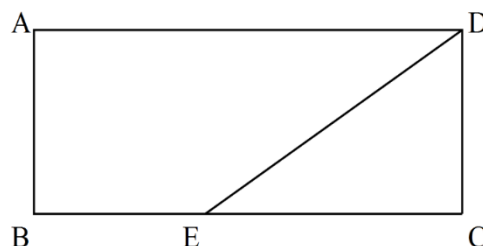
- What is the value of $(2 + 4 + 6 + \dots + 198 + 200) - (1 + 3 + 5 + \dots + 197 + 199)$?
- The diagram shows a square inside an equilateral triangle. What is the value of $x + y$?



- If the product of four consecutive integers is equal to the value of one of those integers, then what is the largest possible value for any of the integers?
- What is the difference between the largest and the second largest odd factors of 2016?

11. There are twice as many girls as boys at a school. If 30% of the girls and 45% of the boys have already completed their holiday project, what percentage of the learners still needs to complete their project?

12. In the figure, ABCD is a rectangle.
The area of triangle DEC is 9 cm^2 and $BE = \frac{2}{5} BC$.
What is the area of ABCD in cm^2 ?



13. Boris takes a taxi to his home but falls asleep when the taxi is halfway to his house. He wakes up when the remaining part of his journey is equal to half the distance covered by the taxi while he was asleep.

If the fraction of the journey for which he slept is $\frac{1}{n}$, what is the value of n ?

14. I accidentally decreased a number by 60% instead of increasing it by 60%. This incorrect value now needs to be increased by $k\%$ to get to the correct value. What is the value of k ?

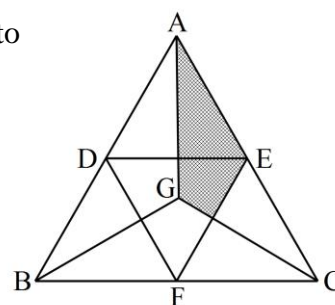
15. Exactly two years ago the Benson family had 4 members, and their average age was 19. The Bensons then adopted another child. If the average age of the family today is still 19, what is the present age of the adopted child?

Part C: Six marks each

16. Four teams, A, B, C and D each play a single game against each of the other teams. There are no draws and teams A, B and C have the same number of wins. If team A beats team D, how many wins does team D have?

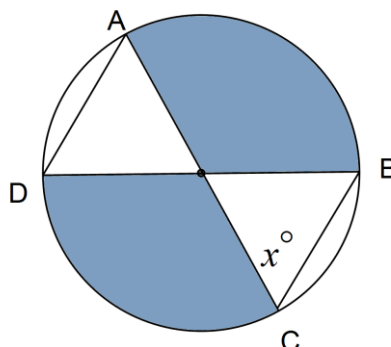
17. For how many positive integers n less than 50 is the product $(n - 8)(n - 38)$ positive?

18. An equilateral triangle ABC is shown alongside. The centre G is joined to A, B and C forming three identical triangles.
D, E and F are the midpoints of AB, AC and BC respectively.



If the area of $\triangle ABC$ is 120 cm^2 , what is the shaded area in cm^2 ?

19. AC and BD are diameters of the circle.
 $AC = BD = 6 \text{ cm}$. If the area of the shaded region is $7\pi \text{ cm}^2$, find the value of x .



20. For how many positive three-digit numbers is the hundreds digit smaller than the units digit?