



science  
& technology

Department:  
Science and Technology  
REPUBLIC OF SOUTH AFRICA

SOUTHERN AFRICAN SENIOR MATHEMATICS OLYMPIAD

FEMSISA MATHEMATICS OLYMPIAD

(SASMO)  
GRADE ELEVEN  
DATE: 12 OCTOBER 2017  
FINAL ROUND  
TIME: 120 MINUTES

Instructions:

1. This booklet has 20 questions.
2. Use the answer sheet provided. Enter your answer in the block.
3. All working details must be done in the space provided.
3. Calculators are not permitted..
4. Diagrams are not necessarily drawn to scale.
5. The first 15 problems carry one mark each and the next 5 carry 2 marks each.
6. You have 120 minutes for the paper which works out to an average of 6 minutes per question.
7. Read the questions carefully before answering.



FEMSISA



National Research  
Foundation

SAASTA

South African Agency for Science  
and Technology Advancement

*NON PROFIT COMPANY*

*REGISTRATION NO: 2015/050119/08*

## Grade Eleven Mathematics Olympiad 2017 Final Round

1. Write down the smallest surd

$$\sqrt{5}; \sqrt[3]{11}; \sqrt[4]{24}$$

2. If  $P = 2x^2 - 4x + c$  and the minimum value of  $P$  is 5 then find the value of  $c$ .

3. If  $f(x) = \frac{-4}{x^2}$  then simplify  $\frac{f(x+h) - f(x)}{h}$  if  $h \neq 0$

4. Solve for  $k$

$$\sqrt{2k+1} - \frac{24}{\sqrt{2k+1}} = 5$$

5. Rewrite  $y = \frac{2x+3}{x-1}$  in the form  $y = \frac{a}{x+p} + q$  and then write down the value of  $a+p+q$ .

6. 852 digits are used to number the pages of a book from 1. How many pages does this book have?

7. Solve for  $x$

$$6 \geq \frac{2}{x-2}$$

8. If  $f(n+1) = 2n + 5$  then find  $f(n)$  which is of the form  $an+b$

9. Determine the ordered pair  $(x;y)$  such that it satisfies both equations and  $y \geq 0$ :-

$$3^{x+1} + 4y = 91$$

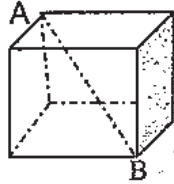
$$3^x + 2^{y+2} = 41$$

10. Simplify to a single ratio.

$$\frac{\sin x - \frac{1}{\sin x}}{\frac{1}{\tan x}}$$

11. 480 writing pads are distributed equally among a certain number of students. If there were 20 less students each would have received 2 more writing pads.. Determine the number of students.

12. The diagram represents a cube with diagonal AB which is equal to  $8\sqrt{2}$ . Determine the volume of the cube.



13. Solve for x

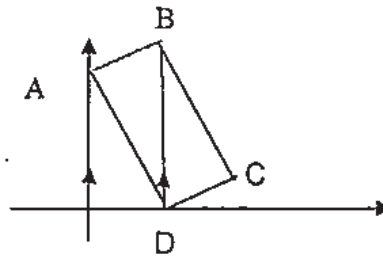
$$\sqrt{4x + 9} - \sqrt{2x + 1} = 2$$

14. 7 people went to a party and all sat next to each other on the same side of the table, How many different arrangements are there if the 2 couples have to sit next to each other?

15. Find the sum of the first 15 terms of the series:-

$$\frac{1}{1 \times 5} + \frac{1}{5 \times 9} + \frac{1}{9 \times 13} + \frac{1}{13 \times 17} \dots \dots \dots$$

16. The rectangle ABCD is such that D is on the X-axis. The equation of AB is  $y = \frac{5}{9}x + 12$ ; A the y intercept. If diagonal BD which is parallel to the Y-axis is 17 units then determine the coordinates of C.



17. The graph A alongside is defined by  $y = -x^2 - 4x + 5$ . The graph is reflected about the X-axis. It is shifted 1 unit to the right.. What is the defining equation of the new graph?

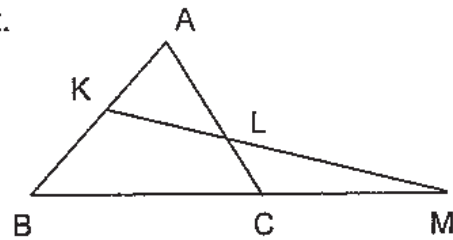


18. Consider the series

$$4^2 - 6^2 + 8^2 - 10^2 + 12^2 - \dots - 52^2 - 54^2$$

Calculate the sum of the numbers of the series?

19. In the adjacent figure  $BC = CM$ ;  $BK:CA = 3:2$ .  
Determine the ratio of  $CL:LA$



20. A;B;C;D and E play soccer or netball but not both.  
A soccer player's statement is always false.  
A netball player's statement is always true  
A says B plays netball  
C says D plays soccer  
E says A does not play soccer  
B says B does not play netball  
D says E and A play different games. How many play soccer?

MARKS: 1-15:  $15 \times 1 = 15$

16-20:  $5 \times 2 = 10$

TOTAL: 25