



science
& technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

SOUTHERN AFRICAN SENIOR MATHEMATICS OLYMPIAD

FEMSSISA
(SASMO)

GRADE ELEVEN
FINAL ROUND

DATE: 11 OCTOBER 2018

TIME: 120 MINUTES

Instructions:

1. This booklet has 20 questions.
2. Use the answer sheet provided.

Write the answer in the block provided
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.

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Grade Eleven Mathematics Olympiad 2018 Final Round

1. Find the sum of the digits

$$100^8 - 10^8$$

2. If $x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$ and $y = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$ then $\frac{xy}{2} = \dots$

3. If $f(x) = 3x^2 - \frac{2}{3}x + 1$ then simplify $\frac{f(x+h) - f(x)}{h}$

4. Solve for k

$$2\sqrt{k+4} - \frac{6}{2\sqrt{k+4}} = 1$$

5. The table below shows the relationship between x and y which is in the form

$$y = \frac{a}{2x - b}$$

x	0	-1
y	1	-3

Determine the value of a + b

6. Did you know?

$$2! = 1 \times 2; \quad 3! = 1 \times 2 \times 3; \quad 4! = 1 \times 2 \times 3 \times 4 \text{ and so on.....}$$

What is the smallest n for which $\frac{(2n+3)!}{(n-5)!}$ will end in at least four 0's?

7. Solve for x

$$\frac{4}{2x-1} \leq 1$$

8. Write the following product in terms of 'n'

$$\left(1 - \frac{1}{4}\right) \left(1 - \frac{1}{5}\right) \left(1 - \frac{1}{6}\right) \dots \left(1 - \frac{1}{n}\right)$$

9. Determine the ordered pair (x;y) such that it satisfies both equations:- n

$$3^{x+1} + 2^{2y} = 89$$

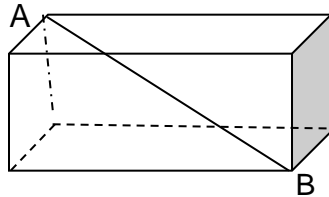
$$3^x - 2^{2y} = 19$$

10. Simplify to a single ratio

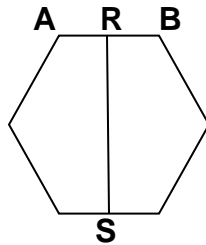
$$\frac{\tan^2 x - 1}{\sin^2 x - \cos^2 x}$$

11. A small factory can produce 300 pairs of shoes per week and sell them at R480 per pair. For each increase of R40 per pair 1 less pair is sold. If there are 'x' increases then the value of x which maximises the receipts.

12. The diagram represents a right rectangular prism with length = 2 x the width. The surface area is 250 square units. If the height of the prism is equal the width then determine the numerical value of AB. .



13. In the following regular hexagon RS = 24 cm. Determine the length of AB.

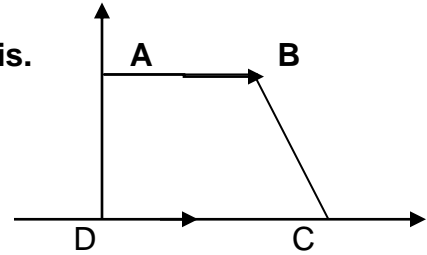


14. $f(x) = mx^3 - 5x^2 - m^2x + 3$.

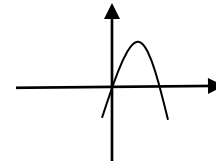
If $f\left(\frac{1}{2}\right) = 0$ then find the value(s) of m.

15. If $\frac{\sqrt{3}+1}{(\sqrt{3}-1)^2}$ is written in the form $a + b\sqrt{c}$ then write the value of $(a + b + c)$.

16. The trapezium ABCD is such that DC is on the X-axis.
 The equation of BC is $y = -2x + 12$.
 $AD = 4$
 If the area of ABCD is 48 square units then determine the coordinates of B.

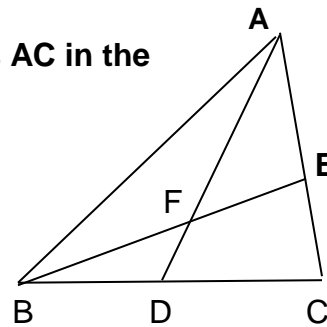


17. The graph A alongside is defined by $y = -x^2 + 4x$.
 The graph was moved 3 units to the left and 3 units downwards. What is the new defining equation of the new graph?



18. A mixture of concentrate and water is in the ratio concentrate : water = $m:n$.
 Adding x units of water or removing x units of concentrate; $x \neq 0$. each produces the same new ratio of concentrate : total or water : total. Calculate the numerical value of this new ratio.

19. In the adjacent triangle AD bisects BC. E divides AC in the ratio 2:1. BE intersects AD at F.
 Determine the ratio BF:FE.



20. There are 4 indistinguishable blue beads ; 3 indistinguishable white beads and 2 indistinguishable green beads.
 How many different arrangements are there?

MARKS: 1-15: $15 \times 1 = 15$
 16-20: $5 \times 2 = 10$
 TOTAL: 25