



science
& technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

SOUTHERN AFRICAN SENIOR MATHEMATICS OLYMPIAD

FEMSSISA
(SASMO)

GRADE ELEVEN
FINAL ROUND

DATE: 10 OCTOBER 2019

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 2019 Final Round

1. Evaluate

$$45^3 - 35^3$$

2. If $x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$ and $y = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$ then $\frac{xy}{3} = \dots$

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

4. Solve for k

$$3\sqrt{k-2} - \frac{4}{3\sqrt{k-2}} = 1$$

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

$$y = \frac{a}{4x - b}$$

x	$\frac{1}{2}$	-1
y	-2	2

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 $\frac{(5n+2)!}{(3n+2)!}$ will end in at least four 0's?

7. Solve for x

$$\frac{3}{3-x} \leq 2$$

8. If the following product is $\frac{1}{7}$ then find 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:

$$4^{x+1} + 3^{2y} = 73$$

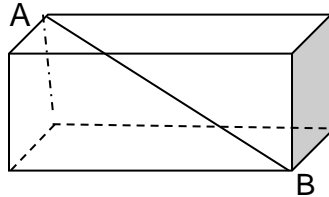
$$4^{x-1} - 3^{2y} = -77$$

10. Simplify to a single ratio

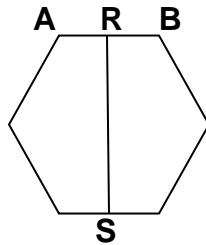
$$\frac{\cos \theta}{1 - \sin \theta} - \frac{\cos \theta}{1 + \sin \theta}$$

11. A small factory can produce 600 books per week and sell them at R300 each. For each increase of R30 per book 3 less books are 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 = 3 times the width. The surface area is 300 square units. If the height of the prism is equal the length then determine the numerical value of AB. .



13. In the following regular hexagon RS = 36 cm. Determine the length of AB.

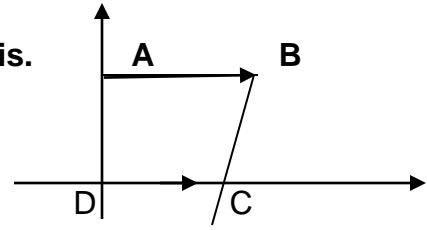


14. $f(x) = 2x^3 - (m+5)x^2 - (m-2)^2 x + m$.

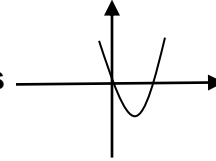
If $f\left(\frac{3}{2}\right) = 0$ then find the value(s) of m.

15. If $\frac{\sqrt{2}+1}{(\sqrt{2}-1)^2}$ 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 $y = x - 4$.
If the area of ABCD is 24 square units then
determine the coordinates of B.

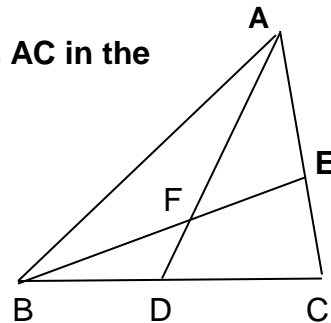


17. The graph A alongside
is defined by $y = x^2 - 4x$.
The graph is reflected about the X-axis and shifted 2 units
downwards. What is the new defining equation of the
new graph?



18. 8 litres of fruit drink is made of 30% concentrate and 70% water. How many
litres of concentrate must be added so that the mixture has 40% concentrate?

19. In the adjacent triangle AD bisects BC. E divides AC in the
ratio 3:2. BE intersects AD at F.
Determine the ratio BF:FE.



20. There are 4 indistinguishable red beads ; 3 indistinguishable orange beads
and 2 indistinguishable pink beads.
How many different arrangements are there?

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