SOUTHERN AFRICAN SENIOR MATHEMATICS OLYMPIAD
FEMSSISA

GRADE 11

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DATE: 15 – 19 AUGUST 2022

TIME: 90 MINUTES

INSTRUCTIONS:

1. This booklet has 15 multiple choice and 5 open ended questions.
2. Use the answer sheet provided.

   Circle the letter corresponding to your answer.
3. All working details must be done in the space provided.
4. Calculators are not permitted.
5. Diagrams are not necessarily drawn to scale.
6. The first 15 problems carry one mark each and the next 5 carry 2 marks each.
7. You have 90 minutes for the paper which works out to an average of 4.5 minutes per question.
8. Read the questions carefully before answering.
9. Visit the websites: www.saolympiads.co.za.

ENJOY THE OLYMPIAD

Grade Eleven Mathematics Olympiad 2021

1. What is the value(s) of x where $2.x^{\frac{2}{3}} = 8$

   (A) -8 (B) -8;8 (C) 8 (D) 6

2. If f(x) = (5 + 2x)(2 - 3x) then simplify $\frac{f(x+h)-f(x)}{h}$; h≠ 0

   (A) -12x – 6h + 11 (B) -12x+11 (C) -12x – 6h - 11 (D) -12x –6h

3. Points A(1; 3) ; B(4;6) and C(5;5) are on y = $q + \frac{a}{x+p}$.

   Write down the value of a + p + q.

   (A) -4 (B) 4 (C) -3 (D 3

4. Solve for x:

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

   (A) $4 < x \leq 8$ (B) $x < 4 \; or \; x \geq 8$ (C) $-4 < x \leq 8$ (D) $x \leq 8$

5. Solve for x: $(x^2- 3)^2 - 23(x^2- 3) + 22 = 0$

   (A) ±2; ±5 (B) ±2 (C) ±5 (D) 2;5

6. If 2sin θ = 3cos θ then $\frac{9}{tan^2\theta}$=

   (A) 9 (B) 6 (C) 5 (D) 4

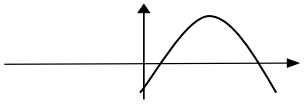
7. If f(n-2) = 2n – 1 then determine f(n) in the form an + b.

   (A) 2n + 1 (B) 2n + 3 (C) 2n - 3 (D) 3n

8. 6000 was divided equally among a certain number of persons. If 5 less shared these coins, then each one would receive 40 more. How many people are in the initial group?

   (A) 15 (B) 20 (C) 25 (D) 30

9. The graph B alongside is defined by $y = -x^2 + 6x - 5$. The equation of the graph which is reflection of B about the X-axis and translated 4 units to the left is…



   (A) $y = x^2 - 2x - 3$ (B) $y = x^2 + 2x + 1$ (C) $y = x^2 - 2x$ (D) $y = x^2 + 2x - 3$

10. Did you know? 2! = 1 x 2; 3! = 1 x 2 x3 ; 4! = 1 x 2 x 3 x4 and so on…….

    What is the smallest n for which $\frac{(6n+1)!}{(3n+4)!}$ will end in at least three 0's?

    (A) 4 (B) 5 (C) 6 (D) 7

11. Evaluate: $6^2 - 8^2 + 10^2 - 12^2 + 14^2 \ldots\ldots + 38^2 - 40^2 + 42^2$

    (A) 900 (B) 936 (C) 972 (D) 1002

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

    $3^{x-1} + 2^{y-1} = 5$ and $3^{x+1} - 2^{y-1} = 21$

    (A) $(-3; 2)$ (B) $(3; 2)$ (C) $(2; 3)$ (D) (2;-3)

13. Simplify to a single ratio:

$$\frac{1 + \cos\theta}{\sin\theta} x \frac{1}{\tan\theta}$$

    (A) $1 - cos\theta$ (B) $\frac{\cos\theta}{1-\cos\theta}$ (C) $\frac{1-\cos\theta}{\cos\theta}$ (D) $1 + \cos\theta$

14. A small factory can produce 200 tables per week and sell them at R800 each. For each increase of R100 per table 10 less tables are sold. If there are 'x' increases then what is the value of x which maximises the receipts.

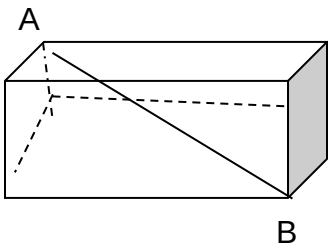
(A) 10 (B) 8 (C) 6 (D) 4

15. What is the probability that 3 digit numbers formed from the following numbers are divisible by 18 if no digit is repeated?

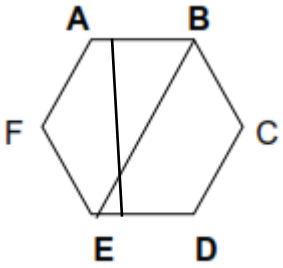
1; 2; 5; 6; 8; 9

(A) $\frac{1}{30}$ (B) $\frac{7}{30}$ (C) $\frac{11}{30}$ (D) $\frac{1}{15}$

16. The diagram represents a right rectangular prism with length equal to 3 times the width. The surface area is 2200 square units. If the height of the prism is twice the width, then determine the numerical value of AB.



17. In the following regular hexagon AB = 8 cm. Determine the area of ABE. Leave the answer in surd form.

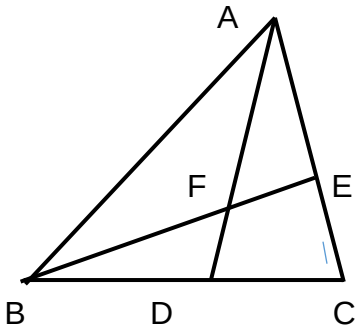


18. Consider the series:-

$$\frac{1}{3}+\frac{2}{3}+\frac{3}{3}+\frac{1}{4}+\frac{2}{4}+\frac{3}{4}+\frac{4}{4}+\frac{1}{5}+\frac{2}{5}+\frac{3}{5}+\frac{4}{5}+\frac{5}{5}+\cdots$$

What is the 80th term of this series?

19. In the adjacent triangle AD divides BC in the ratio 5:2. E divides AC in the ratio 4:3. BE intersects AD at F. Determine the ratio of BF:FE.



20. There are two teams Blues and Reds. Each team has to comprise 6 players. There are 3 sets of twins. Each pair of twins had to play in the same team. How many combinations of players can the two teams have?

MARKS: 1-15: 15 X 1 = 15
16-20: 5 X 2 = 10