SOUTHERN AFRICAN SENIOR MATHEMATICS OLYMPIAD FEMSSISA

GRADE 10

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DATE: 28 AUGUST 2023 – 1 SEPTEMBER 2023

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 1 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 website: www.saolympiads.co.za.

ENJOY THE OLYMPIAD.

Grade Ten Mathematics Olympiad 2023

1. Write down the unit's digit of:

   $27^{14} + 45^{9} - 9^{21} + 26^{26}$

   (A) 9 (B) 5 (C) 3 (D) 1

2. If f(x) = $4x^2$ - x then the simplification of $\frac{f(x+h)-f(x)}{h}$ if $h \neq 0$ is equal to …

   (A) 8x + h (B) 8x + 4h - 1 (C) 8x - 1 (D) 8x- 4h - 1

3. The table below shows the relationship between x and y which is in the form: $y = \frac{x+a}{x+b}$ then $a\ x\ b\ is$ … …

x	5	-1
y	0	-1

   (A) -35 (B) -33 (C) -30 (D) -27

4. The equation of the line perpendicular to x +3y + 6 = 0 and passing through P(2; -1) is…

   (A)y = -3x – 7 (B)y = -3x + 7 (C)y = 3x – 7 (D)y = 3x + 7

5. Factorize: $(4x + 1)^3 + (1 - 4x)^3$

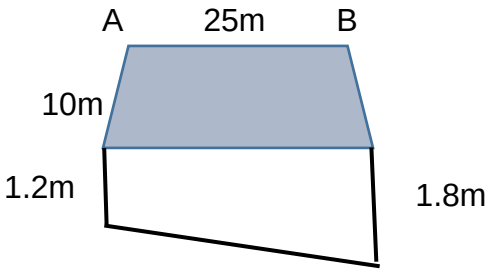
   (A) $32x^2 + 1$ (B) $96x^2 - 1$ (C) $48x^2 + 1$ (D) $96x^2 + 2$

6. Solve for x:

$$\frac{2x+3}{x+2} = \frac{x+2}{2x+3}$$

   (A) $-1\ only$ (B) $-1\ or\ \frac{-5}{3}$ (C) $\frac{-5}{3}\ only$ (D) $\frac{5}{3}\ or\ 1$

7. A rectangular swimming pool has dimensions measuring 25m by 10m. The shallow end is 1.2 m and 1.8m in the deep end. The cross section is a trapezium. Determine the volume of the pool in kl if $1m^3 = 1kl$.



(A) 325 (B) 375 (C) 550 (D) 750

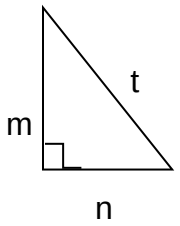
8. 20000 tickets for a cricket football match were sold at R100 and R120 each. The revenue realized was R2.16 million. How many R120 tickets were sold?

(A) 12000 (B) 10000 (C) 8000 (D) 6000

9. If $t = \frac{1}{1-m}$ and $m = \frac{1}{3-2n}$ then write n in terms of 't'.

(A) $\frac{3-2t}{2-2t}$ (B) $\frac{3-2t}{2t}$ (C) $\frac{3-2t}{2+2t}$ (D) $\frac{3}{2-2t}$

10. In the right-angle triangle alongside, m - n = 12 and t = $4\sqrt{10}$. Calculate the area of the triangle in square units independent of m and n.



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

11. Write in its simplest form:

$$\frac{12}{(2c+1)(2c-1)} - \frac{3}{c(2c-1)} + \frac{3}{c(2c+1)}$$

(A) $\frac{6}{c(2c-1)}$ (B) $\frac{3}{c(2c-1)}$ (C) $\frac{6}{c(2c+1)}$ (D) $\frac{-6}{c(2c-1)}$

12. Evaluate: $96^2 - 94^2 + 92^2 - 90^2 + 88^2 - 86^2 + \ldots + 32^2 - 30^2$

(A) 4260 (B) 4284 (C) 4460 (D) 4560

13. Evaluate: $28\frac{2}{5} \; x \; 25\frac{1}{7}$

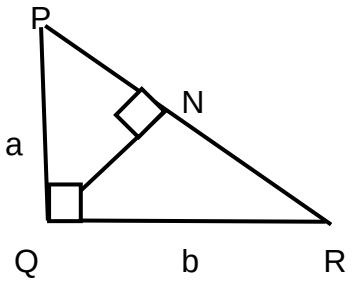
(A) 714 (B) $704\frac{2}{35}$ (C) $714\frac{2}{35}$ (D) $710\frac{2}{35}$

14. Write down the ordered pair (x;y) which is the common solution of both equations:

$$\frac{3}{3x+1}+\frac{2}{3y-1}=1 \text{ and } \frac{6}{3x+1}+\frac{2}{1-3y}=-4$$

(A) $(\frac{-4}{3};\frac{2}{3})$ (B) $(\frac{-4}{3};\frac{1}{3})$ (C) $(\frac{-2}{3};\frac{2}{3})$ (D) $(\frac{4}{3};\frac{2}{3})$

15.



In the above $\Delta PQR; \hat{Q}=90^0; P\hat{N}Q=90^0; PN=3; NR=6; PQ=a; QR=b$

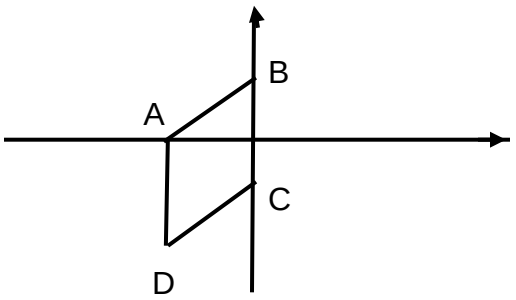
The value of a x b is…

(A) $6\sqrt{3}$ (B) $9\sqrt{3}$ (C) $27\sqrt{2}$ (D) $18\sqrt{2}$

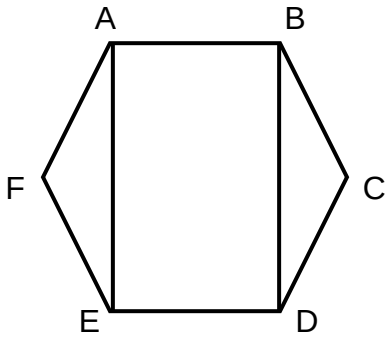
16. On a road there are 100 houses which are either blue or green. Each house is either a single storey or a double storey.
In addition, we have the following information:
- 65 are single storey houses,
- 20 are double storey green houses,

How many double storey blue houses are there?

17. B and C are the y-intercepts and A is the x-intercept of rhombus ABCD. The equation of AB is $y = \frac{4}{3}x + 8$. Determine the co-ordinates of D.



18. In the following regular hexagon ABCDEF, the area of ABDE = $100(\sqrt{3})cm^2$, Determine the perimeter of ABCD in cm.



19. Two cyclists, each cycling at their own constant speeds around an cycling track complete 30 and 40 rounds in 2 hours. If they start together from the same starting point and in the same direction then how many times will the faster cyclist pass the slower cyclist in 2 hours?

20. At 01:50 the angle between the hour hand and the minute hand on the analogue clock is 120^0. At what earliest next time will the minute hand form an angle of 76^0 with the hour hand?

MARKS: 1-15: 15 X 1 = 15
16-20: 5 X 2 = 10
TOTAL = 25