



science
& technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

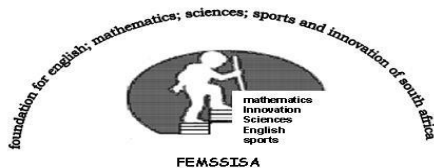
SOUTHERN AFRICAN SENIOR MATHEMATICS OLYMPIAD
FEMSSISA
GRADE TEN

DATE: 30 – 31 AUGUST; 1-10 SEPTEMBER 2021

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.
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9. Visit the websites: www.saolympiads.co.za



REGISTRATION NO: 2015/050119/08



Grade Ten Mathematics Olympiad 2021:

1. If $x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$ and $a = 3; b = -2; c = -8$ then value of x is ...
 (A) 2 (B) 3 (C) -2 (D) -3
2. If $f(x) = 2x^2 - 5x$ then the simplification of $\frac{f(x+h) - f(x)}{h}$ if $h \neq 0$ is equal to ...
 (A) $4x + 2h + 5$ (B) $4x - 2h - 5$ (C) $4x + h - 5$ (D) $4x + 2h - 5$

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

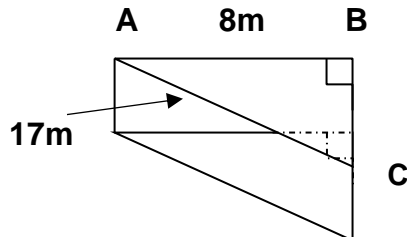
$$y = \frac{x+a}{x+b}; \quad a + b \text{ is } \dots \dots$$

4. x	5. -2	6. 3
7. y	8. -4	9. $\frac{1}{6}$

- (A) 2 (B) 1 (C) -1 (D) -2
4. The equation of the line perpendicular to $x + 3y + 6 = 0$ and passing through $P(-2; -1)$ is...
 (A) $y = 3x + 5$ (B) $y = 3x - 5$ (C) $y = 2x + 5$ (D) $y = -2x - 5$
5. Factorize : $(4x - 3)^2 - (4 - 3x)^2$
 (A) $(2x-9)(x+1)$ (B) $(5x-9)(6x-1)$ (C) $(5x-1)(x+5)$ (D) $7(x+1)(x-1)$

6. Two towns Vale and Hazy are 210km apart. Two cars A and B leave Vale and Hazy at the same time travelling in opposite directions meet after 90 minutes. Car A travels at a speed of 20km faster than car B. Determine the speed of car B in km/h:
 (A) 54 (B) 60 (C) 72 (D) 80

7. A right triangular prism has $AB = 8m$ and $AC = 17m$ and a uniform height of 10m. Determine the cost of painting the exterior at $R60m^2$



- (A) R24000 (B) R27600 (C) R31 200 (D) R34800

8. 10000 tickets for a cricket match were sold at R80 and R100 each.

The revenue realized was R900 000. How many R80 tickets were sold?

- (A) 3 600 (B) 5 000 (C) 6 400 (D) 7 200

9. Solve for x:

$$\frac{-2x - 1}{3} = \frac{8}{x + 10}$$

- (A) -2 only (B) $\frac{-17}{2}$ only (C) 2 only (D) $\frac{-17}{2}$ or $x = -2$

10. If $T = 2\pi \sqrt{\frac{m}{k}}$ then $m = \dots\dots$

- (A) $\frac{kt}{4\pi^2}$ (B) $\frac{kT^2}{4\pi^2}$ (C) $\frac{kT^2}{2\pi^2}$ (D) $\frac{T^2}{k\pi^2}$

11. An item was marked down by $x\%$ during a sale. One month later the article was marked up by 25% to bring it to its original price. Determine x

- (A) 20 (B) 22 (C) 24 (D) 25

12. Write in its simplest form:

$$\frac{y}{(3x + 2)(3x - 2)} - \frac{y}{x(2 - 3x)} + \frac{y}{x(3x + 2)}$$

- (A) $\frac{7}{(3x+2)(3x-2)}$ (B) $\frac{7y}{x(3x-2)}$ (C) $\frac{7y}{(3x+2)(3x-2)}$ (D) $\frac{7y}{x(3x+2)}$

13. Evaluate: $48^2 - 46^2 + 44^2 - 42^2 + 40^2 - 38^2 + \dots + 4^2 - 2^2$

- (A) 1320 (B) 1280 (C) 1240 (D) 1200

14. Evaluate: $24\frac{1}{5} \times 19\frac{5}{6}$

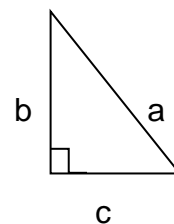
- (A) $479\frac{27}{30}$ (B) $479\frac{29}{30}$ (C) $469\frac{29}{30}$ (D) $459\frac{29}{30}$

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

$$\frac{5}{2x+1} + \frac{2}{y-2} = 3 \quad \text{and} \quad \frac{10}{2x+1} + \frac{1}{2-y} = 1$$

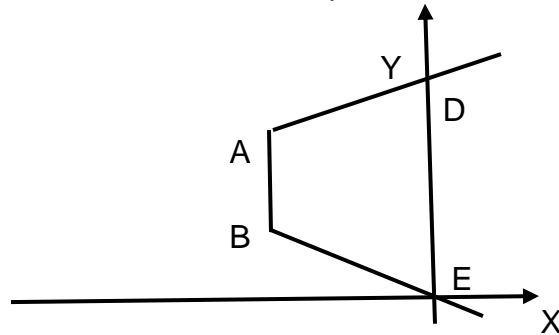
- (A) (2;3) (B) (2;-3) (C) (-2;3) (D) (-2;-3)

16. In the right-angle triangle alongside $b + c = 11$ and $a = \sqrt{65}$
Calculate the area of the triangle independent of b and c.

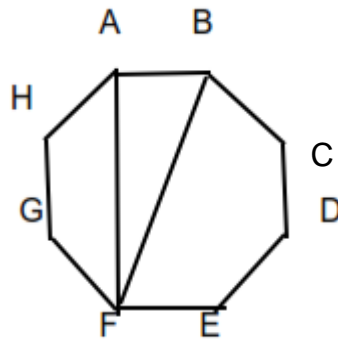


17. Each person in a group of 90 is either female or male. In this group they are brown-eyed or black-eyed. In addition, you are given the following information:
- 20 are black-eyed males, 54 are females and 40 are brown-eyed
- How many females are black-eyed?

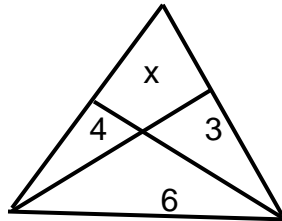
18. D and E are the y-intercepts and $AB \parallel DE$. The equation of AB is $x = -5$ and EB is $y = -x$; the y intercept of AD is $(0;15)$ and the area of ABED is 50 square units. Determine the equation of AD.



19. In the following regular octagon ABCDEFGH the area of $ABF = 18(\sqrt{2}+1)$ cm². Determine the length of AH in cm.



20. In the triangle ABC determine the value of x if the areas of the 3 regions are given.





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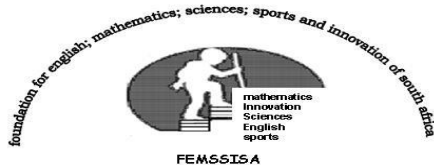
SOUTHERN AFRICAN SENIOR MATHEMATICS OLYMPIAD FEMSSISA: GRADE ELEVEN

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Grade Eleven Mathematics Olympiad 2021

1. What is the value of $3 \cdot x^{\frac{2}{3}} = 12$

- (A) 8 (B) -8 (C) 8; -8 (D) 4

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

- (A) $-12x - 6h + 1$ (B) $-12x+1$ (C) $12x - 6h + 1$ (D) $-12x$

3. Points $A(1; 0)$; $B(0;\frac{1}{4})$ and $C(3;-2)$ are on $y = q + \frac{a}{x-p}$. Write down

The value of a x p.x q is:

- (A) -12 (B) 12 (C) 8 (D) -8

4. Solve for x:

$$\frac{2x - 3}{1 - x} \geq 2$$

- (A) $-1 < x \leq \frac{5}{4}$ (B) $1 < x \leq 2$ (C) $1 < x \leq \frac{5}{4}$ (D) $x \leq 2$

5. Solve for k:

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

- (A) -1 (B) 14 only (C) 2 (D) 7

6. If $\sin \theta = 2\cos \theta$ then, $3\tan^2 \theta - 5\sin^2 \theta =$

- (A) 2 (B) 4 (C) 6 (D) 8

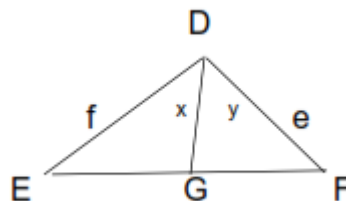
7. If $xy = 2$ and $2x - 3y = 5$ then find the value of $x^2 + 9y^2$

- (A) 25 (B) 49 (C) 69 (D) 89

8. Did you know? Area of $\Delta ABC = \frac{1}{2}ab \cdot \sin C$

EG:GF = 2:1 of ΔDEF with G on BC.

$$\frac{\sin x}{\sin y} = \dots$$

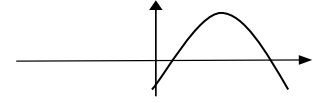


- (A) $\frac{2g}{f}$ (B) $\frac{2f}{g}$ (C) $\frac{g}{f}$ (D) $\frac{f}{2g}$

9. R9000 was divided equally among a certain number of persons. If 5 more shared this amount then each one would receive R300 less. How many people are in the initial group?

- (A) 25 (B) 20 (C) 15 (D) 10

10. The graph B alongside is defined by $y = -x^2 + 4x - 3$. The equation of the graph which is reflection of B about the X-axis and translated 1 unit to the left is...



- (A) $y = x^2 - 2x - 3$ (B) $y = x^2 - 4x + 3$ (C) $y = x^2 - 2x + 1$ (D) $y = x^2 - 2x$

11. Did you know? $2! = 1 \times 2$; $3! = 1 \times 2 \times 3$; $4! = 1 \times 2 \times 3 \times 4$ and so on.....

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

- (A) 5 (B) 6 (C) 7 (D) 8

12. Evaluate: $4^2 + 5^2 - 6^2 + 7^2 - 8^2 + 9^2 + \dots + 43^2 - 44^2 + 45^2$

- (A) 1121 (B) 1080 (C) 1061 (D) 1020

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

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

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

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

14. Simplify to a single ratio:

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

- (A) $\tan \theta$ (B) $\frac{2}{\tan \theta}$ (C) $\frac{2}{\tan \theta}$ (D) $\frac{2}{\tan \theta}$

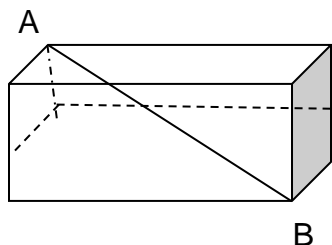
15. A small factory can produce 800 chairs per week and sell them at R400 each. For each increase of R50 per chair 5 less chairs are sold. If there are 'x' increases then the value of x which maximises the receipts.

- (A) 68 (B) 72 (C) 76 (D) 80

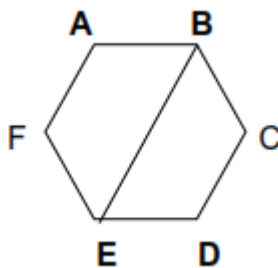
16. What is the probability that 3-digit numbers formed from the following numbers are divisible by 12 if no digit is repeated?

1; 2; 5; 6; 8; 9

17. The diagram represents a right rectangular prism with length equal to 2 times the width. The surface area is 1000 square units. If the height of the prism is half the length, then determine the numerical value of AB.



18. In the following regular hexagon, $BE = 20$ cm. Determine the area of ABEF. Leave answer in surd form.



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

20. In the adjacent triangle AD bisects BC. E divides AC in the ratio 4:3. BE intersects AD at F. Determine the ratio BF:FE.

