

2022 Senior Mathematical Olympiad

Qualifying Round Examination (Grades 9 to 11)

NAME_____

GRADE_____

SCHOOL_____

STUDENT CONTACT NUMBER_____

- EACH entry MUST be accompanied by a nominal entry fee of **J\$500**
- Be sure to staple ALL pages (including this one) together
- All entries must reach the Mathematics Department, U.W.I by **Wednesday 14 December**
- You may deliver by (a) Hand (b) Courier (c) Local Mail

- The Courier address is
Mathematics Department, UWI
Mona
Kingston 7

- The Mailing address is
Senior Mathematical Olympiad
P.O. Box 94
Mona Post Office
Kingston 7

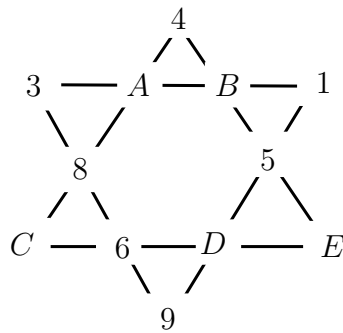
For each question, determine the letter corresponding to the correct or best response; along with the question number, indicate this letter by circling or shading it

1. In a group of 50 persons each person is classified as being tall or short. Given that there are 14 tall men, 31 women and 18 are short persons, how many of the women are short?
(A) 5 (B) 7 (C) 9 (D) 13 (E) 18
2. In a bag of marbles, $\frac{3}{5}$ of the marbles are blue and the rest are red. If the number of red marbles is doubled and the number of blue marbles stays the same, what fraction of the marbles will be red?
(A) $\frac{2}{5}$ (B) $\frac{3}{7}$ (C) $\frac{4}{7}$ (D) $\frac{3}{5}$ (E) $\frac{4}{5}$
3. Four politicians are arguing about who is responsible to pay for work done by an independent contractor. Using first names only, the politicians are Arlene, Barbara, Canute and Duncan. Arlene says Barbara is, Barbara says Canute is, while Canute and Duncan says they have idea who is responsible. The only person who is lying is the person who is responsible to pay for the work done. Who is responsible to pay for the work done?
(A) Arlene (B) Barbara (C) Canute (D) Duncan (E) Need more information
4. A multiple choice examination consists of 20 questions. The scoring is +5 for each correct answer, -2 for each incorrect answer and 0 for questions unanswered. Pete scored a total of 48 on the examination. What is the **maximum** number of correct answers Pete could have had?
(A) 8 (B) 10 (C) 12 (D) 14 (E) 16
5. Thirty dollars is divided among 8 persons according to the following rules
 - Each person gets at least \$1
 - At least one person gets more than \$5
 - At least four persons gets more than \$1
 - Each person gets and exact amount of dollars.

What is the **largest** amount that a person can receive?

- (A) \$13 (B) \$15 (C) \$17 (D) \$19 (E) \$23

6. A sum of money is to be divided between Alyah, Byron and Cecil. Alyah receives \$1 plus one-third of what is left. Byron then receives \$6 plus one-third of what remains. Cecil receives the rest, which amounts to \$40. How much did Byron receive?
- (A) \$26 (B) \$28 (C) \$30 (D) \$32 (E) \$34
7. The interior angles of a triangle are x° , y° and z° where $x \leq y \leq z$. If the angles are all multiples of 20, how many triples $(x^\circ, y^\circ, z^\circ)$ are there?
- (A) 6 (B) 7 (C) 9 (D) 27 (E) 28
8. The numbers 1 to 12 are to be placed on the figure, to the right, in such a way that the sum of the 4 numbers along the six straight lines are all equal.

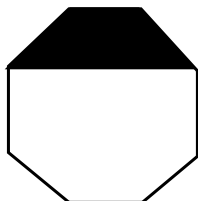


Where on the diagram should the 7 be placed?

- (A) A (B) B (C) C (D) D (E) E
9. At the Centre for High Achievers, there are 100 students of which 99% are females. Of the student living on campus, 98% are females. How many of the students live off campus?
- (A) 1 (B) 2 (C) 49 (D) 50 (E) 98
10. The three digit number abc is equivalent to $100a + 10b + c$. Which of the following is a factor of abc when $a > 0$ and $a = b = c$?
- (A) 7 (B) 11 (C) 13 (D) 19 (E) 37
11. Three car washers can wash 4 cars in 5 hours. The the nearest whole number of hours, how long would it take 7 car washers to wash 18 cars, if all are working at the same rate all the time
- (A) 3 (B) 4 (C) 7 (D) 10 (E) 18

12. On planet ZeeZee, the number of days in a week is the same as the number of weeks in a month and the number of months in a year is twice the number of days in a month. On ZeeZee there are 1,250 days in a year. How many months are there on ZeeZee?
- (A) 50 (B) 25 (C) 20 (D) 10 (E) 5

13. In the figure shown,



what fraction of the total area of the regular octagon is shaded?

- (A) $1/3$ (B) $1/4$ (C) $1/5$ (D) $1/6$ (E) $3/8$
14. A box contains 10 balls numbered 1 to 10. Two balls are randomly chosen, one at a time, from the box and without replacement. In how many ways can the balls be drawn so that the sum of the two balls is even?
- (A) 5 (B) 10 (C) 15 (D) 30 (E) 40
15. A common notation is $n!$, which reads “ n factorial”, and is defined as

$$n! = n(n - 1)(n - 2) \cdots \cdots 2 \cdot 1$$

For example, $4! = 4(3)(2)(1) = 24$.

The number

$$m = 1! + 2! + 3! + \cdots + 2021! + 2022!$$

What is the units digit of m ?

- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
16. The perimeter of a rectangle is 56 metres. The ratio of the width to the length is 3 : 4. The length of the diagonal of the rectangle is
- (A) 17.5 m (B) 20 m (C) 25 m (D) 40 m (E) 50 m
17. Let $a = 2^{5555}$, $b = 3^{3333}$ and $c = 6^{2222}$. Which of the following is correct?
- (A) $a < b < c$ (B) $a < c < b$ (C) $c < b < a$ (D) $b < c < a$ (E) $b < a < c$

18. Converting to seconds, 2000 days, 2000 hours, 2000 minutes and 2000 seconds is equivalent to N million seconds.

N is closest to

- (A) 1 (B) 15 (C) 45 (D) 180 (E) 2000

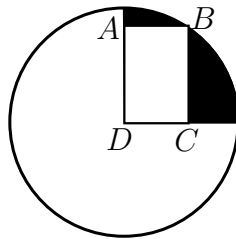
19. The altitude h , of a triangle is increased by m . How much should be taken off the base b , so that the area of the new triangle is one-half that of the original triangle?

- (A) $\frac{bm}{h+m}$ (B) $\frac{bh}{2(h+m)}$ (C) $\frac{b(2m+h)}{m+h}$ (D) $\frac{b(m+h)}{2m+h}$ (E) $\frac{b(2m+h)}{2(m+h)}$

20. Store A sells red marbles at 4 per dollar and blue marbles at 3 per dollar. Store B sells red marbles at 4 per dollar and blue marbles at 6 per dollar. Mary spends \$10 buying m red marbles and n blue marbles from store A and m red marbles and n blue marbles from store B. How many marbles (altogether) did Mary buy?

- (A) 20 (B) 30 (C) 40 (D) 50 (E) 60

21. D is the centre of a circle and $ABCD$ is a rectangle, where B is on the circle. Given that $AB = 3$ units and $BC = 4$ units.



The area, in square units, of the shaded region is between

- (A) 4 and 5 (B) 5 and 6 (C) 6 and 7 (D) 7 and 8 (E) 8 and 9

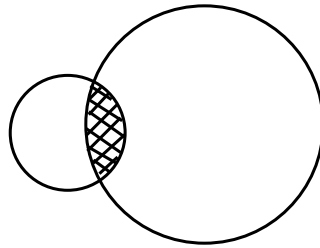
22. Two numbers are such that the ratios of their difference, their sum and their product are (respectively) $1 : 7 : 18$. What is the product of these two numbers?

- (A) 21 (B) 23 (C) 25 (D) 27 (E) 29

23. When the time is 3 : 26 on a conventional clock, what is the angle between the minute hand and the hour hand?

- (A) 45° (B) 47° (C) 49° (D) 51° (E) 53°

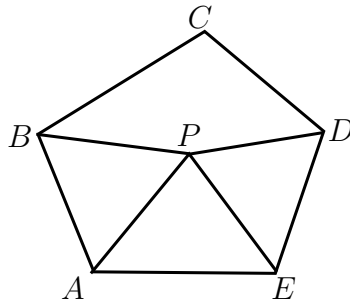
24. Two circles of radii 1 unit and 3 units overlap as shown in the figure.



If the area of the shaded region is $\frac{\pi}{3}$, what is the sum of the areas of the unshaded portions in the two circles?

- (A) 8π (B) $\frac{26\pi}{3}$ (C) 9π (D) $\frac{28\pi}{3}$ (E) $\frac{29\pi}{3}$

25. In the diagram, $ABCDE$ is a regular pentagon and triangle APE is equilateral.



What is the size of the obtuse angle BPD ?

- (A) 168° (B) 165° (C) 132° (D) 150° (E) 172°

Please write your name here _____