The University of the West Indies, Mona

presents

2024-2025 Senior Mathematical Olympiad

Round Two Examination (Grades 9, 10 and 11) - 11:00 am

SECTION A

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

1. If $10^x = m$ and
$$y = 10^{2x+2},$$
then
(A) $y = 2m + 2$ (B) $y = 2m + 100$ (C) $y = m^2 + 2$ (D) $y = m^2 + 100$
(E) $y = 100m^2$

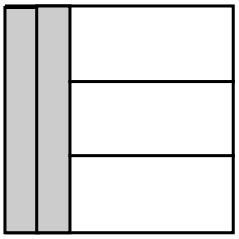
2. Tara thought of a whole number and then multiplied it by either 5 or 6. Christa added 5 or 6 to Tara's answer. Finally, Elias subtracted either 5 or 6 from Christa's answer. The final result was 73. What number did Tara think of?
(A) 10 (B) 11 (C) 12 (D) 13 (E) 14

3. How many fractions between $\frac{1}{6}$ and $\frac{1}{3}$ inclusive, can be written with a denominator of 15?
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

4. Two 2-digit numbers a and b are both multiples of 7. Given that $ab = 7007$, what is the value of $a + b$?
(A) 144 (B) 154 (C) 158 (D) 164 (E) 168

5. There are 20 persons in a math exam consisting of students in grade 8 or grade 9. The average grade of the grade 8 students is 80% and the average grade of the grade 9 students is 90%. Furthermore, the average grade of all the students is 84%. How many of the students in the class are from grade 9?
(A) 7 (B) 8 (C) 9 (D) 10 (E) 11

6. The diagram below shows a square made from five rectangles. Each of these rectangles has the same perimeter.



What is the ratio of the area of a shaded rectangle to the area of an unshaded rectangle?

(A) 6 : 19 (B) 2 : 5 (C) 4 : 9 (D) 5 : 11 (E) 3 : 7

7. Three positive integers, a, b, c are such that $a + b + c = 93$ and $abc = 3375$. If a, b and c are in the ratio $1 : k : k^2$, what is the value of the positive integer k?

(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

8. What is the units digit of

$$1^{2025} + 2^{2025} + 3^{2025} + 4^{2025}?$$

(A) 0 (B) 3 (C) 6 (D) 7 (E) 9

9. Jherrie or Kellie (but not both) tells lies on Mondays, Tuesdays and Wednesdays, and tells the truth on the other days of the week. The other (Jherrie or Kellie) lies on Thursdays, Fridays and Saturdays, and tells the truth on the other days of the week. Here is a conversation between the two:

Jherrie: *I lie on Saturdays.*
Kellie: *I will lie tomorrow.*
Jherrie: *I lie on Sundays.*

Which day of the week did the above conversation take place?

(A) Monday (B) Wednesday (C) Thursday (D) Saturday (E) Sunday

10. A room has a floor that is 6 m wide and 9 m long. The ceiling of the room is 3 m high. The room requires soundproof padding on the inner sides of the walls and ceiling, but not on the floor. The padding is 0.5 m thick. Measured in cubic metres, what is the total volume of padding required?

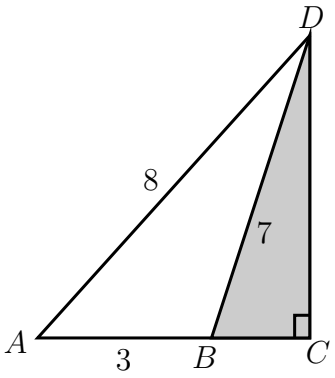
(A) 62 (B) 64 (C) 68.5 (D) 70 (E) 72

SECTION B

For each question, provide a complete solution by showing all your workings.

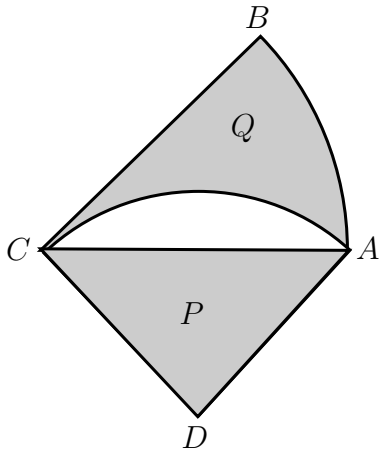
1. At last week's soccer game involving the Boyz of UWI, the price of a Box ticket was \$2500, the price of a Grandstand ticket was \$1000, the price of a Bleachers ticket was \$500, and the price of a Student ticket was \$100. Opie bought 10 tickets at an average cost of \$1400. If she had bought n more Box tickets, the new average cost of the tickets would have been \$2000. What is the value of n?

2. The diagram below shows a right-angled triangle ACD with a point B on the side AC. The sides of triangle ABD have lengths $3, 7$ and 8 (units).



   What is the area of triangle BCD?

3. The diagram below shows two arcs. Arc AB is one-eighth of a circle with centre C, and arc AC is a quarter of a circle with centre D. The points A and B are joined by straight lines to C, and A and C are joined by straight lines to D.



   Do the calculations to show that the area of the shaded triangle P is equal to the area of the shaded region Q.

4. Xavia, Yohan and Zack each pick an integer greater than or equal to 1 and less than or equal to 9. Xavia multiplies her number by 12, and then adds Yohan's number. The result is then multiplied by10 before adding the three original numbers picked. If the result is 878, what three numbers were picked?

5. It is well known that:

   - A number is divisible by 8 if the number formed by its last 3 digits is divisible by 8, and
   - A number is divisible by 9 if the sum of its digits is divisible by 9.

   In the ten-digit number $541G5072H6$, G and H each represent a single digit. What are the possible pairs of G and H if the ten-digit number is divisible by 72?