

2022-2023 Senior Mathematical Olympiad

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

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. The statement below is true:

$$(6\blacksquare 3) + 4 - (2 - 1) = 5.$$

The symbol \blacksquare between the 6 and the 3 is representing

- (A) \div (B) \times (C) $+$ (D) $-$ (E) None of these

2. What is another representation of

$$(2022)(2022)^{2022} ?$$

- (A) $(2022)^{2023}$ (B) $(4088\ 484)^{2022}$ (C) $(2022)^{4044}$ (D) $(4044)^{4044}$ (E) $(2023)^{2022}$

3. The product of four of the digits

3, 4, 5, 6, 7

is 360. Which digit was not used?

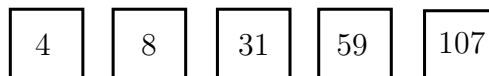
- (A) 3 (B) 4 (C) 5 (D) 6 (E) 7

4. Let J, M and O be distinct (different) positive integers. Given that $JMO = 2022$. What is the largest possible value of $J + M + O$?

(In the above, $JMO = J \cdot M \cdot O = J \times M \times O$)

- (A) 1014 (B) 342 (C) 343 (D) 2023 (E) 60

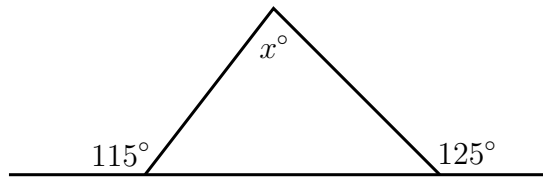
5. The following five cards are arranged to form the **smallest** 9 digit number.



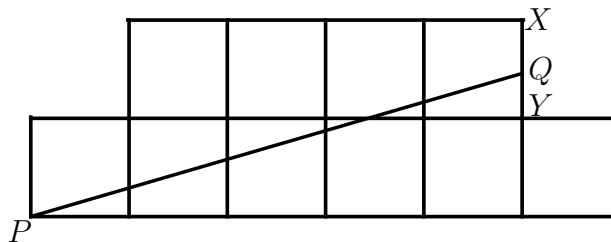
Which card must be placed furthest on the right? The card marked

- (A) 4 (B) 8 (C) 31 (D) 59 (E) 107

6. What is the value of x in the diagram below?

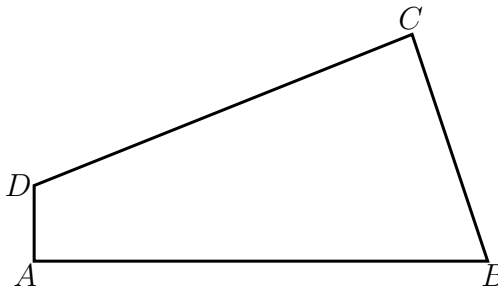


- (A) 50 (B) 55 (C) 60 (D) 65 (E) 70
7. The diagram shows an octagon consisting of 10 unit squares. The shapes below PQ is a unit square and a triangle with base 5.



If PQ divides the area of the octagon into two equal parts, what is the value of the ratio $\frac{XQ}{QY}$?

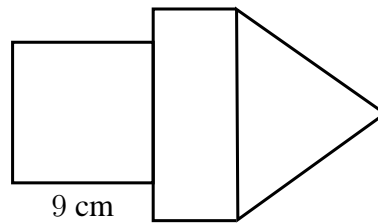
- (A) $\frac{2}{5}$ (B) $\frac{1}{2}$ (C) $\frac{3}{5}$ (D) $\frac{2}{3}$ (E) $\frac{3}{4}$
8. The quadrilateral $ADCB$ is such that $AB = 11$ cm, $BC = 7$ cm, $CD = 9$ cm and $AD = 3$ cm.



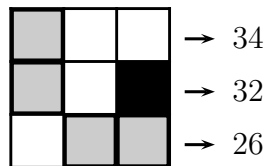
If the angle at points A and C are 90° , in square centimetres, what is the area of the quadrilateral?

- (A) 30 (B) 44 (C) 48 (D) 52 (E) 60

9. Charmaine pays an on-line service provider a fixed monthly fee plus an hourly charge for connect time. Her December bill was \$1248.00, but in January her bill was \$1754.00 because she used twice as much connect time as in December. What is the fixed monthly fee?
- (A) \$253.00 (B) \$506.00 (C) \$624.00 (D) \$742.00 (E) \$877.00
10. The diagram below consists of three shapes of equal perimeter: a square, a rectangle and an equilateral triangle. The side length of the square is 9 cm.

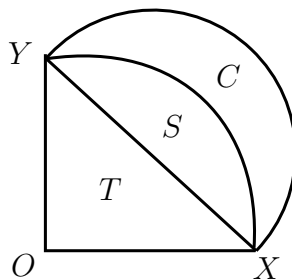


- What is the length of the short side of the rectangle?
- (A) 4 cm (B) 5 cm (C) 6 cm (D) 7 cm (E) 8 cm
11. How many integers between 100 and 300 have only odd digits?
- (A) 25 (B) 50 (C) 75 (D) 100 (E) 150
12. Under cards with the same colour, the same number is always found. If the three hidden numbers in one row are added, one obtains the number to the right of the row.



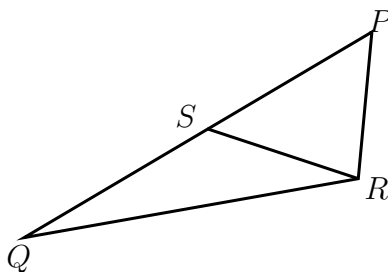
- Which number is hidden under the black card?
- (A) 6 (B) 8 (C) 10 (D) 12 (E) 14
13. A large watermelon weighs 20 kg, with 98% of its weight being water. It is left to stand in the sun, and some of the water evaporates so that now only 95% of its weight is water. What does it now weigh?
- (A) 17 kg (B) 19.4 kg (C) 10 kg (D) 19 kg (E) 8 kg

14. Two radii of a circular quadrant are OX and OY . A semi-circle is drawn on XY as shown. T , S and C denote the resulting triangle, segment and crescent.



What is the value of the ratio $\frac{\text{Area of } T}{\text{Area of } C}$?

- (A) $3/\pi$ (B) 1 (C) $13/4\pi$ (D) $7/2\pi$ (E) $15/4\pi$
15. The triangle PRS is equilateral and its area is half that of the triangle PQR .



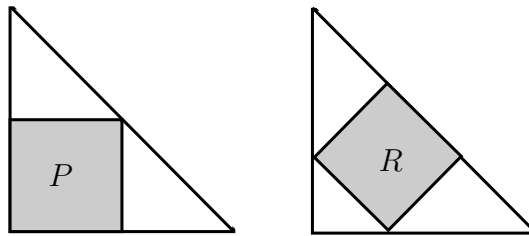
What is the size, in degrees, of the angle PRQ ?

- (A) 75 (B) 80 (C) 90 (D) 100 (E) 120
16. Adam, Barney and Joe carry 999 books out of the library. Adam works for 3 hours, Barney works for 4 hours and Joe works for 5 hours. They work at different speeds, with Adam carrying 5 books for every 3 books Barney carries and every 2 books Joe carries. How many books did Adam carry?
- (A) 305 (B) 405 (C) 505 (D) 605 (E) 705
17. Two non-zero real numbers, a and b , satisfy $ab = a - b$. What is a possible value

$$\frac{a}{b} + \frac{b}{a} - ab?$$

- (A) -2 (B) $-1/2$ (C) $1/3$ (D) $1/2$ (E) 2

18. Karen and Jacqui are in separate classes. Karen's class and Jacqui's class are sharing some apples donated by a local farmer and everyone in each classroom will have 6 apples. If Karen's class shared all the apples, each student would have 10 apples. If Jacqui's class shared all the apples, how many apples would each student in the class have?
- (A) 5 (B) 8 (C) 10 (D) 12 (E) 15
19. Aaa, Bee, Cee, Dee, Eee, Fff and Gee are 1, 2, 3, 4, 5, 6 and 7 years old, in some order but not this order. Dee is three times as old as Bee. Cee is four years older than Eee. Fff is older than Aaa and Aaa is older than Gee, but the combined ages of Aaa and Gee is greater than the age of Fff. What is Aaa's age?
- (A) 2 (B) 3 (C) 4 (D) 5 (E) 6
20. Dried dog food is available in three sizes: 1 kg bags, which cost \$60; 3 kg bags, which cost \$150; and 8 kg bags, which cost \$250. What is the smallest number of bags you can buy such that the average price per kilogram is exactly \$40?
- (A) 4 (B) 5 (C) 6 (D) 7 (E) 8
21. One square is drawn inside each of the two congruent isosceles right-angled triangles. The area of square P is 45 units.



How many units is the area of square R ?

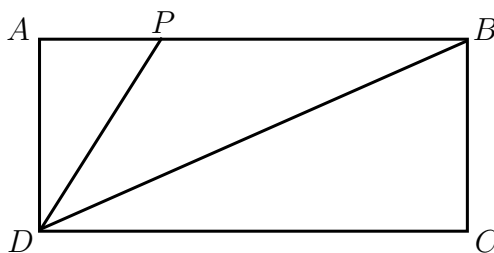
- (A) 35 (B) 40 (C) 45 (D) 50 (E) 60
22. Professor T gave an exam to a class of 5 students. The scores, in order, are

71, 76, 80, 82, 91.

In random order, Professor T enters the scores into a spreadsheet, which recalculated the class average after each score was entered. Professor T noticed that after each score was entered, the average was always an integer. What was the last score Professor T entered?

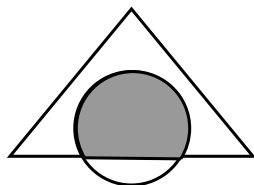
- (A) 71 (B) 76 (C) 80 (D) 82 (E) 91

23. In rectangle $ABCD$, $AD = 1$, P is on \overline{AB} , and \overline{DB} and \overline{DP} trisect $\angle ADC$.



What is the perimeter of $\triangle BDP$?

- (A) $3 + \frac{\sqrt{3}}{3}$ (B) $2 + \frac{4\sqrt{3}}{3}$ (C) $2 + 2\sqrt{2}$ (D) $\frac{3 + 3\sqrt{5}}{2}$ (E) $2 + \frac{5\sqrt{3}}{3}$
24. A shape is made up of a triangle and a circle that partially overlap. The grey area is 45% of the entire area of the shape. The white part of the triangle is 40% of the total area of the shape.



What percent of the area of the circle is the white part, outside the triangle?

- (A) 20% (B) 25% (C) 30% (D) 35% (E) 50%
25. Two different prime numbers are chosen between 4 and 18. When their sum is subtracted from their product, which of the following number could be obtained?
- (A) 21 (B) 60 (C) 119 (D) 180 (E) 231