2020 Senior Mathematical Olympiad
Test for Grades 7 and 8

NAME _____

GRADE _____

SCHOOL _____

STUDENT PHONE _____

EXAMINATION QUESTIONS

1) How many hours are in one-half of one-third of one-fourth of a day?

    a) $\dfrac{1}{3}$ b) $\dfrac{1}{2}$ c) 3   d) 2   e) 1

2) What is the value of the product $\dfrac{3}{2} \times \dfrac{4}{3} \times \dfrac{5}{4} \times \cdots \times \dfrac{2020}{2019}$?

    a) 1   b) 1009   c) 1010   d) 2019   e) 2020

3) Gabriella had several square sheets of paper and each one had an area of 4. She cut the squares into right triangles and smaller squares, as shown on the left below. She used several pieces to make the shape of a bird, as shown on the right. What is the area of the shape of the bird?
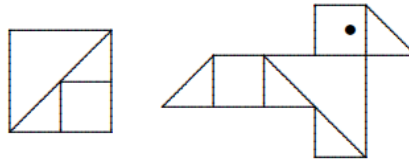

    a) 3   b) 6   c) $\dfrac{9}{2}$ d) 5   e) 4

4) In the expressions below, d represents one of the nine digits 1, 2, 3, 4, 5, 6, 7, 8, or 9. Which expression has the same value no matter what the value of d is?

    a) $(d + d) \div d + d$ b) $d \times (d + d) \div d$ c) $d + d - d + d$

    d) $(d + d - d) \times d$ e) $(d + d - d) \div d$

5) Which of the following numbers is odd for every positive integer n?

    a) $2019n$ b) $2n^2 + 2019$ c) n^3 d) $n + 2020$ e) $n^2 + 2019$

6) What percent of the positive integers from 1 to 10,000 are perfect squares? (A perfect square is a number which is the square of a positive integer. For example, 64 is a perfect square because $8 \times 8 = 64$.)

    a) 1%   b) 1.5%   c) 2%   d) 2.5%   e) 5%

7) Suppose p, q, r, s, and t are numbers such that $r < s$, $t > q$, $q > p$, and $t < r$. Which of these numbers is greatest?

    a) p b) q c) r d) s e) t

8) Maria drew some polygons on square sheets of paper and shaded them grey. (All angles in her polygons were right angles.) In how many figures below is the perimeter of the shaded polygon equal to the perimeter of the sheet of paper it is drawn on?
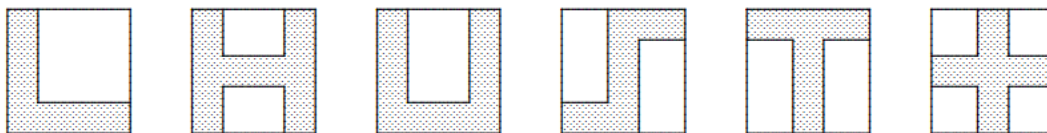
    a) 2   b) 3   c) 4   d) 5   e) 6

9) A two-digit number is divisible by 8, 12, and 18. The number is between:

    a) 10 and 19   b) 20 and 39   c) 40 and 59   d) 60 and 79   e) 80 and 99

10) Tiara divided the sheet on the left side of Figure 10 into smaller pieces. Each small piece was identical to one of those on the right side of Figure 10. At the end, no parts of the large sheet were left over. What is the smallest number of three-square pieces Tiara could have used?
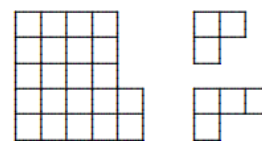

Figure 10

    a) 1   b) 2   c) 3   d) 4

    e) Tiara could not do this.

11) Big Al the ape ate 100 yellow bananas from May 1 through May 5. Each day, he ate 6 more bananas than on the day before. How many yellow bananas did Big Al eat on May 5?

    a) 32   b) 22   c) 30   d) 20   e) 34

12) A mixture of 30 litres of paint is 25% red tint, 30% yellow tint, and 45% water. Five litres of yellow tint are added to the mixture. What percent of the new mixture is yellow tint?

    a) 25   b) 35   c) 40   d) 45   e) 50

13) In the figure on the right, $w = 55°$, $x = 40°$, and $y = 35°$. What is the measure of a?

    a) 100°   b) 105°   c) 120°

    d) 125°   e) 130°
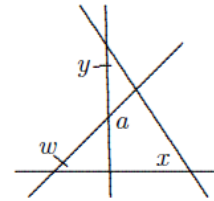
14) Three stores, Apex, Best, and Criss, sell the same model of cell phone for the same price. All of them plan to decrease their prices before Christmas, on Boxing Day, and on New Year's Day. Apex will be decreasing by 10% before Christmas, another 20% on Boxing Day, and a further 30% on New Year's Day. Best will decrease prices by 20% all three times. Criss will reduce prices by 30%, then by 10%, and then by 20%. After New Year's Day, who will have the cheapest phones?

    a) Apex   b) Best   c) Criss   d) Apex and Criss

    e) All three stores will have the same price.

15) How many subsets of two elements can be removed from the set the set

$$\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11\}$$

so that the mean (average) of the remaining numbers is 6?

    a) 1   b) 5   c) 3   d) 6   e) 2

16) Akira wrote down the largest three-digit number which is divisible by 8 and contains the digit 8. Braelyn wrote down the smallest three-digit number which is divisible by 8 and contains the digit 8. If Braelyn's number is subtracted from Akira's number, what will the difference be?

    a) 800   b) 840   c) 856   d) 864   e) 904

17) Jamar bought some pencils at the school bookstore and paid $143. Sharona bought some of the same pencils and paid $187. How many more pencils did Sharona buy than Jamar? (The pencils cost more than $1 each.)

    a) 2   b) 3   c) 4   d) 5   e) 6

18) In the figure on the right, $ABCD$ is a square, $AB = 8$, and $PB = QC = RD = SA = 2$. What is the area of square $PQRS$?

    a) 58   b) 52   c) 48

    d) 40   e) 36
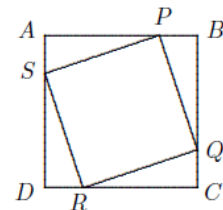
19) The positive numbers x, y, and z satisfy the equations $xy = 14$, $yz = 10$, and $zx = 35$. What is the value of $x + y + z$?

    a) 10   b) 12   c) 14   d) 16   e) 19

20) Some three-digit numbers abc have the property that both ab and bc are perfect squares. What is the sum of all the three-digit numbers that have this property?

   a) 1013   b) 1177   c) 1465   d) 1993   e) 2016

21) Using a balance, Stephanique discovered that □□□□ balances ○○, and ○○○ balances △△. Which of he following would **not** balance △○□?

   a) △○□   b) □□□△   c) □□○○   d) ○□□□□   e) △△□

22) Before district play, the Blazers won 45% of their basketball games. During district play, they won 6 games and lost 2. At that point, they had won half of all their games. How many games did the Blazers play in all?

   a) 48   b) 64   c) 79   d) 96   e) 131

23) The shape on the right is made of unit squares. Points P, A, B, C, D, and E have been marked as shown, where B is the midpoint of AC and D is the midpoint of EC. A line passeing through P cuts the shape into two pieces of equal area. Which other point does this line pass through?

   a) A b) B c) C

   d) D e) E
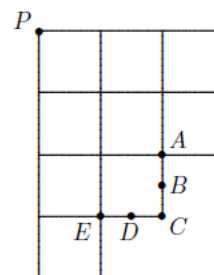
24) The digits 1, 2, 3, 4, and 5 are each used once to form the five-digit number $PQRST$. The three-digit number PQR is divisible by 4, the three-digit number QRS is divisible by 5, and the three-digit number RST is divisible by 3. What is P?

   a) 1   b) 2   c) 3   d) 4   e) 5

25) Given a set of three numbers, a *transformation* replaces each number in the set with the sum of the other two. For example, $\{3,4,6\}$ is transformed into $\{10,9,7\}$, and this set can be transformed again into $\{16,17,19\}$. The set $\{20,1,9\}$ is transformed 2019 times into a new set. What is the largest difference between members of the new set?

   a) 1   b) 8   c) 11   d) 19   e) 2019

End of Questions

You may mail this completed question paper to:

Senior Olympiad
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Kingston 7

You may also deliver your entry by hand or by courier directly to the Department of Mathematics at the UWI, Mona Campus. Each entry should be accompanied by a $500 Entrance Fee. In all cases, an entry must be received by December 9, 2019, to be guaranteed consideration.