

2022-2023 Junior Mathematical Olympiad

Final Round Examination (Grades 5 and 6)

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 product

$$2^2 \times 2^{2020} \times 2$$

is equal to

- (A) 2^{4040} (B) 2^{2022} (C) 2^{4041} (D) 2^{2023} (E) 2^{8080}

2. The human heart beats an average of 70 times per minute. On average how many times does it beat during one hour?

- (A) 42,000 (B) 7,000 (C) 4,200 (D) 700 (E) 420

3. How many of the integers

123, 234, 345, 456, 567

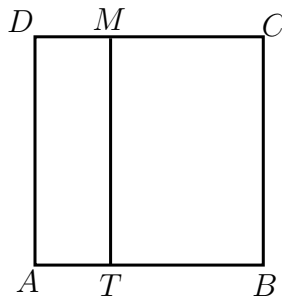
are multiples of 3?

- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5

4. Which of the following fractions below is the greatest (largest)?

- (A) $\frac{7}{8}$ (B) $\frac{66}{77}$ (C) $\frac{555}{666}$ (D) $\frac{4444}{5555}$ (E) $\frac{33333}{44444}$

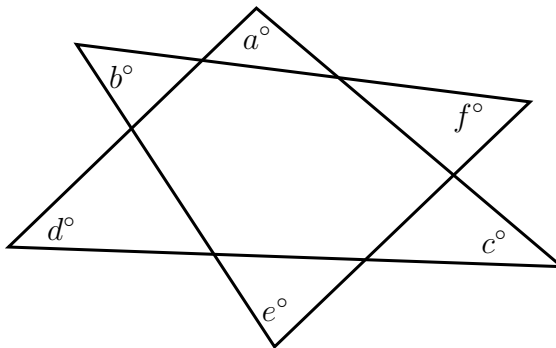
5. Quadrilateral $ABCD$ is a square and its side is 10 cm long. Quadrilateral $ATMD$ is a rectangle and its shorter side is 3 cm.



What is the difference between the sum of the lengths of all the sides of the square and the sum of the lengths of all the sides of the rectangle?

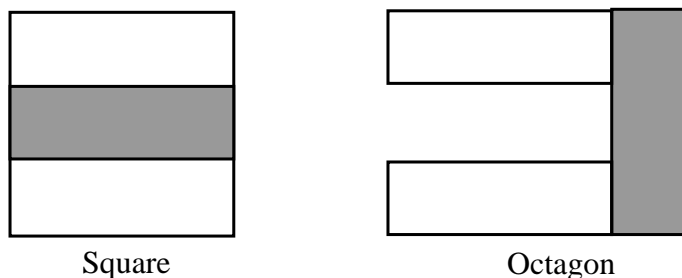
- (A) 14 cm (B) 10 cm (C) 7 cm (D) 6 cm (E) 4 cm

6. In any order, Julie, Kassie, Zoe and Helen have their birthdays on March 1st, May 17th, July 20th and March 20th. Kassie and Zoe were born in the same month. Julie and Zoe were born on the same day of a month. Which of the girls was born on May 17th?
 (A) Julie (B) Kassie (C) Zoe (D) Helen (E) Cannot say
7. All Mother Hubbard have to feed her children is one Giant chocolate bar. She gave each of her children one-twelfth of the chocolate bar. One third of the bar was left. How many children does Mother Hubbard have?
 (A) 6 (B) 8 (C) 12 (D) 15 (E) 18
8. In the diagram below, 6 angles are marked.



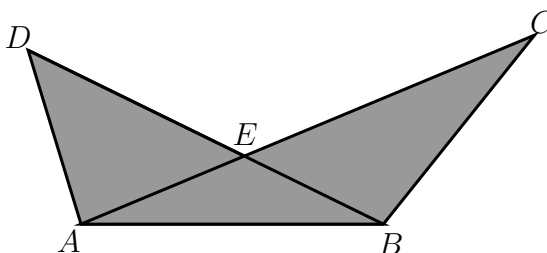
- What is the value of $a + b + c + d + e + f$?
 (A) 90 (B) 180 (C) 240 (D) 300 (E) 360
9. Peter Peters picked a peck of purple peppers. You are given that
 $1 \text{ peck} = 1/4 \text{ bucket}$ and $1 \text{ bucket} = 1/9 \text{ barrel}$.
- How many more pecks of purple peppers must Peter Peters pick to fill a barrel?
 (A) 12 (B) 13 (C) 34 (D) 35 (E) 36
10. The area of a certain rectangle is equal to 1 m^2 . What is the area of a triangle that was cut off from that rectangle along the line connecting the midpoints of the two adjacent sides?
 (A) 33 dm^2 (B) 25 dm^2 (C) 40 dm^2 (D) $3,750 \text{ cm}^2$ (E) $1,250 \text{ cm}^2$
11. Diana is 3 years old and her mother is 28 years older than her. How many years later will Diana's mother be three times older than her?
 (A) 9 (B) 12 (C) 10 (D) 1 (E) 11

12. A square is divided into three congruent rectangles. The middle rectangle is removed and placed on the side of the original square to form an octagon as shown.



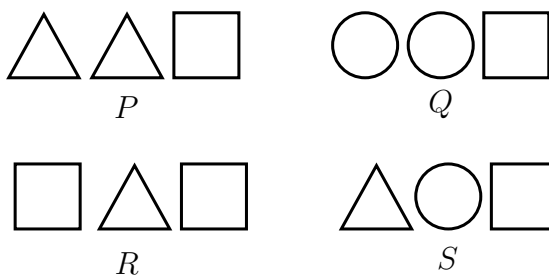
- What is the ratio of the length of the perimeter of the square to the length of the perimeter of the octagon?
- (A) 3 : 5 (B) 2 : 3 (C) 5 : 8 (D) 1 : 2 (E) 1 : 1
13. One medal can be cut out from a golden square plate. If four medals are made from four plates, the remaining parts of those four plates can be used to make one more plate. What is the largest number of medals that could be formed when 16 plates are used?
- (A) 17 (B) 19 (C) 20 (D) 21 (E) 32
14. The longest five-set tennis match in history lasted 11 hours and 5 minutes. The fifth set of that match lasted 8 hours and 11 minutes. Approximately what fraction of the whole match was taken up by the fifth set?
- (A) $1/5$ (B) $2/5$ (C) $3/5$ (D) $3/4$ (E) $9/10$
15. The students in Grade Five are holding an election with 4 candidates. A candidate receiving more votes than the other 3 candidates wins. The four candidates receive a total of 83 votes between them. What is the smallest number of votes the winner could receive?
- (A) 21 (B) 22 (C) 23 (D) 41 (E) 42
16. How many different three-digit numbers divisible by 25 can be made with the digits 0, 3, 5, 7 if the digits can be repeated?
- (E) 16 (B) 9 (C) 81 (D) 64 (E) 3

17. In the diagram below, the area of triangle ABD is equal to 15, the area of triangle ABC is equal to 12 and the area of triangle ABE is equal to 4.



- What is the area of pentagon $ABCED$?
- (A) 19 (B) 31 (C) 23 (D) 27 (E) 35
18. Ida has 14 gray balls, 8 white balls and 6 black balls in a bag. What is the least number of the balls she has to take out of her bag having her eyes closed to make sure that she took at least one ball of each color?
- (A) 23 (B) 22 (C) 21 (D) 15 (E) 9
19. A cyclist went up a hill with the speed of 12 km/h and went down the hill with the speed of 20 km/h. The ride up the hill took him 16 minutes longer than the ride down the hill. How many minutes did the cyclist take to go down the hill?
- (A) 24 (B) 40 (C) 32 (D) 16 (E) 28
20. On July 1st in Norwich the sun will rise at 4 : 53 A.M. and set at 9 : 25 P.M. In the middle of that period is **local noon**. At what time will the **local noon** be in Norwich on July 1st?
- (A) 12 : 00 P.M. (B) 12 : 39 P.M. (C) 1 : 09 P.M. (D) 4 : 32 P.M. (E) 11 : 08 A.M.
21. In one month three Sundays were on even dates. What day of the week was the 20th day of the month?
- (A) Monday (B) Tuesday (C) Wednesday (D) Thursday (E) Saturday
22. A computer virus destroys computer memory. On the first day it destroyed $\frac{1}{2}$ of this memory. On the second day it destroyed $\frac{1}{3}$ of the memory remaining after the first day; on the third day it destroyed $\frac{1}{4}$ of the memory remaining after two days and on the fourth day it destroyed $\frac{1}{5}$ of the memory remaining after three days. What part of all the computer memory was left after those four days?
- (A) $\frac{1}{5}$ (B) $\frac{1}{6}$ (C) $\frac{1}{10}$ (D) $\frac{1}{12}$ (E) $\frac{1}{24}$

23. What is the greatest value of the sum of the digits of the number made from the sum of the digits of a three-digit number?
 (A) 9 (B) 10 (C) 11 (D) 12 (E) 18
24. In a chess competition 32 players were competing. The competition was taking place by steps. In each step all the players were divided into groups of four. In each of these groups every player played once with every other player. The two best players from the group went to the next step and the two worst players were out of the competition. After the step in which four last players played, the two best players played an additional final game. How many games were played during the whole competition?
 (A) 49 (B) 89 (C) 91 (D) 97 (E) 181
25. Symbols P, Q, R, S indicate the total weight of the figures drawn above them.



It is known that any two figures of the same shape have the same weight. If $P < Q < R$, then

- (A) $P < S < Q$ (B) $Q < S < R$ (C) $S < P$ (D) $R < S$ (E) $R = S$