



## A TRADITION OF EXCELLENCE



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5. The exam consists of 25 multiple-choice questions, with each question carrying a weight of 4 points. The maximum achievable score is 100. However, it's important to note that there is a penalty of one point for each incorrect answer. Consequently, it is advisable to respond only to questions you are confident about.
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1. Alex wants to choose between two paths in Central Park for his morning run. Their combined length is 108 meters, and the longer path is 6 meters longer than the shorter one. What is the length, in meters, of the shorter path?

A) 51  
B) 52  
C) 53  
D) 54

2. Alex is tasked with checking the distribution of flowers on a tree in the Brooklyn Botanic Garden. The tree has 9 branches, each capable of holding up to 4 flowers. Which of the following numbers cannot be the total count of flowers on the tree?

A) 37  
B) 36  
C) 35  
D) 34

3. How many multiples of 14 are there between 100 and 600?

A) 49  
B) 42  
C) 35  
D) 7

4. While riding the NYC subway, Alex noticed the pattern below in the train numbers. What is the missing number?

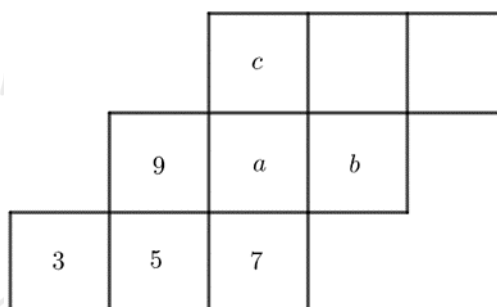
2, 11, 6, 15, 10, ?, 14, 23

A) 17  
B) 18  
C) 19  
D) 20

5. At a soccer game in Yankee Stadium, Alex learns that a player has scored 28 goals in 35 games. He calculates the number of goals this player will score in 75 games if he maintains the same scoring rate. What is this number?

A) 68  
B) 60  
C) 56  
D) 45

6. Nine squares are completed with numbers such that three consecutive horizontal squares or three vertical squares sum up to the same number. What is the value of  $c - b$ ?



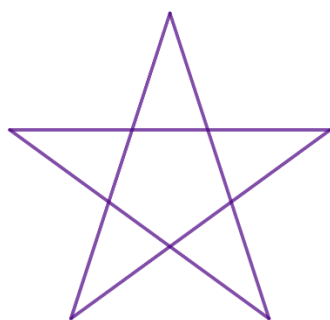
A) -1  
B) 0  
C) 1  
D) 2



7. Alex, the Astronaut, went to his favorite bookstore in New York to buy a book on astronomy. When he got there, he was surprised: the book was 20% off. Without thinking twice, Alex bought it, paying \$32. What was the original price of the book before the discount?

A) \$25.60  
B) \$35  
C) \$38.40  
D) \$40

8. How many triangles are there in the following figure?



A) 5  
B) 8  
C) 10  
D) 15

9. Alex is volunteering at a science fair in a Manhattan school. Part of his task is to analyze the participation data. He finds that 75 students are involved in a robotics club, 85 in a coding club, and 25 students are active in both clubs. Additionally, he discovers that 35 students are not participating in either club. To plan for next year's resources, Alex needs to figure out the total number of students who participated in the fair. What is this number?

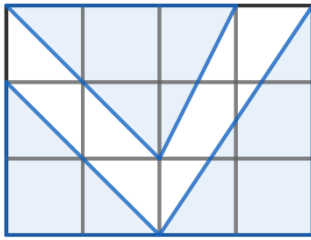
A) 100  
B) 150  
C) 170  
D) 220

10. During a math workshop at the New York Public Library, Alex is challenged with understanding a numerical sequence displayed on the projector. The pattern is shown below. What number should replace the question mark?

$\frac{1}{24}, \frac{1}{24}, \frac{1}{12}, \frac{1}{4}, 1, 5, 30, ?$

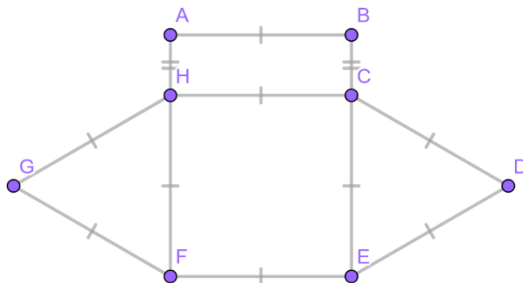
A) 210  
B) 180  
C)  $\frac{145}{2}$   
D)  $\frac{180}{7}$

11. What is the area of the blue region, in  $\text{cm}^2$ , if each small square has a side length of 1 cm?



- A) 6  
B) 8  
C) 9  
D) 12

12. Two equilateral triangles and one rectangle are glued to a square, as shown in the picture. It is known that the side  $AB$  equals three times side  $AH$ . If the perimeter of the rectangle  $ABCH$  is 56 cm, find the perimeter, in cm, of the total figure.



- A) 126  
B) 140  
C) 152  
D) 203

13. On the International Space Station, Alex presents a logic test to his fellow astronauts. He asks them to consider two distinct integers between 1 and 9, inclusive, where the larger number is exactly 3 more than the smaller one. He then challenges them to identify which of the following sums cannot be the result of adding these two numbers. What is the correct answer?

- A) 9  
B) 11  
C) 13  
D) 14

14. Find the value of  $A + L + E + X$ .

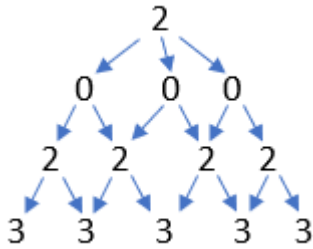
	A	L	E	X
×				8
	9	8	8	0

- A) 9  
B) 10  
C) 11  
D) 12

15. Alex, on the International Space Station, is in charge of meal planning for the crew. He has a stock of 150 slices of bread, 90 burgers, and 80 slices of cheese. To make a sandwich, he needs two slices of bread, one burger, and one slice of cheese. How many complete sandwiches can he make?

- A) 45  
B) 75  
C) 90  
D) 150

16. How many ways are there of creating the number 2023 by following the arrows?



- A) 60  
B) 13  
C) 12  
D) 5

17. As part of a rocket launch calculation, Alex comes across the expression below. What is its value?

$$\left[ \left( \frac{1}{5} + \frac{1}{4} \right) \times 5 + 6 \right] \div \frac{1}{4}$$

- A) 15  
B) 25  
C) 28  
D) 33

18. While in Manhattan, Alex overhears a conversation where a father says he's 5 times older than his son, and their ages add up to 48 years. How old is the father?

- A) 40  
B) 43  
C) 48  
D) 53

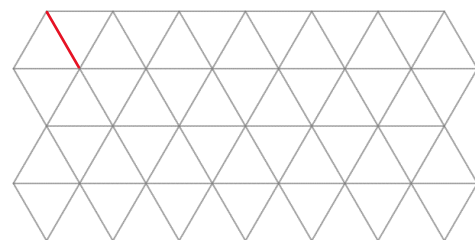
19. After running the NYC Marathon, Alex wants to convert the race distance into miles. He remembers that 1 mile equals 1.609 kilometers, and the race is 42,195 meters long. How many miles did he run approximately?

- A) 23  
B) 26  
C) 27  
D) 38

20. Which of the following numbers has the same remainder when divided by 3 and by 5?

- A) 12  
B) 24  
C) 25  
D) 31

21. How many unit segments, such as the one colored in red, can we find in the following image?



- A) 84  
B) 88  
C) 100  
D) 102



**22.** Alex came across an interesting mathematical term: a 'fantastic' number, defined as any number less than 1000 where all digits are identical. He's curious about prime numbers that fit this 'fantastic' criteria. What is the total number of prime 'fantastic' numbers?

- A) 4
- B) 5
- C) 6
- D) 7

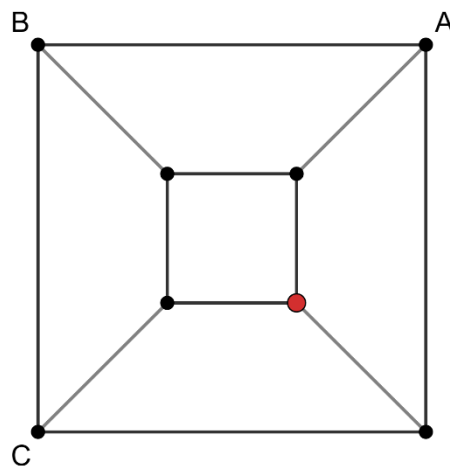
**23.** If  $\frac{y}{x} = 5$  and  $2y + 3x = 39$ , what is the value of  $x + y$ ?

- A) 18
- B) 15
- C) 12
- D) 3

**24.**  $A$  and  $B$  are digits such that  $\overline{AB}$  is a prime number, and  $B - A = 6$ . What is the value of  $B$ ?

- A) 5
- B) 6
- C) 7
- D) 8

**25.** In the figure below, each of the 8 points must be labeled with a letter: A, B, C, or D. All four points that form a quadrilateral must have different letters. If three dots have already been labeled, which letter should the red dot have?



- A) A
- B) B
- C) C
- D) D



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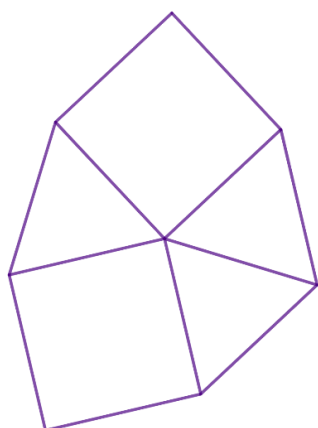




1. Alex, the Astronaut, needs to calculate the total fuel usage for his spacecraft over three missions. The fuel usage for each mission is  $10^6$ ,  $3 \cdot 10^6$ , and  $6 \cdot 10^6$  pounds. What is the total fuel usage, in pounds, for the three missions?

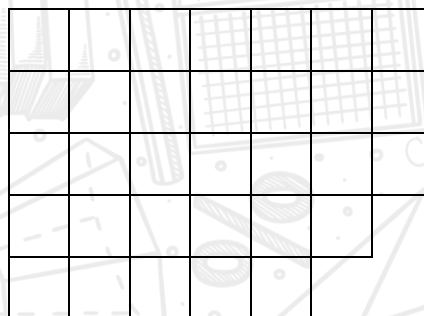
- A)  $9 \cdot 10^6$   
B)  $10^7$   
C)  $10^6 + 10^7$   
D)  $21 \cdot 10^{18}$

2. Three equilateral triangles and two squares form the figure below. If the side of the triangles measures 3 cm, what is the perimeter of the whole figure in cm?



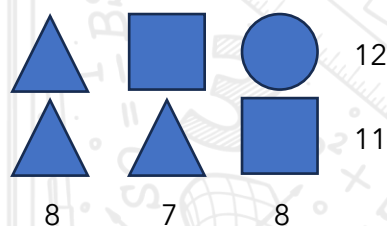
- A) 21  
B) 24  
C) 36  
D) 51

3. How many squares are there in the following picture?



- A) 32  
B) 35  
C) 70  
D) 71

4. The sum of each row and column is given. What is the value of the blue circle?



- A) 2  
B) 3  
C) 4  
D) 5

5. How many multiples of 14 are there between 100 and 600?

- A) 49  
B) 42  
C) 35  
D) 7



6. As part of a rocket launch calculation, Alex comes across the expression below. What is its value?

$$(7 \times 5 \times 9 \times 0.4) \div (20 \times 21 \times 30)$$

- A) 0.001
- B) 0.01
- C) 0.1
- D) 1

7. Alex, the Astronaut, went to his favorite bookstore in New York to buy a book on astronomy. When he got there, he was surprised: the book was 20% off. Without thinking twice, Alex bought it, paying \$32. What was the original price of the book before the discount?

- A) \$25.60
- B) \$35
- C) \$38.40
- D) \$40

8. Alex, to enter Columbia University and start his lecture on Astrophysics, first has to go up a flight of stairs with 12 steps right at the entrance. Being methodical, he climbs 1 or 3 steps at a time. How many ways can Alex get to the top of the stairs and proceed with his lecture?

- A) 15
- B) 20
- C) 60
- D) 233

9. Alex, the Astronaut, plans to build a new rocket production center in exactly 15 days. As it is very large, the building will have a total of 125 walls. When he contacted a contractor, he was told that 4 men could build 10 walls in 3 days. How many men will be needed to carry out Alex's project?

- A) 8
- B) 10
- C) 15
- D) 20

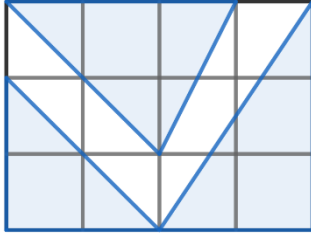
10. During a STEM outreach event at a New York City school, Alex, the Astronaut, uses a fruit basket to demonstrate the concept of ratios to students. The basket contains apples and oranges in a 4 : 7 ratio, respectively. If there are 22 fruits in the basket, how many oranges are there?

- A) 4
- B) 7
- C) 8
- D) 14

11. Alex, on the International Space Station, is in charge of meal planning for the crew. He has a stock of 150 slices of bread, 90 burgers, and 80 slices of cheese. To make a sandwich, he needs two slices of bread, one burger, and one slice of cheese. How many complete sandwiches can he make?

- A) 45
- B) 75
- C) 90
- D) 150

- 12.** Knowing that each unit segment in the figure below measures 1 cm, determine the fraction of the figure that is not colored blue.



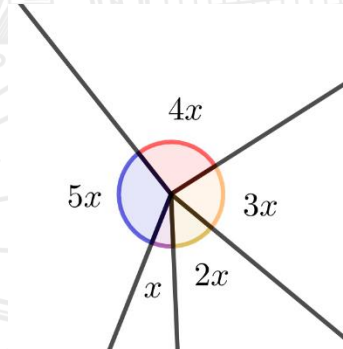
- A)  $\frac{1}{3}$   
B)  $\frac{1}{4}$   
C)  $\frac{1}{5}$   
D)  $\frac{1}{6}$

- 13.** If the operation # is defined as follows, what is the value of  $3 \# 4$ ?

$$\left(\frac{2a+b}{5}\right) \# (a-3b) = a^b$$

- A) 7  
B) 9  
C) 16  
D) 25

- 14.** Five angles, with measures equal to  $x$ ,  $2x$ ,  $3x$ ,  $4x$ , and  $5x$ , form a full turn, as shown in the image below. How many of these five angles are acute?



- A) 1  
B) 2  
C) 3  
D) 4

- 15.** What percentage of a week equals 10 hours and 30 minutes?

- A) 6.25%  
B) 0.625%  
C) 0.0625%  
D) 0.00625%

- 16.** At a math workshop in the Hayden Planetarium, New York, Alex the Astronaut shares an intriguing sequence, as shown below. Visitors are invited to engage with the exhibit by determining the next term in the sequence. What is the next term?

$$\frac{32}{9}, \frac{16}{3}, 8, 12, 18, 27, ?$$

- A)  $\frac{27}{2}$   
B) 36  
C)  $\frac{81}{2}$   
D) 81



17. At a soccer game in Yankee Stadium, Alex learns that a player has scored 28 goals in 35 games. He calculates the number of goals this player will score in 75 games if he maintains the same scoring rate. What is this number?

- A) 68
- B) 60
- C) 56
- D) 45

18. While working on a new satellite model at the New York Hall of Science, Alex, the Astronaut, needs to calculate the dimensions of a component in the shape of a miniature rectangular prism that will fit inside the satellite. Three of the faces of this component have areas equal to  $28 \text{ cm}^2$ ,  $52 \text{ cm}^2$ , and  $91 \text{ cm}^2$ . To ensure that the component fits perfectly into the designated slot inside the satellite, Alex needs your help: what is the length, in cm, of the biggest side of the prism?

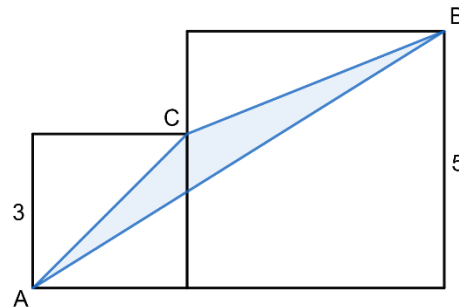
- A) 7
- B) 9
- C) 11
- D) 13

19. Find the value of the expression below.

$$10 + \frac{24}{10 + \frac{24}{10 + \frac{24}{10 + \dots}}}$$

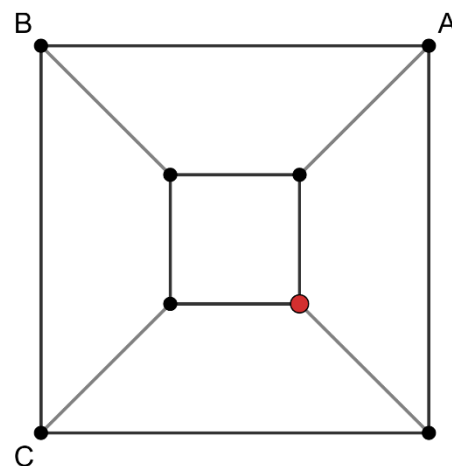
- A)  $\frac{10}{24}$
- B)  $\frac{24}{10}$
- C) 12
- D) 24

20. A triangle  $ABC$  is found between two squares with sides 3 and 5, as shown in the picture. What is the area of this triangle?



- A) 4.5
- B) 5
- C) 5.5
- D) 6

21. In the figure below, each of the 8 points must be labeled with a letter: A, B, C, or D. All four points that form a quadrilateral must have different letters. If three dots have already been labeled, which letter should the red dot have?



- A) A
- B) B
- C) C
- D) D

**22.** Alex, Brenda, Carlos, and David went out trick-or-treating on Halloween. When they got back, they counted how many sweets they each had and discovered that Brenda had three times as many sweets as Alex, Carlos had half as many sweets as Brenda, and David had half as many sweets as the other three friends. If David got 33 sweets, how many sweets did Carlos get?

- A) 12
- B) 15
- C) 18
- D) 33

**23.** If the number  $\overline{18A}$  is prime, then what is the value of the digit  $A$ ?

- A) 1
- B) 3
- C) 5
- D) 7

**24.** Which of the following numbers has the same remainder when divided by 3 and by 5?

- A) 20
- B) 22
- C) 31
- D) 36

**25.** On the International Space Station, Alex presents a logic test to his fellow astronauts. He asks them to consider two distinct integers between 1 and 9, inclusive, where the larger number is exactly 3 more than the smaller one. He then challenges them to identify which of the following sums cannot be the result of adding these two numbers. What is the correct answer?

- A) 9
- B) 11
- C) 13
- D) 14





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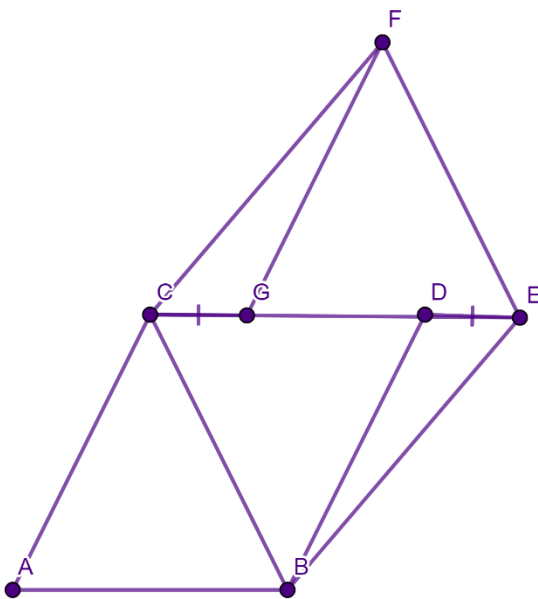


1. At a math workshop in the Hayden Planetarium, Alex, the Astronaut, shares an intriguing sequence, as shown below. Visitors are invited to engage with the exhibit by determining the next term in the sequence. What is the next term?

$$\frac{1}{24}, \frac{1}{24}, \frac{1}{12}, \frac{1}{4}, 1, ?$$

- A) 3  
B) 4  
C) 5  
D) 12

2. In the figure below,  $ABDC$  and  $BCFE$  are parallelograms so that points  $C, G, D$ , and  $E$  are collinear and  $CG = DE$ . If  $AC + BE = 15$ , what is the value of  $FC + FG$ ?



- A) 30  
B) 20  
C) 18  
D) 15

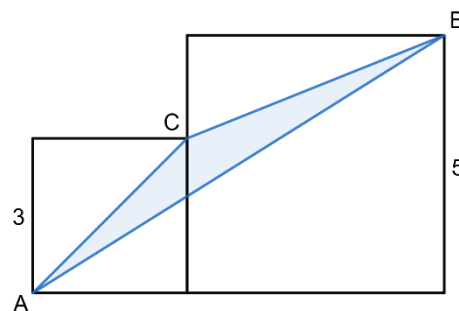
3. To pass his free time, Alex decided to make a bead bracelet as a gift for his niece. Knowing that Alex will use exactly 6 different beads, determine the number of different bracelets he can make.

- A) 60  
B) 120  
C) 360  
D) 720

4. If  $4x + 6y = 12$  and  $4xy = 24$ , what is the value of  $64x^3 + 216y^3$ ?

- A) -3456  
B) +3456  
C) +6912  
D) -1908

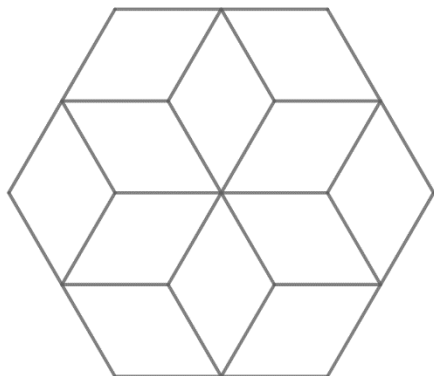
5. A triangle  $ABC$  is found between two squares with sides 3 and 5, as shown in the picture. What is the area of this triangle?



- A) 4.5  
B) 5  
C) 5.5  
D) 6



6. In an interactive exhibition at the New York Hall of Science, Alex, the Astronaut, shows a model of a sensor used in a new generation satellite. The model is formed by overlapping six identical hexagons, as shown in the figure below. If the perimeter of each hexagon is 100 cm, what is the perimeter, in cm, of the entire model?



- A) 100  
B) 200  
C) 300  
D) 600

7. Knowing that the first day of 2024 was a Monday, determine the day of the first Sunday of 2027.

- A) 1  
B) 2  
C) 3  
D) 4

8. If the operation # is defined as follows, what is the value of  $3 \# 4$ ?

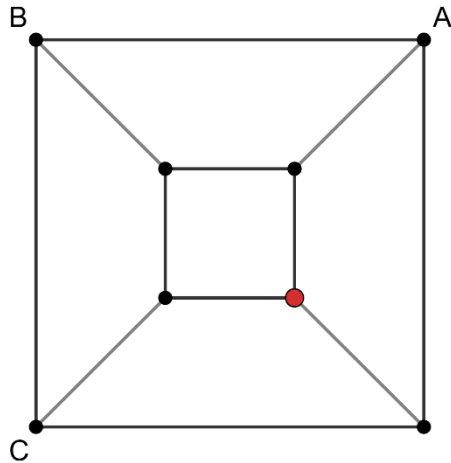
$$\left(\frac{2a+b}{5}\right) \# (a-3b) = a^b$$

- A) 7  
B) 9  
C) 16  
D) 25

9. If you place a 25 m long ladder on a vertical wall so that the foot of the ladder is 700 cm from the base of the wall, how high on the wall does the ladder reach in meters?

- A) 6  
B) 16  
C) 20  
D) 24

10. In the figure below, each of the 8 points must be labeled with a letter: A, B, C, or D. All four points that form a quadrilateral must have different letters. If three dots have already been labeled, which letter should the red dot have?



- A) A  
B) B  
C) C  
D) D

11. Alex, on the International Space Station, is in charge of meal planning for the crew. He has a stock of 150 slices of bread, 90 burgers, and 80 slices of cheese. To make a sandwich, he needs two slices of bread, one burger, and one slice of cheese. How many complete sandwiches can he make?

- A) 45  
B) 75  
C) 90  
D) 150

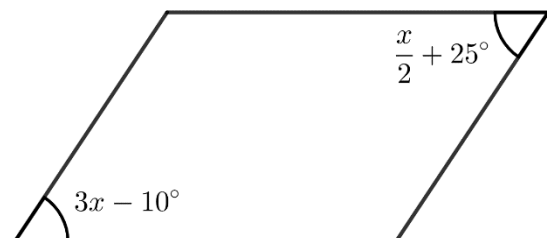
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C) 35  
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- A) 1  
B) 3  
C) 5  
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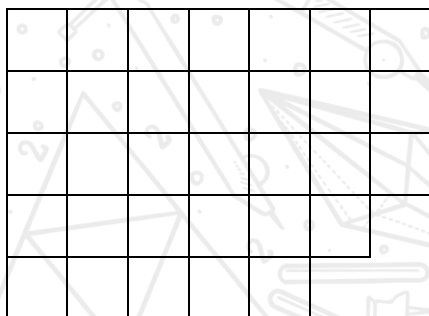
14. In the figure below, two of the internal angles of a parallelogram have been shown. Based on this, find the value of the largest internal angle of this parallelogram.



- A) 76°  
B) 104°  
C) 122°  
D) 148°



15. How many squares are there in the following picture?



- A) 32  
B) 35  
C) 70  
D) 71

16. Alex, the Astronaut, plans to build a new rocket production center in exactly 15 days. As it is very large, the building will have a total of 125 walls. When he contacted a contractor, he was told that 4 men could build 10 walls in 3 days. How many men will be needed to carry out Alex's project?

- A) 8  
B) 10  
C) 15  
D) 20

17. In a Copernicus Math Workshop, Alex, the Astronaut, presents a combinatorics exercise involving four boxes numbered 1, 2, 3, and 4. The challenge for the participants is to fill each box with one, and only one, red or green ball. The rule is that at least one box must contain a green ball, and all green balls used must be placed in consecutively numbered boxes. Given these conditions, how many different arrangements can be made?

- A) 4  
B) 8  
C) 10  
D) 14

18. Let  $a$ ,  $b$ , and  $c$  be natural numbers that satisfy the equality below. Find  $a + b + c$ .

$$a + \frac{1}{b + \frac{1}{c}} = \frac{188}{61}$$

- A) 17  
B) 18  
C) 19  
D) 20

19. Which of the following is equivalent to  $(12\%)^2$ ?

- A) 144%  
B) 14.4%  
C) 1.44%  
D) 0.144%

**20.** Alex, to enter Columbia University and start his lecture on Astrophysics, first has to go up a flight of stairs with 12 steps right at the entrance. Being methodical, he climbs 1 or 3 steps at a time. How many ways can Alex get to the top of the stairs and proceed with his lecture?

- A) 60
- B) 20
- C) 15
- D) 13

**21.** Two dice are thrown. What is the probability that the sum of the two numbers in the upper faces of the dice is a prime number?



- A)  $\frac{5}{36}$
- B)  $\frac{5}{12}$
- C)  $\frac{5}{11}$
- D)  $\frac{1}{2}$

**22.** Alex, Brenda, Carlos, and David went out trick-or-treating on Halloween. When they got back, they counted how many sweets they each had and discovered that Brenda had three times as many sweets as Alex, Carlos had half as many sweets as Brenda, and David had half as many sweets as the other three friends. If David got 33 sweets, how many sweets did Carlos get?

- A) 12
- B) 15
- C) 18
- D) 33

**23.** In a New York City international summer camp with 400 students, a survey on language skills reveals that 130 students are fluent in Portuguese, 150 in Spanish, and 40 students are fluent in both. Given these numbers, if a student is randomly picked from the camp, what is the probability that this student is not fluent in either Portuguese or Spanish?

- A) 10%
- B) 20%
- C) 30%
- D) 40%

**24.** What is the remainder when dividing the number below by 49?

$$(1 + 7)(1 + 2 \cdot 7)(1 + 3 \cdot 7)(1 + 4 \cdot 7)(1 + 5 \cdot 7)$$

- A) 2
- B) 8
- C) 14
- D) 48



25. Find the value of  $\frac{B}{A}$  in the following expression.

$$\frac{2x}{2x^2 + 5x - 3} = \frac{A}{2x - 1} + \frac{B}{x + 3}$$

- A) 1
- B) 2
- C) 3
- D) 4



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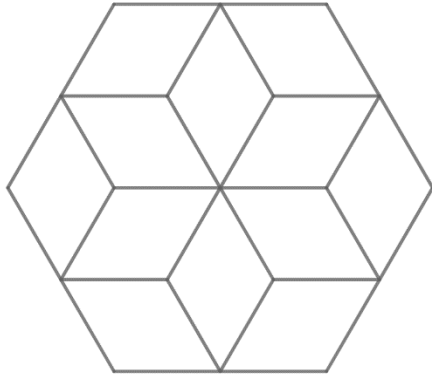
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**We wish you the very best luck on the exam.**





1. In an interactive exhibition at the New York Hall of Science, Alex, the Astronaut, shows a model of a sensor used in a new generation satellite. The model is formed by overlapping six identical hexagons, as shown in the figure below. If the perimeter of each hexagon is 100 cm, what is the perimeter, in cm, of the entire model?



- A) 100  
B) 200  
C) 300  
D) 600
2. The product of a natural number doubled and reduced by one, and the same number quadrupled and reduced by three is equal to the original number. What is this number?
- A) 4  
B) 3  
C) 2  
D) 1

3. In a Copernicus Math Workshop, Alex, the Astronaut, presents a combinatorics exercise involving four boxes numbered 1, 2, 3, and 4. The challenge for the participants is to fill each box with one, and only one, red or green ball. The rule is that at least one box must contain a green ball, and all green balls used must be placed in consecutively numbered boxes. Given these conditions, how many different arrangements can be made?

- A) 4  
B) 8  
C) 10  
D) 14

4. If you place a 25 m long ladder on a vertical wall so that the foot of the ladder is 700 cm from the base of the wall, how high on the wall does the ladder reach in meters?

- A) 6  
B) 16  
C) 20  
D) 24

5. In an exhibition at the American Museum of Natural History, Alex, the Astronaut, shows the process for creating a crucial part of a satellite: a giant circular ring. This ring, essential to the satellite's functionality, has a radius of 16 meters and must be made of wire. If the wire is available in packages of 15 meters, what is the minimum number of packages Alex will need to complete his project? (Use  $\pi = 3$ )

- A) 4  
B) 6  
C) 7  
D) 52

6. Considering the equation below, find the value of  $A + B + C$ .

$$(x^3 - 2x^2 - 5x + 6) \div (x + 2) = Ax^2 + Bx + C$$

- A) -1
- B) 0
- C) 1
- D) 8

7. Alex, the Astronaut, plans to build a new rocket production center in exactly 15 days. As it is very large, the building will have a total of 125 walls. When he contacted a contractor, he was told that 4 men could build 10 walls in 3 days. How many men will be needed to carry out Alex's project?

- A) 8
- B) 10
- C) 15
- D) 20

8. If  $f(x) = \sqrt[3]{2x^2 + 3x + 5}$  and  $g(x) = x^5$ , find  $g(f(g(x)))$ .

- A)  $(2x^5 + 3x + 5)^{\frac{5}{3}}$
- B)  $(2x^{10} + 3x^5 + 5)^{\frac{5}{3}}$
- C)  $(2x^{10} + 3x^5 + 5)^{\frac{3}{5}}$
- D)  $(2x^{10} + 3x^5 + 5)^{\frac{1}{3}}$

9. What is the largest possible area in  $\text{m}^2$  for a rectangle whose perimeter is 64 m?

- A) 256
- B) 512
- C) 1024
- D) 4096

10. Alex, to enter Columbia University and start his lecture on Astrophysics, first has to go up a flight of stairs with 12 steps right at the entrance. Being methodical, he climbs 1 or 3 steps at a time. How many ways can Alex get to the top of the stairs and proceed with his lecture?

- A) 15
- B) 20
- C) 60
- D) 233

11. If  $4x + 6y = 12$  and  $4xy = 24$ , what is the value of  $64x^3 + 216y^3$ ?

- A) -3456
- B) +3456
- C) +6912
- D) -1908

12. Alex was invited to the birthday of the son of one of his astronaut friends. As the boy is a fan of the New York City Football Club, Alex bought a soccer ball and wrapped it in a cubic gift box. Knowing that the box has a surface area of  $1944 \text{ cm}^2$  and that the ball touches all the inside faces of the box simultaneously, find the volume of the box that was not filled by the ball. (Use  $\pi = 3$  and give your answer in  $\text{cm}^3$ )

- A) 729
- B) 2916
- C) 5832
- D) 17496



- 13.** Two dice are thrown. What is the probability that the sum of the two numbers in the upper faces of the dice is a prime number?

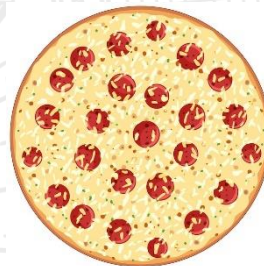


- A)  $\frac{5}{36}$   
B)  $\frac{5}{12}$   
C)  $\frac{5}{11}$   
D)  $\frac{1}{2}$

- 14.** If the number  $\overline{18A}$  is prime, then what is the value of the digit  $A$ ?

- A) 1  
B) 3  
C) 5  
D) 7

- 15.** Alex is enjoying a delicious pizza with a diameter of 12 inches. If he eats a quarter of the pizza, what is the area of the remaining pizza in square inches? (Use  $\pi = 3$ )



- A) 27  
B) 36  
C) 54  
D) 81

- 16.** Alex, Brenda, Carlos, and David went out trick-or-treating on Halloween. When they got back, they counted how many sweets they each had and discovered that Brenda had three times as many sweets as Alex, Carlos had half as many sweets as Brenda, and David had half as many sweets as the other three friends. If David got 33 sweets, how many sweets did Carlos get?

- A) 12  
B) 15  
C) 18  
D) 33

- 17.** Find the value of  $x$  in the following expression.

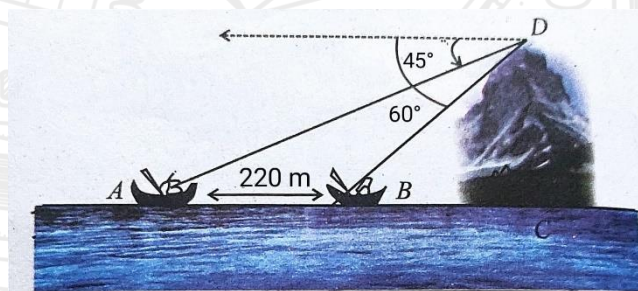
$$2^{2x+6} = 16$$

- A)  $\log 10$   
B)  $\log \frac{1}{10}$   
C)  $-4$   
D)  $\log 2$

**18.** Alex participated in a Copernicus Racing Event. During the race, Alex completed 4 laps around a circular track with a radius of 15 m. What was the total distance he ran in meters? (Use  $\pi = 3$ )

- A) 45
- B) 90
- C) 180
- D) 360

**19.** Standing on a cliff, Alex looks down and sees two boats in the water. Using a theodolite, he discovers that one boat is at  $45^\circ$  and the other at  $60^\circ$  from his point of view as shown in the figure below. If the distance between the two boats is 220 m, how many meters above sea level is Alex? (Disregard Alex's height)



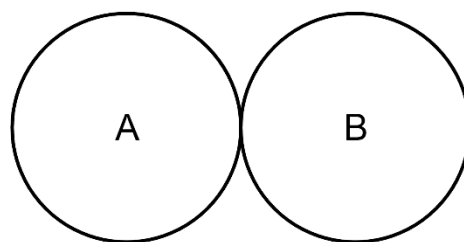
- A)  $\frac{220\sqrt{3}}{\sqrt{3}-1}$
- B)  $\frac{220\sqrt{3}}{1-\sqrt{3}}$
- C)  $\frac{220}{\sqrt{3}-1}$
- D)  $\frac{220\sqrt{3}}{\sqrt{3}+1}$

**20.** If the operation # is defined as follows, what is the value of  $3 \# 4$ ?

$$\left(\frac{2a+b}{5}\right) \# (a-3b) = a^b$$

- A) 7
- B) 9
- C) 16
- D) 25

**21.** Alex has two identical coins A and B, as shown in the picture below. From the position shown in the picture, Alex rolls coin A around coin B. At the end of how many revolutions will the center of coin A first reach its starting point?



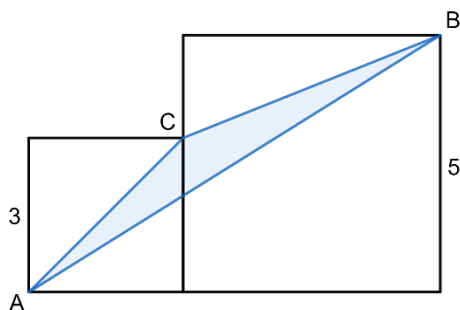
- A)  $\frac{1}{2}$
- B) 1
- C)  $\frac{3}{2}$
- D) 2

**22.** Which of the following is equivalent to  $(12\%)^2$ ?

- A) 144%
- B) 14.4%
- C) 1.44%
- D) 0.144%



- 23.** A triangle  $ABC$  is found between two squares with sides 3 and 5, as shown in the picture. What is the area of this triangle?



- A) 4.5  
B) 5  
C) 5.5  
D) 6

- 24.** In the Copernicus Mathematics Olympiad, 1600 students participated in the Global Round, out of which 3% got the Gold Medal, 6% got the Silver Medal, and 12% got the Bronze Medal. If 25% of the remaining students got an Honorable Mention award, how many students were not presented with an award?

- A) 316  
B) 336  
C) 864  
D) 948

- 25.** Find the value of  $\frac{B}{A}$  in the following expression.

$$\frac{2x}{2x^2 + 5x - 3} = \frac{A}{2x - 1} + \frac{B}{x + 3}$$

- A) 1  
B) 2  
C) 3  
D) 4



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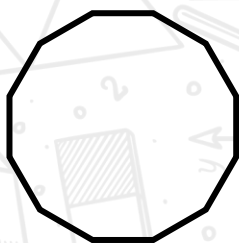
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talent when talent doesn't work hard"  
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1. Alex is currently engaged in engineering a complex satellite component at a New York space center. The component has an intricate design, shaped like a 12-sided polygon. To enhance its structural integrity, Alex plans to reinforce it with diagonals connecting its vertices. He needs to calculate the total number of diagonals possible. How many diagonals can Alex form in this 12-sided polygon?



- A) 12  
B) 44  
C) 54  
D) 108

2. What is the coefficient of  $x^2$  in the expansion of the polynomial below?

$$(1 - 2x^2)^5$$

- A) -80  
B) -40  
C) -20  
D) -10

3. If  $f(x) = \sqrt[3]{2x^2 + 3x + 5}$  and  $g(x) = x^5$ , find  $g(f(g(x)))$ .

- A)  $(2x^5 + 3x + 5)^{\frac{5}{3}}$   
B)  $(2x^{10} + 3x^5 + 5)^{\frac{5}{3}}$   
C)  $(2x^{10} + 3x^5 + 5)^{\frac{3}{5}}$   
D)  $(2x^{10} + 3x^5 + 5)^{\frac{1}{3}}$

4. To pass his free time, Alex decided to make a bead bracelet as a gift for his niece. Knowing that Alex will use exactly 7 different beads, determine the number of different bracelets he can make.

- A) 360  
B) 720  
C) 2520  
D) 5040

5. Let  $m$  and  $n$  be natural numbers. Knowing that  $3^m - 3^n = 702$ , calculate the value of  $3^{m-n}$ .

- A) 243  
B) 81  
C) 27  
D) 9

6. What is the largest possible area in  $\text{m}^2$  for a rectangle whose perimeter is 64 m?

- A) 256  
B) 512  
C) 1024  
D) 4096

7. In the middle of a busy day at the New York Space Museum, Alex, the astronaut, looks at his wristwatch and notices it is exactly 8 o'clock. This observation sparks a mathematical question in his mind about the smallest angle formed between the hour and minute hands of the clock at that particular time. What is the measure of this angle in radians?

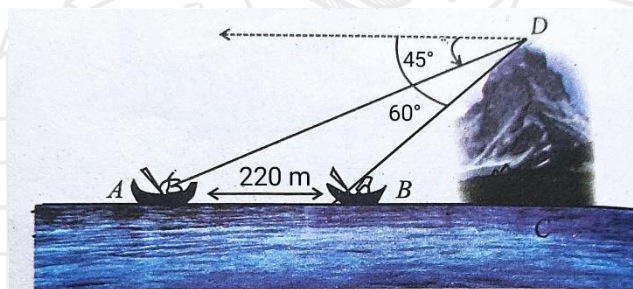


- A)  $\frac{\pi}{2}$   
B)  $\frac{2\pi}{3}$   
C)  $\frac{3\pi}{4}$   
D)  $\frac{4\pi}{3}$

8. Given that  $n! = n \cdot (n-1) \cdot (n-2) \cdot \dots \cdot 2 \cdot 1$ , find the number of zeros at the end of  $2024!$ .

- A) 202  
B) 224  
C) 316  
D) 503

9. Standing on a cliff, Alex looks down and sees two boats in the water. Using a theodolite, he discovers that one boat is at  $45^\circ$  and the other at  $60^\circ$  from his point of view as shown in the figure below. If the distance between the two boats is 220 m, how many meters above sea level is Alex? (Disregard Alex's height)



- A)  $\frac{220\sqrt{3}}{\sqrt{3}-1}$   
B)  $\frac{220\sqrt{3}}{1-\sqrt{3}}$   
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10. Alex, the Astronaut, plans to build a new rocket production center in exactly 15 days. As it is very large, the building will have a total of 125 walls. When he contacted a contractor, he was told that 4 men could build 10 walls in 3 days. How many men will be needed to carry out Alex's project?

- A) 8  
B) 10  
C) 15  
D) 20



**11.** Considering the equation below, find the value of  $A + B + C$ .

$$(x^3 - 2x^2 - 5x + 6) \div (x + 2) = Ax^2 + Bx + C$$

- A) -1
- B) 0
- C) 1
- D) 8

**12.** The sum of a number with two times its reciprocal is 2. Find the sum of the cubes of the two possible values for this number.

- A) 4
- B) 0
- C) -4
- D) -8

**13.** Two dice are thrown. What is the probability that the sum of the two numbers in the upper faces of the dice is a prime number?



- A)  $\frac{5}{36}$
- B)  $\frac{5}{12}$
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**14.** Which of the following is equivalent to  $(12\%)^2$ ?

- A) 144%
- B) 14.4%
- C) 1.44%
- D) 0.144%

**15.** While exploring the circular architecture of the Guggenheim Museum in New York, Alex becomes curious about the possibility of expressing the area  $A$  of a circle as a function of the length  $C$  of its circumference. Help him and determine which of the following options correctly formulates this relationship.

- A)  $A = \frac{C\pi}{4}$
- B)  $A = \frac{C}{4\pi}$
- C)  $A = \frac{C^2\pi}{4}$
- D)  $A = \frac{C^2}{4\pi}$

**16.** Find the value of  $x$  that satisfies the equation below.

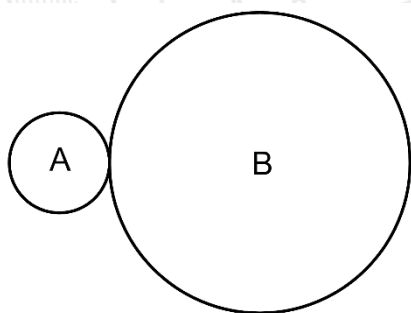
$$(3\sqrt{3})^x = 729$$

- A) 3
- B) 4
- C) 6
- D) 9

**17.** Knowing that the first day of 2024 was a Monday, determine the day of the first Sunday of 2027.

- A) 1
- B) 2
- C) 3
- D) 4

**18.** Alex has two coins A and B, and the radius of coin A is one-third of the radius of coin B. From the position shown in the picture below, Alex rolls coin A around coin B. At the end of how many revolutions will the center of coin A first reach its starting point?



- A) 3
- B)  $3\frac{1}{2}$
- C) 4
- D) 5

**19.** Considering  $i$  as the imaginary unit, which of the following is equivalent to  $\sqrt{-49} \cdot \sqrt{-36}$ ?

- A)  $-42$
- B)  $42$
- C)  $-42i$
- D)  $42i$

**20.** If  $4x + 6y = 12$  and  $4xy = 24$ , what is the value of  $64x^3 + 216y^3$ ?

- A)  $-3456$
- B)  $+3456$
- C)  $+6912$
- D)  $-1908$

**21.** What is the remainder when dividing the number below by 49?

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**22.** Alex, to enter Columbia University and start his lecture on Astrophysics, first has to go up a flight of stairs with 12 steps right at the entrance. Being methodical, he climbs 1 or 3 steps at a time. How many ways can Alex get to the top of the stairs and proceed with his lecture?

- A) 15
- B) 20
- C) 60
- D) 233



**23.** At a math workshop in the Hayden Planetarium, Alex, the Astronaut, shares an intriguing sequence, as shown below. Visitors are invited to engage with the exhibit by determining the next term in the sequence. What is the next term?

$$\frac{1}{24}, \frac{1}{24}, \frac{1}{12}, \frac{1}{4}, 1, ?$$

- A) 1
- B) 3
- C) 4
- D) 5

**24.** In the Copernicus Mathematics Olympiad, 1600 students participated in the Global Round, out of which 3% got the Gold Medal, 6% got the Silver Medal, and 12% got the Bronze Medal. If 25% of the remaining students got an Honorable Mention award, how many students were not presented with an award?

- A) 316
- B) 336
- C) 864
- D) 948

**25.** A certain ice cream shop in New York has 5 flavors of ice cream, which are sold in cups with 3 ice cream scoops. How many ways can you buy a cup of ice cream at this ice cream shop?

- A) 35
- B) 50
- C) 60
- D) 125

	CAT 1	CAT 2	CAT 3	CAT 4	CAT 5
Question	Correct Answer	Correct Answer	Correct Answer	Correct Answer	Correct Answer
1	A	B	C	B	C
2	A	A	D	D	D
3	C	D	A	C	B
4	C	D	A	D	A
5	B	C	A	C	C
6	D	B	B	B	A
7	D	D	C	B	B
8	C	C	A	B	D
9	C	B	D	A	A
10	A	D	B	C	B
11	B	B	B	A	B
12	B	A	C	B	C
13	D	A	A	B	B
14	C	C	D	A	C
15	B	A	D	D	D
16	C	C	B	C	B
17	D	B	C	B	C
18	A	D	D	D	C
19	B	C	C	A	A
20	D	A	A	A	A
21	B	B	B	D	B
22	B	C	C	C	C
23	A	A	D	A	D
24	C	C	B	D	D
25	B	D	C	C	A