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2024-2025 Math League Preliminary Round

(Grades 10-12)

(Unofficial version, for reference only)

1. How many solutions does the equation $|x + 2| = 2x$ have?

   A) 0 B) 1 C) 2 D) 3

2. If $x = \frac{1}{3} - \frac{1}{4} + \frac{1}{5} - \frac{1}{6} + \frac{1}{7} - \frac{1}{8} + \ldots + \frac{1}{99} - \frac{1}{100}$, then

   A) $-\frac{1}{3} < x < -\frac{1}{12}$ B) $-\frac{1}{12} < x < 0$ C) $0 < x < \frac{1}{12}$ D) $\frac{1}{12} < x < \frac{1}{3}$

3. What is the ordered pair of real numbers (U, V) for which $\frac{2}{x^2-4} = \frac{U}{x+2} + \frac{V}{x-2}$ is true for all $x \neq -2$ or 2?

   A) $\left(-\frac{1}{2}, \frac{1}{2}\right)$ B) $\left(-\frac{1}{2}, -\frac{1}{2}\right)$ C) $\left(\frac{1}{2}, -\frac{1}{2}\right)$ D) $\left(\frac{1}{2}, \frac{1}{2}\right)$

4. If $2x - 5y = 11$ and $3x + 4y = 7$, then $13x + 2y =$

   A) 4 B) 18 C) 43 D) 62

5. If an *equithagorean* triangle is an equilateral triangle in which the sum of the cubes of two sides is equal to the square of the third side, what is the perimeter of an *equithagorean* triangle?

   A) 0.5 B) 1.5 C) 4.5 D) 6

6. What percent of $0.5p$ is p?

   A) $\left(\frac{1}{2}\right)\%$ B) 20% C) 50% D) 200%

7. $x^3 - 1 = (x - 1)(\ ?\ )$



A) $x^2 - 1$ B) $x^2 + 1$

C) $x^2 + x + 1$ D) $x^2 - x + 1$

8. The roots of the equation $x^2 + bx + c = 0$ are 4 and 5. If the winning lottery number is $b + c$, then the winning lottery number is



A) 9 B) 11

C) 19 D) 21

9. Add all 100 roots of $(x + 1)(x - 2)(x + 3) \times ... \times (x - 98)(x + 99)(x - 100) = 0$.

A) 100 B) 50 C) -50 D) -100

10. What is the least integer $n > 0$ for which 12^n is divisible by 2^9?

A) 3 B) 4 C) 5 D) 9

11. My phone number has 7 digits. Their product is an even perfect square. The greatest possible value of their sum is

A) 28 B) 58 C) 61 D) 63

12. Increasing the length of a certain rectangle by 12.5 has the same effect on its area as increasing its width by 12. If the area of the rectangle is 600, what is its perimeter?

A) 49 B) 52 C) 98 D) 104

13. If $\sqrt{M \times A \times T \times H} = M \times A \times T$, then the value of H must be

A) $M \times A \times T$ B) $\sqrt{M \times A \times T}$

C) $M^2 \times A^2 \times T^2$ D) 1

14. A circle and a square have equal areas. The ratio of the length of a side of the square to the length of a diameter of the circle is

A) $\sqrt{\pi} : 1$ B) $2\sqrt{\pi} : 1$ C) $\sqrt{\pi} : 2$ D) $1 : \sqrt{\pi}$

15. I added 10^{2006} and 10^{2007}. Their sum is a __?__-digit number.

A) 2007 B) 2008 C) 4013 D) 4015

16. What are all real values of x for which $\dfrac{1}{4x^4 - 4}$ is undefined?

A) 0 B) ±1 C) ±2 D) ±4

17. If I begin flipping a fair coin repeatedly, what is the probability that I get three heads before I get two tails?

A) less than $\frac{1}{5}$ B) between $\frac{1}{5}$ and $\frac{1}{4}$, inclusive

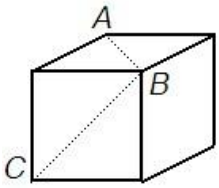
C) greater than $\frac{1}{4}$ and less than $\frac{1}{3}$ D) greater than or equal to $\frac{1}{3}$

18. What is the perimeter of a parallelogram with diagonals of lengths 6 and 8 whose longest side has the least possible length?

A) less than 8 B) between 8 and 24, inclusive

C) between 25 and 40, inclusive D) greater than 40

19. A cube is illustrated in the diagram at the right. In this cube, what is the measure of $\angle ABC$?



A) 30° B) 45° C) 60° D) 90°

20. If a, b, and c are the smallest possible positive integers for which $3a = 4b = 5c$, what is the sum $a + b + c$?

A) less than 8 B) between 8 and 24, inclusive

C) between 25 and 40, inclusive D) greater than 40

21. If Ali wrote a list of 2000 consecutive odd integers, by how much would the greatest number on her list exceed the smallest?

A) less than 2000 B) between 2000 and 3000, inclusive

C) between 3001 and 4000, inclusive D) greater than 4000

22. Three integers a, b, and c are said to be in *arithmetic progression* if $c - b = b - a$. Every item sold in a certain store has a price, in cents, that belongs to the arithmetic progression 7, 11, 15, 19, 23, 27, ... In cents, what is the least such price greater than 250?

A) less than 255 B) between 255 and 275, inclusive

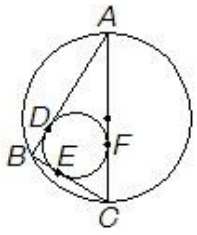
C) between 276 and 300, inclusive D) greater than 300

23. For every 2 widgets I buy at the regular price, I get a 3rd widget for a penny. I spent 45¢ for 9 widgets. In cents, what is the regular price of 1 widget?

A) less than 6 B) between 6 and 9, inclusive

C) between 10 and 15, inclusive D) greater than 15

24. In ΔABC, $m\angle B = 90°$. The circle circumscribed about the triangle has a radius of length 10. The circle inscribed in the triangle is tangent to $\overline{AB}$ at D, to $\overline{BC}$ at E, and to $\overline{AC}$ at F. If the perimeter of the triangle is 42, what is $EB + BD$?



A) less than 3 B) between 3 and 6, inclusive

C) between 7 and 10, inclusive D) greater than 10

25. The number 1000 has 16 positive integral divisors. How many positive integral divisors does the number 3000 have?

A) less than 8 B) between 8 and 24, inclusive

C) between 25 and 40, inclusive D) greater than 40

26. What is the ordered pair of real numbers (x, y) for which $16^x - 16^y = 192$ and $4^x - 4^y = 8$?

Note: Please enter the value of $x + y$ as your answer.

A) less than 8 B) between 8 and 24, inclusive

C) between 25 and 40, inclusive D) greater than 40

27. If $\pi = 3.14159265...$, what is the sum of both values of x for which $\left|3.14 - \pi\right| + \left|\frac{22}{7} - \pi\right| = \left|x - \frac{22}{7}\right|$?

A) less than 6 B) between 6 and 9, inclusive

C) between 10 and 15, inclusive D) greater than 15

28. The length of each side of a quadrilateral is 9. What is the largest possible area of the quadrilateral?

A) less than 64 B) between 64 and 81, inclusive

C) between 82 and 100, inclusive D) greater than 100

29. Triangle T is *not* equilateral. If every side of triangle T has an integral length, what is the least possible perimeter of triangle T?

A) less than 6 B) between 6 and 9, inclusive

C) between 10 and 15, inclusive D) greater than 15

30. The two imaginary solutions of $(x - 1)(x - 2)(x - 3) = (6 - 1)(6 - 2)(6 - 3)$ satisfy the equation $x^2 + k = 0$. What is the value of k?

A) less than 6 B) between 6 and 9, inclusive

C) between 10 and 15, inclusive D) greater than 15

Answers										
Question	1	2	3	4	5	6	7	8	9	10
Answer	**B**	**D**	**A**	**C**	**B**	**D**	**C**	**B**	**B**	**C**
Question	11	12	13	14	15	16	17	18	19	20
Answer	**C**	**C**	**A**	**C**	**B**	**B**	**C**	**B**	**C**	**D**
Question	21	22	23	24	25	26	27	28	29	30
Answer	**C**	**A**	**B**	**A**	**C**	**A**	**B**	**B**	**A**	**C**