www.mathleague.world

# 2024-2025 Math League Preliminary Round

(Grades 8-9)

**(Unofficial version, for reference only)**

1. What is the coefficient of $x^1$ in the complete expansion of $(x + 1)^{20}$?

   A) 400 B) 20 C) 19 D) 1

2. The product of both values of $x$ for which $2003^{x^2+2x-35} = 1$ is

   A) -2 B) 2 C) -35 D) 35

3. The greatest common factor of $2^{2004}$ and $2^{2005}$ is

   A) 1 B) 2 C) $2^{2004}$ D) $2^{2005}$

4. $|x - 1| =$

   A) $x - 1$ B) $1 - x$ C) $|x + 1|$ D) $|1 - x|$

5. In a certain right triangle, the lengths of the legs have a sum of 50 and a product of 282. What is the length of the hypotenuse?

   A) 44 B) 42 C) 40 D) $25\sqrt{2}$

6. If $x^2 - a^2 = 0$ has two real roots, then _?_ also has two real roots.

   A) $x - a = 0$ B) $x + a = 0$ C) $x^2 + a^2 = 0$ D) $x^4 - a^4 = 0$

7. They-intercept of $y = x + 1$ equals the $x$-intercept of

   A) $y = x - 1$ B) $y = x$ C) $y = x + 1$ D) $y = x^2$

8. $\sqrt{16^{16}} =$

   A) $16^8$ B) $16^4$ C) $4^8$ D) $4^4$

9. If $x$ is $y$ less than $2z$, what is the value of $z$ in terms of $x$ and $y$?

A) $2x - y$ B) $\frac{x+y}{2}$ C) $\frac{x-y}{2}$ D) $\frac{x}{2}+y$

10. Our spring break lasted only $a + b$ days, where $a$ and $b$ are positive integers and $\sqrt{a}+\sqrt{b}=\sqrt{8}$. Our break lasted __?__ days.




A) 4 B) 6 C) 8 D) 16

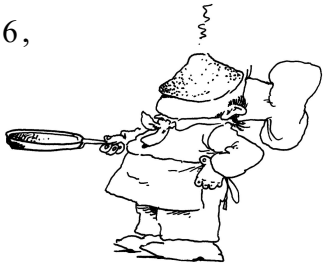
11. $\sqrt{2}+\sqrt{4}+\sqrt{8}+\sqrt{16}=$

A) $\sqrt{30}$ B) $6+3\sqrt{2}$ C) $10\sqrt{2}$ D) $3+4\sqrt{2}$

12. If $x$ is a prime number greater than 3, how many different positive divisors does $6x$ have?

A) 2 B) 4 C) 6 D) 8

13. It took me a while to learn how to flip flapjacks. In fact, if $a+\frac{1}{a}=6$, then the value of $a^2+\frac{1}{a^2}$ is the number of attempts it took me. How many attempts did it take me?



A) 34 B) 35 C) 36 D) 38

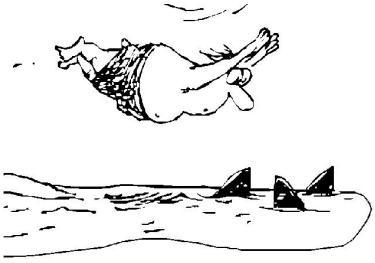
14. How many ordered pairs of integers $(x, y)$ satisfy $x^2 + y^2 = 2$?

A) 2 B) 4 C) 6 D) 8

15. Whenever $\frac{1999}{x} < 1$, it is *always* true that

A) $\frac{1}{x}<\frac{1}{1999}$ B) $\frac{x}{1999}>1$ C) $x > 1999$ D) $\frac{1998}{x}<0$

16. The number of fish that swam with me is the *sum of the digits* of the largest integer $x$ which satisfies $\frac{x}{x+1}<\frac{2004}{2005}$. How many fish swam with me?



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

17. If $a + b = 7$ and $a^2 + b^2 = 49$, then $ab =$

A) 42 B) 36 C) 7 D) 0

18. $(1 - x^2) \div (x + 1) =$

A) $x + 1$ B) $1 - x$ C) $-x$ D) $x - 1$

19. Ben runs $x$ **m** per minute. How many **km** does he run in $y$ minutes?

A) $\frac{x}{1000y}$ B) $\frac{y}{1000x}$ C) $\frac{xy}{1000}$ D) $\frac{1000}{xy}$

20. What is the least positive integer $n > 1$ for which the expression $\sqrt{1+2+3+...+n}$ simplifies to an integer?

A) less than 10 B) between 10 and 20, inclusive

C) between 21 and 30, inclusive D) greater than 30

21. A function $f$ will be called *repetitive* if there are at least two different values of $x$ in the interval $0 \leq x \leq 1$ for which $f(x)$ has the same value. The set of all real numbers $b$ for which $f(x) = x^2 + bx + 3$ will be repetitive is $p < b < q$? What is the ordered pair $(p, q)$?

Note: Please enter the value of $p + q$ as your answer.

A) less than -5 B) between -5 and 0, inclusive

C) between 1 and 10, inclusive D) greater than 10

22. What are three different positive integers whose sum equals the product of the largest two of them?

Note: Please enter the sum of the three integers.

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

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

23. Write, as a three-digit number, the final three digits of $5^{100}$.

A) less than 100 B) between 100 and 200, inclusive

C) between 201 and 400, inclusive D) greater than 400

24. In a triangle containing an obtuse angle, the lengths of the sides, in increasing order, are the integers 3, 4, and $x$. What is the value of $x$?

A) less than 6 B) between 6 and 8, inclusive

C) between 9 and 10, inclusive D) greater than 10

25. What is the maximum value of $x$ for which there exist real numbers $x$ and $y$ which satisfy the inequalities $-10 \le x + y \le 4$ and $x^2 + y^2 - 36(x + y) \le 2xy$?

A) less than 10 B) between 10 and 20, inclusive

C) between 21 and 30, inclusive D) greater than 30

26. What is the smallest integer that can be the perimeter of a square whose diagonal exceeds 29?

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

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

27. What is the ordered pair of real numbers $(a, b)$ for which the inequalities $2x \le y \le 5x$ and $ay \le x \le by$ are exactly equivalent?

Note: Please enter the value of $10(a + b)$ as your answer.

A) less than -5 B) between -5 and 0, inclusive

C) between 1 and 10, inclusive D) greater than 10

28. If $a \uparrow b$ means $a^b$, and if $a \downarrow b$ means $\sqrt[b]{a}$, what is the value of $[(2 \uparrow 6) \downarrow 3] \uparrow 2$?

A) less than 10 B) between 10 and 20, inclusive

C) between 21 and 30, inclusive D) greater than 30

29. In a circle, two perpendicular chords with lengths 6 and 8 have a common endpoint. The area of the circle is $k\pi$. What is the value of $k$?

A) less than 10 B) between 10 and 20, inclusive

C) between 21 and 30, inclusive D) greater than 30

30. 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

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