Lightning round notes

- Runner should change every 20 minutes - exercise is good for all!
- Runner always sets off to the back of their column of teams FIRST.
- Correct attempt 1=3 points. Correct attempt 2=2 points. 1 point thereafter.
- Teams may pass after at least 3 attempts, that question cannot then be returned to.
- To determine rank when final points are tied, the number of passes is considered.
- Remember to use your formula sheet.
- WRITE YOUR TEAM NAME HERE:

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A closed, right circular cone has height 12 and base radius 5. Find the perimeter of the net of the cone.

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Answer:

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Given that $x = 2025^2 - 2023^2$, find the value of $\frac{45\sqrt{x+4}}{2}$.

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3.

Jenny has 12 different pairs of shoes. In how many ways can she choose a right shoe and a left shoe that do NOT form a pair?

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4.

Six pens in a pouch are orange, all of the remaining pens in the pouch are blue. Sophie Germaine takes two pens from the pouch at random. The probability that she has two orange pens is $\frac{1}{3}$. Find the original number of blue pens in the pouch.

Answer:

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Answer:

5.

If a positive factor of 2025 is selected at random, what is the probability that it is less than 30?

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Answer:

6.

Evaluate $\left(\frac{1-i}{1+i}\right)^{2025}$

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Answer:

7.

When the decimal number $2025!$ is written in base 6, find the number of trailing zeroes that it has.

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Answer:

8.

The remainder when the polynomial $y = x^3 + ax^2 - 5x + 3$ is divided by $(x - 2)$ is three times the remainder when the same polynomial is divided by $(x + 1)$. Find the value of a.

Answer:

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Answer:

9.

Suppose $f(x) = f(x-1) + f(x+1)$ for all x.

If $f(0) = 5 \text{ and } f(1) = 7$, find the value of $f(2024) + f(1024) + f(24)$.

Answer:

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Answer:

10.

The equation $2x^3 + 3x^2 + 5x + 2 = 0$ has 1 real and 2 non-real roots. Find the sum of the 2 non-real roots.

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Answer:

11.

Find the area of a parallelogram whose diagonals are given by the vectors $\begin{bmatrix} 20 \\ -24 \end{bmatrix}$ and $\begin{bmatrix} 13 \\ 21 \end{bmatrix}$.

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Answer:

12.

Simplify $\left(\frac{-1+i\sqrt{3}}{2}\right)^6 + \left(\frac{-1-i\sqrt{3}}{2}\right)^6$.

Write your answer in the form $a + bi$.

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Answer:

13.

From the alphametic CLOCK+TICK+TOCK=PLANET, find the value of K.

Note: Each letter is represented by a distinct single-digit number, 0-9 inclusive.

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Answer:

14.

Solve for $x \in \mathbb{R}$

$$\left(1+\frac{1}{x}\right)^{x+1}=\left(1+\frac{1}{2024}\right)^{2024}$$

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Answer:

15.

Determine the smallest positive integer that can be written as both the sum of 7 consecutive positive integers and as the sum of 8 consecutive positive integers.

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Answer:

16.

In photography, d is the distance of an object from a lens, the distance D of the image from the lens and the focal length of the lens f are related through the following formula: $\frac{1}{d}+\frac{1}{D}=\frac{1}{f}$.

For each lens, f is a constant whereas d and D are variables. In a particular instant, a racing car is moving away from the lens at a rate of $250kmh^{-1}$, in which direction and how fast, in kmh^{-1}, will the image be moving?

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Answer:

17.

Find the number of ways that four distinct positive integers can sum to twenty.

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Answer:

18.

Find the maximum value of $\dfrac{\sin^3(x)\cos(x)}{\tan^2(x)+1}$.

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Answer:

19.

Find the maximum value of $f(x) = \dfrac{x+1}{x^2+1}$.

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Answer:

20.

The curves $f(x) = x^3 + 2x^2 - 3x - 4$ and $g(x) = x^2 + bx + c$ are tangent at $x = -1$.

Find the value of $b + c$.

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Find the smallest integer with exactly six positive divisors, and has units digit 5.

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Answer:

22. Evaluate $\lim\limits_{x \to +\infty} x \ln\left(1 + \frac{3}{x}\right)$.

Answer:

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Answer:

23.

$f(x) = ax^2 + bx + c$

$a, b, c \in \mathbb{Z}$

Given that $f(x-1) + f(x) + f(x+2) = 6x^2 + 13x - 51$, find the value of $f(1) - f(-1)$.

Answer:

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Answer:

24.

a, b, c and d are positive integers such that $\log_a(b) = \frac{3}{2}$ and $\log_c(d) = \frac{5}{4}$.

Given that $a - c = 9$, find the value of $b - d$.

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Answer:

25.

Consider the polynomial $3x^4 - 9x^3 + rx^2 - 10x + 5 = 0, r \in \mathbb{R}$.

The product of its real roots is 1, find the sum of its real roots.

Answer:

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Answer:

26.

There exists a complex number z with magnitude 1 such that $(-24+7i)z$ is a positive real number.

Express z in the form of $a+bi$.

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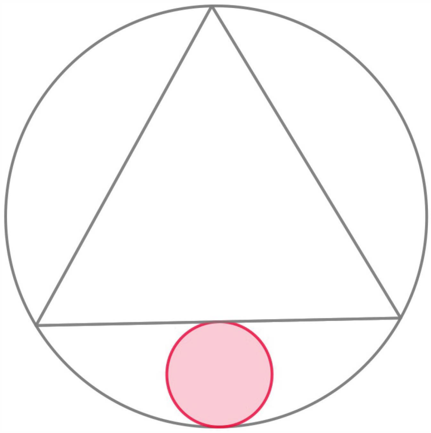
Answer:

27.

An equilateral triangle of side length 1 is inscribed in a circle. Find the area of the largest circle that can be inscribed between the triangle and its circumcircle.



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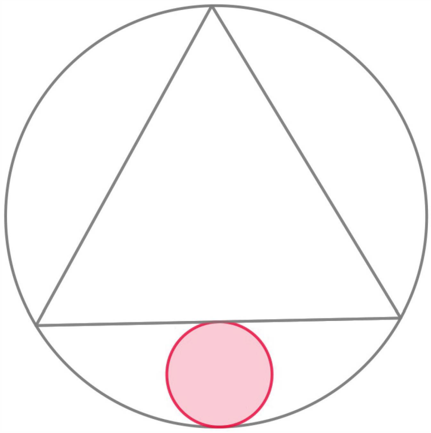

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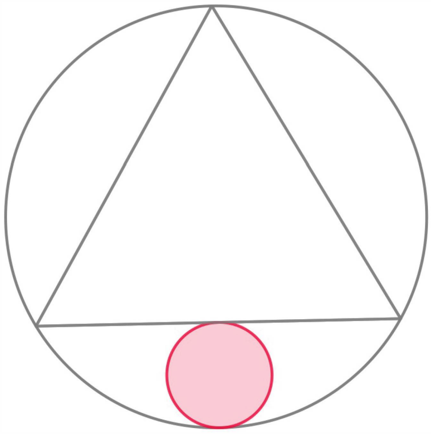

Answer:

28.

Find the value of $\sum_{n=1}^{\infty} \frac{12}{16n^2 + 40n + 21}$.

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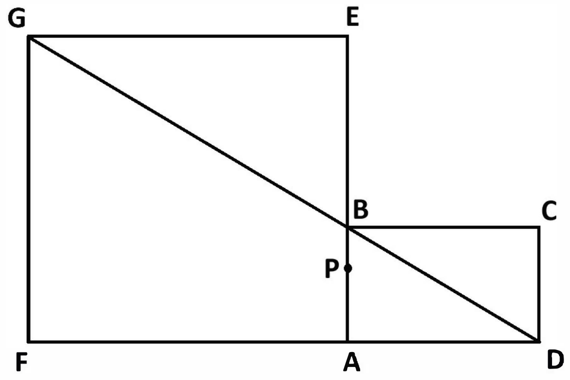
Answer:

29.

Rectangle $ABCD$ is adjacent to square $AFGE$ such that $AB : AE = 3 : 3 + x$ and B, D, G are collinear. Point P lies on AB such that $AB : AP = 3 : 2$.

Find, as a fraction in its simplest terms:

$$\frac{\text{area of triangle} \quad BPG}{\text{area of hexagon} \quad BCDFGE}.$$



Not drawn to scale

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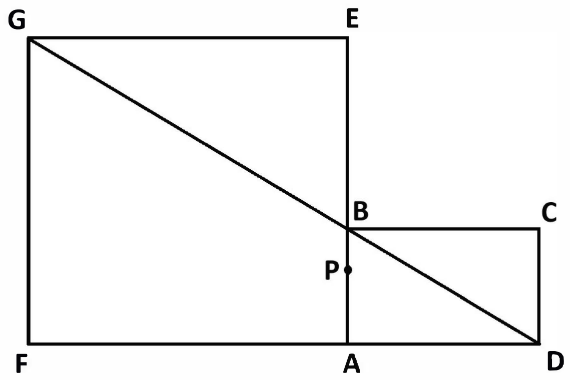

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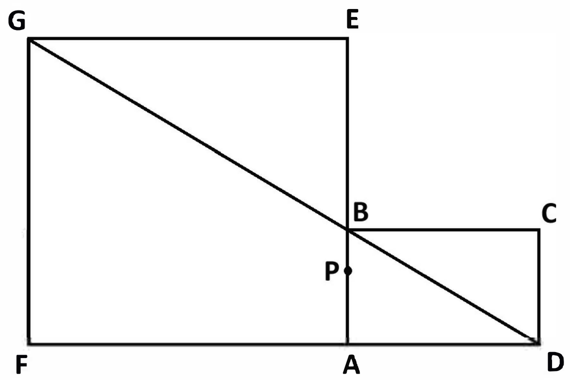

Not drawn to scale

Answer:

30.

Given a point in an equilateral triangle is 2 cm, 4 cm and 8cm from its 3 sides, find the side length of the equilateral triangle.

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