

2014 BOMB – Page 1

School _____ Team _____

Team Members 1. _____ 2. _____

3. _____ 4. _____ 5. _____

Instructions: Label answers with appropriate units.
Do not round or approximate answers.
Write fully simplified answers on the lines provided.

1. Evaluate: $\frac{\log_6 36^3 - \log_4 \sqrt{8}}{\log_{27} 9}$

Ans: _____

2. Evaluate: $\int_{-\pi/4}^{\pi/4} x^2 \sin x dx$

Ans: _____

3. Find all real solutions: $\begin{cases} x^2 - xy - 2y^2 = 0 \\ xy + x + 6 = 0 \end{cases}$

Ans: _____

4. Two circles with radii r and R are externally tangent. Find the distance from the point A of their common tangency to a common tangent line not passing through A.

Ans: _____

5. Find the exact value of $(987654321)(987654321) - (987654319)(987654323)$.

Ans: _____

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1. Evaluate: $(1-i)^3(1+i)^3$

Ans: _____

2. In a 20-mile race, the winner crosses the finish line 2 miles ahead of the 2nd place runner and 4 miles ahead of the 3rd place runner. If each runner maintains a constant speed, by how many miles does the 2nd place runner beat the 3rd place runner?

Ans: _____

3. Evaluate $\lim_{x \rightarrow 5^+} \frac{5x - x^2}{|5 - x|}$.

Ans: _____

4. The area of a regular hexagon inscribed in a circle is A . Find the area of a regular hexagon circumscribed on the circle.

Ans: _____

5. Find the range of $f(x) = \frac{x^2 + x + 2}{x^2 + x + 1}$.

Ans: _____

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1. Six and a half boys can eat six and a half pizzas in an hour and a half. How many pizzas could three boys eat in seven and a half hours?

Ans: _____

2. Solve for x : $\sin(\pi \log x) + \cos(\pi \log x) = 1$, $1 \leq x \leq 100$

Ans: _____

3. A square of side s and a circle of radius r have the same perimeter. Find the ratio of the area of the square to the area of the circle in simplest form.

Ans: _____

4. The polynomial $x^2 - 9x + 3$ has roots r and s . The polynomial $x^2 + bx + c$ has roots r^2 and s^2 . What is (b, c) ?

Ans: _____

5. Evaluate $\lim_{x \rightarrow 2} \frac{\sqrt{6-x}-2}{\sqrt{3-x}-1}$.

Ans: _____

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Instructions: Label answers with appropriate units.
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1. If $2^y = 16^{x-3}$ and $3^{y+2} = 27^x$, find the value of $x + y$.

Ans: _____

2. Evaluate: $\lim_{n \rightarrow \infty} \frac{2 + 4 + \dots + 2n}{(8 - 3n)(5 + 7n)}$

Ans: _____

3. Fresh cherries contain 99% water. You start with 100 pounds of fresh cherries. After a few hours in the sun, some of the water evaporates and the percentage of water in the cherries becomes 90%. What is the new weight of the cherries?

Ans: _____

4. Solve for n : $\left(\frac{n+3}{n+1} \right) = 66$

Ans: _____

5. What is the measure (in degrees) of the acute angle between the hour and minute hands of a clock at 2:20?

Ans: _____

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Instructions: Label answers with appropriate units.
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1. When Jim ran up a certain “up” escalator, he counted 10 steps and the ride took 20 seconds. Running down the same escalator, he counted 50 steps and the ride took 30 seconds. How many steps of the escalator were visible at one time?

Ans: _____

2. In a sequence of positive numbers, each term except the first two is the sum of all its predecessors. The eleventh term of the sequence is 320 and the first term is 1. What is the second term?

Ans: _____

3. A diagonal of a square has endpoints at $(-4, -1)$ and $(2, 1)$. Find the area of the square.

Ans: _____

4. If $6x + 7y = 2004$ and $7x + 6y = 4002$, what is $x + y$?

Ans: _____

5. Find the maximum area of a rectangle if two of the vertices lie on the parabola $y = x^2 - 6x + 9$ and the other two vertices lie on the line $y = 3$ and the rectangle lies in the region bounded by these curves.

Ans: _____