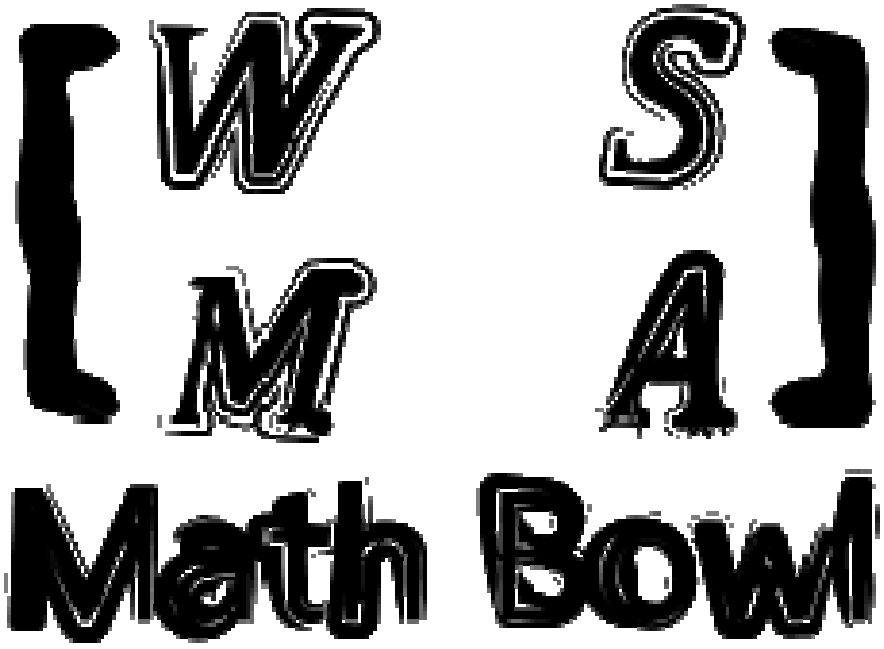

Elimination Tournament Round 3

3nd Annual WSMA Math Bowl

March 2, 2013

Problem 1

Square *ABCD* in the coordinate plane has three of its vertices at points *A*(1, 3), *B*(5, 7) and *C*(9, 3). Find the coordinates of vertex *D*.

Problem 2

If $f(x+y+z) = f(x) + f(y) + f(z) + 1$, $f(1) = \pi$, and $f(\sqrt{5} - 2) = 3$, find the value of $f(\sqrt{5})$.

Problem 3

There are 10 Guardian Angels and 12 Demons under the temple of WSMA. Two beings, chosen among them, are selected to be sent to Evan. When Evan asks truth-telling WSMA members if at least one Demon was selected, the members reply yes. What is the probability that both selected beings are Demons?

Problem 4

3 Siege Tanks attack 12 Zerglings, killing 2 of them and damaging the rest so that the remaining 10 Zerglings have unequal amounts of health remaining. How many ways can Arjun divide the remaining Zerglings into 3 groups of 3, 3 and 4 Zerglings, respectively?

Problem 5

If $1 < x < 3$, simplify $\sqrt{1 - 2x + x^2}$ + $\sqrt[4]{(x^2 - 6x + 9)^2}$.

Problem 6

Solve the following equation for x: $987x^2 - 251x - 736 = 0$.

Problem 7

Let *A* be the number of sides of a regular polygon with exterior angles measuring 36 degrees and let *B* be the sum of the infinite geometric series with initial value $\frac{1}{2}$ and common ratio $\frac{1}{2}$. Find *A*+*B*.

Problem 8

Evaluate the following: $1^3+2^3+3^3+\ldots+15^3$

Problem 9

The line $y = 2x + b$ passes through the points $(-1, 3)$ and $(a, -3)$. Find the value of $\frac{b}{a}$

Extra Question

At 7 p.m., Brian realizes he needs to prepare a presentation for 8 a.m. the next day. His productivity is currently 90% and it decreases to 75% after 10 p.m. and it decreases again to 50% after 3 a.m. If he starts working right away and finishes at 8 a.m., how much time would he have saved by not procrastinating and working at 100% productivity? Express your answer as a decimal.