Time limit: 60 minutes.
Instructions: This test contains 10 short answer questions. All answers must be expressed in simplest form unless specified otherwise. Only answers written inside the boxes on the answer sheet will be considered for grading.
No calculators.

1. How many integers x satisfy $x^2 - 9x + 18 < 0$?

2. Find the point p in the first quadrant on the line $y = 2x$ such that the distance between p and p', the point reflected across the line $y = x$, is equal to $\sqrt{32}$.

3. There are several pairs of integers (a, b) satisfying $a^2 - 4a + b^2 - 8b = 30$. Find the sum of the sum of the coordinates of all such points.

4. Two real numbers x and y are both chosen at random from the closed interval $[-10, 10]$. Find the probability that $x^2 + y^2 < 10$. Express your answer as a common fraction in terms of π.

5. Find the sum of all real solutions to $(x^2 - 10x - 12)^{x^2+5x+2} = 1$

6. Find the maximum value of $\frac{x}{y}$ if x and y are real numbers such that $x^2 + y^2 - 8x - 6y + 20 = 0$.

7. Let r_1, r_2, r_3 be the (possibly complex) roots of the polynomial $x^3 + ax^2 + bx + \frac{4}{3}$. How many pairs of integers a, b exist such that $r_1^3 + r_2^3 + r_3^3 = 0$?

8. A biased coin has a $\frac{6+2\sqrt{3}}{12}$ chance of landing heads, and a $\frac{6-2\sqrt{3}}{12}$ chance of landing tails. What is the probability that the number of times the coin lands heads after being flipped 100 times is a multiple of 4? The answer can be expressed as $\frac{1}{4} + \frac{1+a^b}{c \cdot d^e}$ where a, b, c, d, e are positive integers. Find the minimal possible value of $a + b + c + d + e$.

9. Let a_n be the product of the complex roots of $x^{2n} = 1$ that are in the first quadrant of the complex plane. That is, roots of the form $a + bi$ where $a, b > 0$. Let $r = a_1 \cdot a_2 \cdot ... \cdot a_{10}$. Find the smallest integer k such that r is a root of $x^k = 1$.

10. Find the number of ordered integer triplets x, y, z with absolute value less than or equal to 100 such that $2x^2 + 3y^2 + 3z^2 + 2xy + 2xz - 4yz < 5$