Each correct answer is worth 25 points.

1. Find the value(s) of $c$ so that the equation $x \left( 2x - c \right) = 1 - c$ has only one solution.

2. If $f(x) = 5x^2$, find the $x$-coordinate of the point of intersection of $y = f(x)$ and $y = f(x - 3)$.

3. In the 6 x 6 array of dots at right, adjacent horizontal or vertical dots are one unit apart. How many triangles with area two square units can be drawn using these dots as vertices (congruent triangles with different vertices are considered different)? Assume that one side of the triangle is horizontal.

4. If $2013 \cdot P = 2013^2 - 2012^2 + 2011^2 - 2010^2 + \ldots + 3^2 - 2^2 + 1^2$, find $P$.

5. Find the coefficient of $x^2 y^2$ in the expansion of $\left( \sqrt{x} + \sqrt{y} \right)^8$.

6. Eight circles of radius 1 are tangent to, and form a ring around a larger circle. Adjacent circles in the ring are also tangent. Use the law of cosines to compute the radius of the larger circle.

7. Let $f(x) = 2x + 3$, $g(x) = ax^3 + bx^2 + cx + d$ and $N = a - b + c - d$. If $g(f(x)) = x^3 + x^2 + x + 1$, what is $\left| 8N + 1 \right|$?

8. A “square spiral” bug starts at the point (5, 2) and follows the path shown at right. The first several legs of the path have lengths 4, 4, 3, 3, 2, 2, 3/2, 3/2, 1, 1, 3/4, 3/4, . . . . If the bug follows this pattern indefinitely, find the coordinates of the point $(x, y)$ that the bug approaches.