In the problems below indicate your answers by drawing boxes around them. You must show your work to get credit for a problem.

1. Find the length from $t = 0$ to $t = 1$ of the parametric curve $x = 5 - t^2, y = 1 + 2t^3$. 

2. Sketch the graph of one loop of the polar curve \( r = 3 \sin(2\theta) \).

3. Compute the area of one loop of \( r = 3 \sin(2\theta) \) (graphed above).
4. Let $L$ be the line through the points P(1,0,-2) and Q(-1,4,2). Find two direction vectors for $L$ with length 3.

5. Find the symmetric equations for the line $L$ through the points P(1,0,-2) and Q(-1,4,2). Note that this line is the same as for Problem 4.
6. Find an equation of the plane through the point $(1, -2, 0)$ that is parallel to the plane $2x - 4y + 7z - 4 = 0$.

7. Find the vertex or vertices of $5y^2 + 4y + 4x^2 - 20 = 0$. 
8. Find the slope of the tangent line to the polar curve \( r = 1 + 4 \sin(\theta) \) when \( \theta = \pi/4 \).
9. Compute the cosine of the angle between $\mathbf{a} = <1, -2, 3>$ and $\mathbf{b} = <2, 0, -1>$. Assume the paper is the plane containing these vectors and we are looking down on these vectors as pictured to the right. Would $\mathbf{a} \times \mathbf{b}$ be pointing into or out of the page?

10. Find the equation of the plane containing the points $P(1, 0, 0)$, $Q(0, -3, 0)$, $R(0, 0, -5)$. 
11. Graph the cross-section (trace) in the plane $y = 3$ of the surface in $R^3$ given by

$$\frac{z^2}{25} + y^2 - \frac{x^2}{4} = 5$$

Label the axes of the plane.