Midterm #1

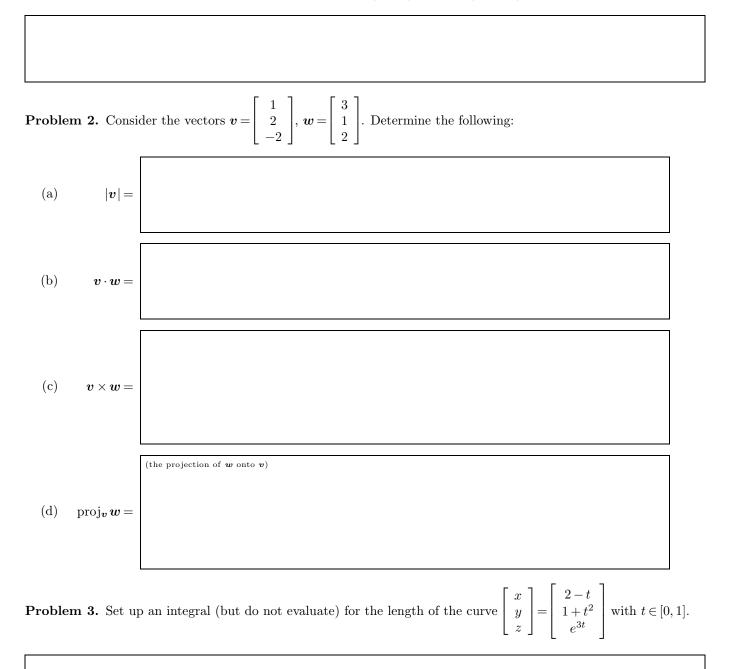*Please print your name:*

Problem 1. What is the distance between the points $A = (2, 0, 1)$ and $B = (1, -1, 1)$?

Problem 2. Consider the vectors $v = \begin{bmatrix} 1 \\ 2 \\ -2 \end{bmatrix}$, $w = \begin{bmatrix} 3 \\ 1 \\ 2 \end{bmatrix}$. Determine the following:

(a) $\quad |v| =$

(b) $\quad v \cdot w =$

(c) $\quad v \times w =$

(d) $\quad \operatorname{proj}_v w =$

(the projection of w onto v)

Problem 3. Set up an integral (but do not evaluate) for the length of the curve $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 - t \\ 1 + t^2 \\ e^{3t} \end{bmatrix}$ with $t \in [0, 1]$.

Problem 4. Consider the triangle with vertices $P = (1, 1, 0)$, $Q = (3, 1, 1)$ and $R = (2, 4, 1)$.

(a) Find the area of the triangle with vertices P, Q and R.

(b) Find an equation for the plane through the points P, Q and R.

Problem 5. Find (a parametrization of) the tangent line to the curve $P(t) = \begin{bmatrix} e^{t^2} \\ \sin(2t) \\ t+2 \end{bmatrix}$ at $t = 0$.

Problem 6. Consider the plane described by $x - 2y + 2z = 4$.

(a) A normal vector for our plane is $\boldsymbol{n} = $ _____ .

(b) Find an equation for the plane through the point $(1, 2, 3)$ which is parallel to our plane.

(c) Determine the distance between the point $(1, 2, 3)$ and our plane.

Problem 7. (Bonus!) What kind of object is that? Do you know its name?