LAST NAME:	FIRST NAME:	CIRCLE:			
		Makhijani 8:30am	Makhijani 11:30am	Makhijani 2:30pm	Zweck 11:30am

1 /12	2 /12	3 /15	4 /12	5 /12	6 /12	T /75

MATH 2415 [Spring 2019] Exam I, Feb 22nd

No books or notes! **NO CALCULATORS!** Show all work and give **complete explanations**. Don't spend too much time on any one problem. This 90 minute exam is worth 75 points.

(1) [12 pts] Let P, Q, and R be the points $P = (2, -1, 6)$, $Q = (3, 1, 6)$, and $R = (2, 5, 1)$.

(a) Calculate the scalar projection of the vector $\overrightarrow{PQ}$ onto the vector $\overrightarrow{PR}$

(b) Calculate the area of the triangle with vertices P, Q, and R.

(2) [12 pts] Let L_1 and L_2 be the lines parametrized by

$$\mathbf{r}_1 = (-1 + 2t, 2 + 5t, 4 - 3t) \qquad \text{and} \qquad \mathbf{r}_2 = (-1 - 2t, 2 + t, 4 + 2t).$$

(a) Is there are plane that contains the line L_1 and is perpendicular to the line L_2? Justify your answer. If there is such a plane find an equation of the form $Ax + By + Cz = D$ for it.

(b) Is there are plane that contains the lines L_1 and L_2? Justify your answer. If there is such a plane find an equation of the form $Ax + By + Cz = D$ for it.

(3) [15 pts] Sketch the following surfaces. Make sure you label the axes and carefully show how you obtained your answers.

(a) $3x + y + 2z = 6$

(b) $z = x^2$

(c) $x^2 + y^2 - z^2 = 1$

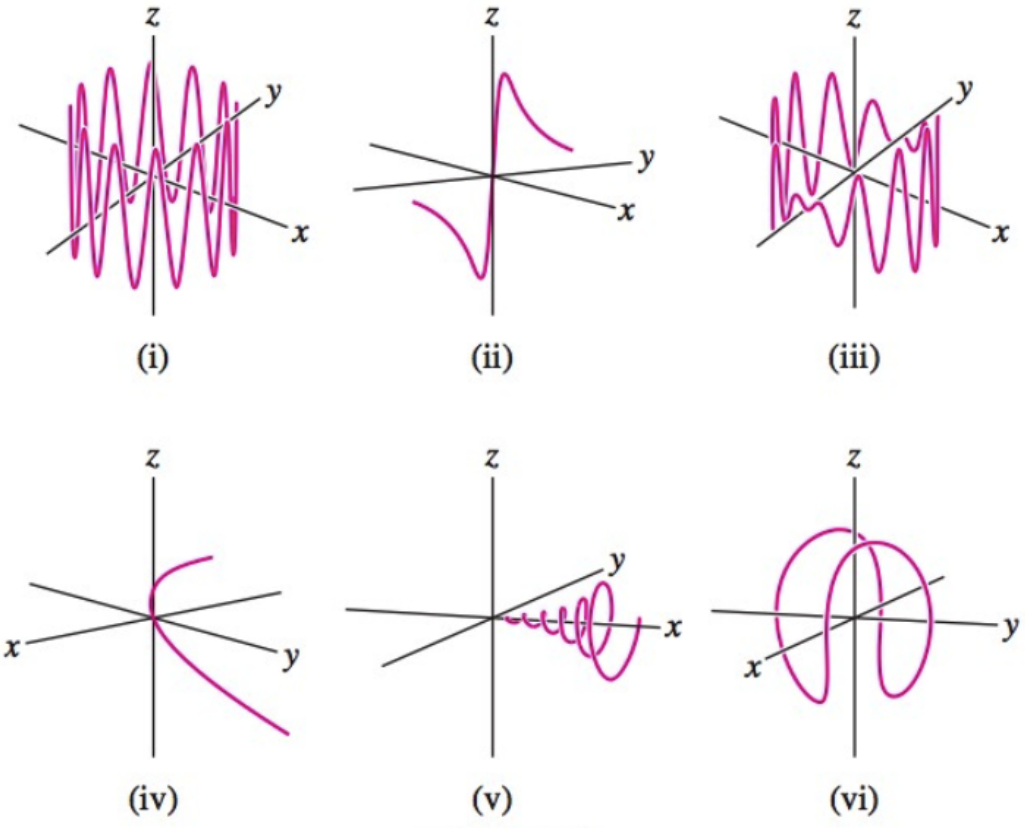
(4) [12 pts] Let C be the curve parametrized by $\mathbf{r}(t) = (e^{-t}, \sqrt{2}t, e^{t})$.

(a) Find the length of the curve C from $(1, 0, 1)$ to $\left(e^{-1}, \sqrt{2}, e\right)$.

(b) Find a parametrization of the tangent line to the curve C at $t = 0$.

(5) [12 pts]
Match the vector-valued functions with the space curves. Carefully justify your answers.

(A) $\mathbf{r}(t) = (t, t^2, 2t)$ (B) $\mathbf{r}(t) = (\cos t, \sin t, \sin 12t)$ (C) $\mathbf{r}(t) = (t, t\cos t, t\sin t)$



(6) [12 pts]
(a) Sketch the surface whose equation in the spherical coordinates is $\phi = 3\pi/4$.

(b) Let P be the point with spherical coordinates $(\rho, \theta, \phi) = (4, \pi/3, 3\pi/4)$. Find the cylindrical coordinates of P.