1. (5 points) Determine if the lines given by the vector parametrizations

$$\mathbf{r}_1(t) = \langle 5, -16, 19\rangle + t\langle 1, -3, 4\rangle \quad \text{and} \quad \mathbf{r}_2(t) = \langle 5, -1, -11\rangle + t\langle -2, 1, 2\rangle$$

intersect and, if so, find the point of intersection.

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2. (5 points) Find a vector parametrization of the line tangent to the curve

$$\mathbf{r}(t) = \langle t^3, 2t, t^2 + 1\rangle$$

at the point $(8, 4, 5)$.

3. (5 points) Give a vector parametrization of the circle contained in the plane $x = 2$ with radius 3 and center at the point $(2, 1, 3)$.

4. (5 points) Compute the length of the helix parameterized by

$$\mathbf{r}(t) = \langle \cos t, 3t, \sin t \rangle$$

over the interval $t = 0$ to $t = 2\pi$.

5. (5 points) Find an equation for the plane (in the form $ax + by + cz = d$) that contains both of the parallel lines given by the vector parameterizations

$$\mathbf{r}_1(t) = \langle 1, 2, 3\rangle + t\langle 1, -1, 1\rangle \quad \text{and} \quad \mathbf{r}_2(t) = \langle 0, 1, 5\rangle + t\langle 1, -1, 1\rangle$$

6. (1 point each) *No work or justification is needed for credit.*

(a) Suppose $\mathbf{w} \times \mathbf{v} = \langle 1, 2, 3 \rangle$. What does $\mathbf{v} \times (3\mathbf{w})$ or $\mathbf{v} \times (2\mathbf{w})$ equal?

(b) What can you say about the angle between $\mathbf{a}$ and $\mathbf{b}$ if $\mathbf{a} \cdot \mathbf{b} < 0$?

(c) To which coordinate plane (xy-, xz- or yz-plane) is the plane $x = -3$ or $y = -3$ parallel?

(d) Suppose that $\text{proj}_{\mathbf{v}}(\mathbf{u}) = \langle 1, 2, 3 \rangle$. What is $\text{proj}_{2\mathbf{v}}(3\mathbf{u})$ or $\text{proj}_{3\mathbf{v}}(2\mathbf{u})$?

(e) Answer true or false. If $\mathbf{v} \neq \mathbf{0}$, then $-\dfrac{1}{\|\mathbf{v}\|}\mathbf{v}$ is a unit vector.