Chapter 13:

1. Find the equation of a plane through (1, -1, 2), (2, 1, 3) and (-1, 2, -1).
2. Find the angle between the planes \( x + y = 1 \) and \( y + z = 1 \).
3. Find parametric equations for the line of intersection of the planes \( x + 2y + z = 1 \) and \( x - y + 2z = -8 \).
4. Are the following lines skew? \( x = 1 + t, \ y = 1 + 2t, \ z = 3 - t \) and \( x = 4 - s, \ y = 7 - 2s, \ z = 4 + s \). Explain your answer.
5. Do the points (0, 0, 0), (1, 2, 1), (1, 2, 3) and (1, 1, 1) lie in a plane? Explain your answer in complete sentences.
6. Find the values of \( x \) such that \( <3, 2, x> \) and \( <2, 4, x> \) are orthogonal.

Chapter 14:

1. Find the parametric equation to the tangent line of \( \vec{r}(t) = (e^t \cos t, e^t \sin t, t^2) \) at the point \((-e^\pi, 0, \pi^2)\).
2. Find the length of the curve \( \vec{r}(t) = (2t^2, \cos 2t, \sin 2t) \) where \( 0 \leq t \leq 1 \).
3. If \( \vec{u}(t) = \vec{r}(t) \cdot ((\vec{r}'(t) \times \vec{r}''(t))) \), show that \( \vec{u}'(t) = \vec{r}(t) \cdot (\vec{r}'(t) \times \vec{r}'''(t)) \). (Explain your calculation.)

Chapter 15:

1. problem 30 on page 935
2. problem 7 on page 1011
3. problems 11 and 12 on page 1011
4. Find the equation of the tangent plane to the surface \( z = e^{xy} \) at the point \((1, 2, e^2)\).
5. problem 39 on page 975
6. problem 32 on page 987
7. Find and classify the critical points of \( f(x, y) = 2x^3 + 3xy + 2y^4 \).
8. Find the points on the curve \( xy^2 = 54 \) which are closest to the origin.
Chapter 16:

1. Evaluate the integral
   \[ \int_0^8 \int_{x^3}^{x^4} \frac{1}{y^4 + 1} \, dy \, dx \]

2. Evaluate the integral
   \[ \int_0^1 \int_0^{x^2} \int_0^{x+y} 2x - y - z \, dz \, dy \, dx \]

3. Evaluate the integral
   \[ \int_{-1}^1 \int_{\sqrt{1-x^2}}^{\sqrt{1-x^2}} \frac{2}{(1 + x^2 + y^2)^2} \, dy \, dx \]

4. Find
   \[ \int \int \int_E xy \, dV \]
   where \( E \) is the tetrahedron bounded by the planes \( x = 0, y = 0, z = 0 \) and \( 3x + 2y + z = 12 \).

5. Find the volume of the region under the paraboloid \( z = x^2 + y^2 \) and above the triangle in the \( xy \)-plane bounded by the lines \( y = x, x = 0 \) and \( x + y = 2 \).

6. Estimate the integral
   \[ \int_0^1 \int_0^2 4x + y \, dy \, dx \]
   Do not integrate it directly. Use the methods of Section 16.1 to obtain an estimate. Explain what method you used.

Chapter 17:

1. problems 11 through 14 on page 1096.

2. Evaluate
   \[ \int_C xy + z \, ds \]
   over the curve \( \vec{r}(t) = (4 \cos t, 4 \sin t, 3t) \) where \( 0 \leq t \leq \pi \).

3. Evaluate
   \[ \int_C xy \, dx + y \, dx \]
   over the curve \( \vec{r}(t) = (t, t^2) \) where \( 1 \leq t \leq 3 \).

4. Are the following vector fields conservative? Explain your answers.
   a) \((y + \cos(x^2))\vec{i} + (x + e^y)\vec{j}\)
   b) \((xy + x)\vec{i} + (xy - y)\vec{j}\).
5. Let \( \vec{F} = 2xy\vec{i} + \left(x^2 + 2yz\right)\vec{j} + y^2\vec{k} \) and let \( C \) be the curve described by \( \vec{r}(t) = (t, t^2, t - 1) \) where \( 1 \leq t \leq 2 \). Find a function \( f \) such that \( \vec{F} = \nabla f \) and use this function to evaluate
\[
\int_C \vec{F} \cdot d\vec{r}
\]

6. Let \( C \) be the ellipse \( x = 3 \cos t, \ y = 4 \sin t, \ 0 \leq t \leq 2\pi \). Evaluate
\[
\int_C (2x + y^2)dx + (2xy + 3y)dy
\]

7. Let \( C \) be the triangle with vertices \((0, 0), (1, 0)\) and \((1, 3)\) oriented positively. Evaluate
\[
\int_C \sqrt{1 + x^3} \ dx + 2xy \ dy
\]

8. Suppose \( C \) is any circle in the plane and \( f \) is a function with continuous partial derivatives. Explain carefully why
\[
\int_C \nabla f \cdot d\vec{r} = 0
\]
Is the same true for any simple closed curve \( C \)?