Homework Assignments

Homework 1 (Sep. 1)

- From the notes (pp. 20-21): 1-5, 7, 9-10.
- Additional problems:
  I. Find the acute angle between the lines $3x - y = 2$ and $x + 2y = 5$.
  II. Given points $A(3, 1, -1)$, $B(2, 0, 1)$, $C(1, -2, 0)$,
      a. find the area of $\Delta ABC$, and
      b. find the equation of the plane containing $\Delta ABC$.

Homework 2 (Sep. 8)

- From the notes (pp. 35-37): 2, 4-7
- Additional problems:
  I. Find the velocity and the acceleration of a particle whose position $\vec{r}$ is given as a function of time $t$ by
     $$\vec{r}(t) = 3t^2 \hat{i} + (1 + \sin t) \hat{j} - (\cos t) \hat{k}.$$  
  II. Find the arclength of one period of the cycloid
     $$\vec{r}(t) = (t - \sin t) \hat{i} + (1 - \cos t) \hat{j}, \quad 0 \leq t \leq 2\pi.$$  
     **Hint:** If you are stuck on the integral, the double-angle identity
     $$\cos(2\theta) = 1 - 2\sin^2 \theta$$
     may come in handly.

Homework 3 (Sep. 15)

- From the notes (pp. 50-52): 1-4, 9-13.
- Additional problems: None!
Homework 4 (Sep. 22)

- From the notes (pp. 55-56): 1-7.
- From the notes (pp. 65-66): 1-10.

Homework 5 (Sep. 29)

- From the notes (pp. 79-81): 1-5, 7-10.
- From the notes (pp. 76-77): 1-8, 10, 12-14.
- From the notes (pp. 85-86): 1-8, 15.

Homework 6 (Oct. 13)

- From the notes (p. 95): 1-7.
- From the notes (pp. 103-104): 2-9.
- From the notes (pp. 89-90): 1-3.

Homework 7 (Oct. 20)

- Additional problems:
  
  I. Find global extrema of

  \[ f(x, y) = 2x - 4xy + y \]

  on the closed region in the first quadrant bounded by the line \( x + y = 1 \).

  II. Find global extrema of

  \[ g(x, y) = (3 + 2x - x^2) \sin y \]

  on the rectangular region where \( 0 \leq x \leq 4 \) and \( 0 \leq y \leq 3\pi/4 \).

- From the notes (p. 108): 1-14.
Homework 8 (Oct. 27)

- From the notes (pp. 122-123): 1-10.
- Additional problems:
  
  I. Evaluate \( \int_0^1 \int_y^1 \arctan x^2 \, dx \, dy \).

  II. Evaluate \( \int_0^1 \int_1^{\sqrt{2-y^2}} \frac{y}{x^2 + y^2} \, dx \, dy \).

Homework 9 (Nov. 3)

- From the notes (pp. 134-137): 1-24.
- For Problems 10 and 20 (p. 136), also find the moments of inertia about the axes of symmetry of the given solids.

Homework 10 (Nov. 17)

- From the notes (p. 144): 1-5.
- From the notes (p. 153): 1-2, 4.
- Additional problems:

  I. For Problem 1 (p. 153), also find the line integral of \( \vec{g}(x, y) \) on an arbitrary curve starting at \((x_1, y_1)\) and ending at \((x_2, y_2)\).

  II. For Problem 2 (p. 153), also find the line integral of \( \vec{F}(x, y, z) \) on an arbitrary curve starting at \((0, 0, 1)\) and ending at \((2, 1, -2)\).

Homework 11 (Nov. 24)

- From the notes (pp. 161-162): 1-5.
- Additional problems: None. Happy Thanksgiving!
Homework 12 (Dec. 1)

• From the notes (pp. 173-175): 1-13.

• Additional problems:

I. Find the total mass of a closed surface $S$ consisting of a cylinder $x^2 + y^2 = 4$ for $-1 \leq z \leq 1$ and two disks $x^2 + y^2 \leq 4$ at $z = \pm 1$ with mass density at each point equal to the square of the distance between that point and the origin.

II. Find the flux of the vector field

$$\vec{F}(x, y, z) = x \hat{i} + y \hat{j} + z \hat{k}$$

outward of $S$ with and without Gauss’ Theorem.