Homework Assignments

Homework 1 (Jan. 21)

- From the course packet (pp. 16-18): 1-3, 5-6, 8-12, 14-17.
- 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 (Jan. 28)

- From the course packet (pp. 31-33): 1-7
- 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 handy.

Homework 3 (Feb. 4)

- From the course packet (pp. 46-48): 1-4, 7, 9-13.
- Additional problems: None!
Homework 4 (Feb. 11)

- From the course packet (pp. 51-52): 1-7.
- From the course packet (pp. 61-62): 1-10.

Homework 5 (Feb. 18)

- From the course packet (pp. 75-77): 1-5, 7-10.
- From the course packet (pp. 72-73): 1-8, 10, 12-14.
- From the course packet (pp. 81-82): 1-8, 15.

Homework 6 (Mar. 4)

- From the course packet (p. 91): 1-7.
- From the course packet (pp. 99-100): 2-10.
- From the course packet (pp. 85-86): 1-3.

Homework 7 (Mar. 11)

- 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 course packet (pp. 104-105): 1-14.
Homework 8 (Mar. 25)

- From the course packet (pp. 120-121): 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 (Apr. 1)

- From the course packet (pp. 133-135): 1-24.
- For Problems 10 and 20, also find the moments of inertia about the axes of symmetry of the given solids.

Homework 10 (Apr. 15)

- From the course packet (p. 142): 1-5.
- From the course packet (p. 151): 1-2, 4.
- Additional problems:
  
  I. For Problem 1 (p. 151), also find the line integral of \( \mathbf{g}(x, y) \) on an arbitrary curve starting at \( (x_1, y_1) \) and ending at \( (x_2, y_2) \).
  
  II. For Problem 2 (p. 151), also find the line integral of \( \mathbf{F}(x, y, z) \) on an arbitrary curve starting at \( (0, 0, 1) \) and ending at \( (2, 1, -2) \).

Homework 11 (Apr. 22)

- From the course packet (pp. 159-160): 1-5.
- Additional problems: None!
Homework 12 (Apr. 29)

- From the course packet (pp. 171-173): 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.