

1. Find $\min_{x,y} f(x,y) = -x^2 - y^2 - 4x - 6y + 10$ and check the second order conditions
2. Find $\max_{x,y} f(x,y) = 2x^2 + y^2 - xy$ s.t. $y = x + 5$ and check the second order conditions
3. Maximize $u(x,y) = (x^{1/2} + y^{1/2})^2$ subject to $x \geq 2, y \geq 4$, and $2x + y \leq 20$
4. $\max_{x,y,z} f(x,y,z) = \ln(xy)$ subject to $x + z = 10, y + z \leq 20, 10 \geq y \geq 1, x \geq 1$, and $z \geq 0$

5. Consider the following matrix.
$$A = \begin{bmatrix} 3 & 2 & 0 \\ 3 & 4 & 0 \\ 0 & 0 & 2 \end{bmatrix}$$

- a. Find A^2
- b. Find A^{-1}
- c. Find the eigenvalues of A
- d. $|A|$
- e. $\text{tr}(A)$

6. Evaluate the following integrals.

- a. $\iiint_R 1 \, dx \, dy \, dz$ where $R: x \geq 0, y \geq 0, z \geq 0, x + y + z \leq 1$

- b. $\iiint_R xyz \, dx \, dy \, dz$ where $R: x \geq 0, y \geq 0, z \geq 0, x + y + z \leq 1$

- c. $\int_1^3 2^x \, dx$

7. Suppose that a random variable y has the following distribution.
$$f(y) = \begin{cases} 1 + y & \text{for } y \in (-1, 0) \\ 1 - y & \text{for } y \in [0, 1) \\ 0 & \text{otherwise} \end{cases}$$
 Show that if $w = 10 - 2y$ then the $E(w) = 10 - 2E(y)$, but that if $z = y^2$ then $E(z) \neq [E(y)]^2$.