1) Use Lagrange multipliers to find the maximum and minimum values of the function subject to the given constraint(s).

a) $f(x, y) = x^2 - y^2$, $x^2 + y^2 = 1$

b) $f(x, y, z) = 2x + 6y + 10z$, $x^2 + y^2 + z^2 = 35$

c) $f(x, y, z, t) = x + y + z + t$, $x^2 + y^2 + z^2 + t^2 = 1$

a) $\boxed{f(\pm 1, 0) = 1 \text{ Max}, \ f(0, \pm 1) = -1 \text{ Min}}$

b) $\boxed{f(1,3,5) = 70 \text{ Max}, \ f(-1,-3,-5) = -70 \text{ Min}}$

c) $\boxed{f(0.5,0.5,0.5,0.5) = 2 \text{ Max}, \ f(-0.5,-0.5,-0.5,-0.5) = -2 \text{ Min}}$

2) Find the extreme values of $f(x, y) = e^{-xy}$ on the region $x^2 + 4y^2 \le 1$.

$$\boxed{f\left(\pm\frac{1}{\sqrt{2}}, \mp\frac{1}{2\sqrt{2}}\right) = e^{1/4} \text{ Max}, \ f\left(\pm\frac{1}{\sqrt{2}}, \pm\frac{1}{2\sqrt{2}}\right) = e^{-1/4} \text{ Min}}$$

3) Find the highest point on the curve of intersection of the cone $x^2 + y^2 - z^2 = 0$ and the plane $x + 2z = 4$. [Hint: You are trying to maximize $f(x, y, z) = z$].

$$\boxed{z = 4,\ (-4, 0, 4)}$$

4) The sum of the length and the girth (perimeter of a cross section) of a package carried by a delivery service cannot exceed 108 inches. Find the dimensions of the rectangular package of largest volume that may be sent.

$$\boxed{36 \times 18 \times 18 \text{ inches}}$$

5) Use Lagrange multipliers to find the dimensions of a right circular cylinder with volume V_0 cubic units and minimum surface area.

$$\boxed{\text{Dimensions: } r = \sqrt[3]{\frac{V_0}{2\pi}} \text{ and } h = 2\sqrt[3]{\frac{V_0}{2\pi}}}$$