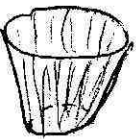
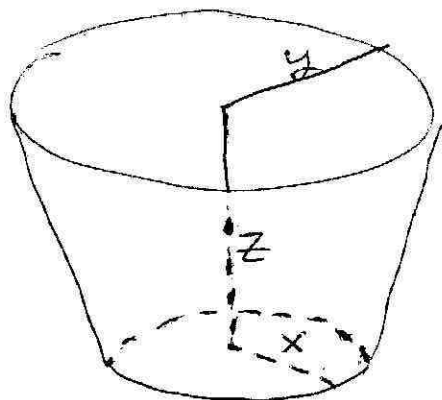


- ① Find the point on the surface $z = x^2 + y^2$ closest to the point $(1, 2, -3)$.

Hint: minimize the squared distance from $(x, y, x^2 + y^2)$ to $(1, 2, -3)$.

- ② Consider a cup  that is a truncated cone with circular base of radius x , (open) circular top with radius y , and height z . Given volume $V = 500 \text{ cm}^3$ (that's half a liter), find x, y, z that minimize the surface area S .



$$V = \frac{\pi z}{3} (x^2 + xy + y^2)$$

$$S = \pi x^2 + \pi(x+y)\sqrt{z^2 + (y-x)^2}$$