1. There are three critical points: (0,0), which is a local minimum, and $(\pm\sqrt{2}, -1)$ which are both saddle points.

2. The tangent plane is $z = (e + 1)x - 1$.

3. The optimum box should have a square base with sides of length $\dfrac{2}{\sqrt[3]{5}}$ meters, and height $\dfrac{5^{2/3}}{2}$ meters.

4. (a) $e^2 - e$ (b) $-\frac{1}{6}\cos 64 + \frac{1}{6}$

5.
$$\iint_D xy \, dA = \int_{\pi/4}^{\pi/2} \int_1^2 r^3 \cos\theta \sin\theta \, dr \, d\theta = \frac{15}{16}$$