P1

(a) Centering: No. Standardization: Yes.

(b) Centering: No. Standardization: Yes.Because

$$D = \sqrt{\sum_{i=1}^{d}(u_i - v_i)^2}$$

Upon Standardization,

$$D = \frac{\sqrt{\sum_{i=1}^{d}(u_i - v_i)^2}}{\hat{\sigma}_i}$$

(c) No.

(d) Yes. By centering all the data, it changes the training error rates of the linear classifiers.

P2

(a)

$$2c \cdot \frac{1}{\sqrt{2\pi}} \cdot e^{-\frac{x^2}{2}} < \frac{2}{\sqrt{2\pi}} \cdot e^{-2(x-2)^2}$$

$$\ln c - \frac{x^2}{2} < -2(x-2)^2$$

$$3x^2 - 16x + 16 + 2\ln c < 0$$

$$\frac{1}{6}(8 - \sqrt{64 - 24\ln c}) < x < \frac{1}{6}(8 + \sqrt{64 - 24\ln c})$$

(b) None, because when $x > e^{\frac{8}{3}}$, previous function has no real root.

P3

(a) $\lambda = \lambda + \sigma^2$

(b) $\lambda = (\lambda + \sigma^2)^{-2}$