1.

$$f = (y - Xw)^T (y - Xw) + \lambda w^T w$$

$$= (y^T - w^T X^T)(y - Xw) + \lambda w^T w$$

$$= y^T y - y^T X w - w^T X^T y + w^T X^T X w + \lambda w^T w$$

$$\frac{\partial f}{\partial w} = 0 - (y^T X)^T - X^T y + X^T X + 2\lambda w I = 0$$

$$2\lambda w I = (y^T X)^T + X^T y - X^T X$$

$$w = \frac{X^T y + X^T y - X^T X}{2\lambda I}$$

$$w = \frac{X^T (2y - X)}{2\lambda I}$$

2.

(1) Confident $= 2e^{-2 \cdot (0.1)^2 \cdot 100 / (0-1)^2} = 0.27$

(2) Confident $= 2e^{-2 \cdot (0.1)^2 \cdot 200 / (0-1)^2} = 0.036$

(3) Confident = 1 - P(either are greater than 0.1 error range)

$= 1 - P(h_1 \cup h_2)$

$= 1 - [P(h_1) + P(h_2) - P(h_1 \cap h_2)]$

$= 1 - P(h_1) - P(h_2) + P(h_1 \cap h_2)$

Since we want to give the most confident result, so since $P(h_1 \cap h_2)$ is unknown, we shall set it to 0.

In the end, $P(h_1) = P(h_2) = 0.27$, so the confident is:

$1 - 0.27 - 0.27 = 0.46$.