1.

$$L[\phi] = \sum_{i=1}^{I} \ell_i = \sum_{i=1}^{I} (\mathrm{f}[x_i, \phi] - y_i)^2$$
$$= \sum_{i=1}^{I} (\phi_0 + \phi_1 x_i - y_i)^2, \qquad (6.5)$$

$$l_i = (\phi_0 + \phi_1 x_i - y_i)^2$$

$$\frac{\partial l_i}{\partial \phi_1} = 2x_i(\phi_0 + \phi_1 x_i - y_i)$$

$$\frac{\partial l_i}{\partial \phi_0} = 2(\phi_0 + \phi_1 x_i - y_i)$$

$$\therefore \frac{\partial l_i}{\partial \underline{\phi}} = \begin{pmatrix} \partial l_i / \partial \phi_0 \\ \partial l_i / \partial \phi_1 \end{pmatrix} = \begin{pmatrix} 2(\phi_0 + \phi x_i - y_i) \\ 2x_i(\phi_0 + \phi x_i - y_i) \end{pmatrix}$$

3.

$$\mathrm{f}[x, \phi] = \sin[\phi_0 + 0.06 \cdot \phi_1 x] \cdot \exp\left(-\frac{(\phi_0 + 0.06 \cdot \phi_1 x)^2}{32.0}\right). \qquad (6.8)$$

$$L[\underline{\phi}] = \sum_i^I l_i = \sum_i^I (f(x_i, \underline{\phi}) - y_i)^2$$

$$l_i = \left(\sin(\phi_0 + 0.06 \cdot \phi_1 x)\, e^{-\frac{(\phi_0 + 0.06\phi_1 x)^2}{32}} - y_i\right)^2$$

$$\frac{\partial l_i}{\partial \phi_0} = 2\Big(\cos(\phi_0 + 0.06\phi_1 x_i)\, e^{-\frac{1}{32}(\phi_0 + 0.06\phi_1 x_i)^2} - \frac{1}{16}(\phi_0 + 0.06\phi_1 x_i)\, e^{-1/32(\phi_0 + 0.06\phi_1 x_i)^2} \sin(\phi_0 + 0.06\phi_1 x_i)\Big)$$
$$\left(\sin(\phi_0 + 0.06\phi_1 x_i)\, e^{-\frac{(\phi_0 + 0.06\phi_1 x)^2}{32}} - y_i\right)$$

$$\frac{\partial l_i}{\partial \phi_1} = 2\Big(0.06 x_i \cos(\phi_0 + 0.06\phi_1 x_i)\, e^{-\frac{1}{32}(\phi_0 + 0.06\phi_1 x_i)^2} - \frac{0.06}{16} x_i\, e^{-\frac{1}{32}(\phi_0 + 0.06\phi_1 x_i)^2} \sin(\phi_0 + 0.06\phi_1 x_i)\Big)$$
$$\left(\sin(\phi_0 + 0.06\phi_1 x_i)\, e^{-\frac{1}{32}(\phi_0 + 0.06\phi x_i)^2} - y_i\right)$$