1. a) $f(x) = \cos x$

$$g(x) = f(\bar{x}) + \left.\frac{df}{dx}\right|_{x=\bar{x}} (x - \bar{x})$$

$$g'(x) = 1$$

b)

$$g(x) = \cos\left(\frac{\pi}{4}\right) - \sin\left(\frac{\pi}{4}\right)\left(x - \frac{\pi}{4}\right)$$

$$g(x) = \frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}\left(x - \frac{\pi}{4}\right)$$

2. $f = m\ddot{x}i - m\pi M - m\dot{v}$

$$f = \bar{F} - m\dot{\pi}\bar{M} + m\ddot{\bar{x}}\bar{\pi} + 1(F - \bar{F}) - m\pi(M - \bar{M}) -$$

$$- m\dot{M}(\pi - \bar{\pi}) + m\bar{x}(\dot{i} - \bar{\pi}) + m\dot{\pi}(x - \bar{x})$$

$$f = F - m\dot{M}\pi + m\ddot{\bar{x}}\pi$$