3. a) $f = -\frac{1}{2}ax^2 + \frac{1}{4}bx^4$

$f' = -ax + bx^3 = 0$

$x = 0, \pm\sqrt{\frac{a}{b}}$

$f'' = -a + 3bx^2$

$f''(0) = -a \quad f''(\sqrt{\frac{a}{b}}) = -a + 3b(\frac{a}{b}) = 2a \quad f''(-\sqrt{\frac{a}{b}}) = 2a$

If $a < 0$: Maxima at $\pm\sqrt{\frac{a}{b}}$, minimum at 0

If $a > 0$: Maximum at $x = 0$, minima at $\pm\sqrt{\frac{a}{b}}$

b) $f = x^2e^{-x^2}$

$f' = e^{-x^2}(2x)(1-x^2) = 0$

$x = 0, \pm 1$

$f'' = e^{-x^2}(2 - 10x^2 + 4x^4)$

$f''(0) = e^0(2 - 0 - 0) = 2$

$f''(1) = e^{-1}(2 - 10 + 4) = -4/e$

$f''(-1) = -4/e$

Minimum at $x = 0$, maxima at $x = \pm 1$