1. (10 pts) Find the derivative of $y = x^3 - e^x$ and the equation of the tangent line to the curve at $(0, -1)$.

$y' = 3x^2 - e^x$ (derivative)

$y'(0) = -1$ (slope)

$y - (-1) = -1(x - 0)$ (point-slope formula)

$$\boxed{y = -x - 1}$$

2. (10 pts) The equation of motion of a particle is $s = t^2 - 3t$, where s is in meters and t is in seconds. Find

a. the velocity and acceleration as functions of t,

b. the acceleration after 2 seconds, and

c. the acceleration when the velocity is 0.

a.   velocity $= S'(t) = \boxed{2t - 3}$

     acceleration $= S''(t) = \boxed{2}$ (m/s^2)

b. $S''(2) = \boxed{2}$ (m/s^2)

c. $S'(t) = 0 \implies 2t - 3 = 0 \implies t = \frac{3}{2}$ (when velocity is 0)

     acceleration at $t = \frac{3}{2}$ is $S''(\frac{3}{2}) = \boxed{2}$ (m/s^2)