1. (4 points) Find the x-value for each point on the graph of $f(x) = x^3 - 7x^2 + 5x$ where the line tangent to the curve is parallel to the line $y = 10x - 3$.

In order for the tangent line to the curve at a point $x_0$ to be parallel to the line $y = 10x - 3$, the two lines must have the same slope. The slope of the tangent line at a point $x_0$ is $f'(x_0)$. The slope of the line $y = 10x - 3$ is $\frac{dy}{dx} = 10$. So we must solve for $x$, $f'(x) = 10$.

$f'(x) = 3x^2 - 14x + 5$. So solve $3x^2 - 14x + 5 = 10$ or $3x^2 - 14x - 5 = 0$. Now we factor.

$3x^2 - 14x - 5 = (3x + 1)(x - 5) = 0$.

So either $3x + 1 = 0$ or $x - 5 = 0$.

$x = -\frac{1}{3}$ or $x = 5$.

So the desired x-values are $\{x = -\frac{1}{3}$ and $x = 5\}$.
2. (2 points each) Using Leibniz notation (i.e., $\frac{dy}{dx}$, $\frac{dp}{dt}$, etc.), find derivatives for each of the following functions. For part (b) simplify your answer.

(a) $r = 2x^3 + 5xe^x + \ln 3$

\[
\frac{dr}{dx} = \frac{d}{dx} \left( 2x^3 + 5xe^x + \ln 3 \right) = 6x^2 + (5x'e^x + 5xe^x) = 6x^2 + 5xe^x + 5xe^x
\]

(b) $w = \left( \frac{\sqrt{x}}{x\sqrt{x}} \right)^{-6}$

\[
\frac{dw}{dx} = \left( x^{1/6} \right)^{-6} = \left( \frac{x^{1/6}}{x^{1/2}} \right)^{-6} = \left( \frac{x^{1/6}}{x^{3/6}} \right)^{-6} = \left( x^{-8/6} \right)^{-6} = x^8
\]

\[
\text{So, } \frac{dw}{dx} = 8x^7
\]

(c) $y = \frac{2t + t^2}{t^5 + 3}$

\[
\frac{dy}{dt} = \frac{(2 + 2t)'(t^5 + 3) - (t^5 + 3)'(2 + t^2)}{(t^5 + 3)^2} = \frac{(2 + 2t)(t^5 + 3) - 5t^4(2 + t^2)}{(t^5 + 3)^2}
\]