Worksheet #7: Derivatives of Polynomials and Exponential Functions

Useful Derivative Formulas:

Powers: $\frac{d}{dx}[x^n] = nx^{n-1}$ Exponential: $\frac{d}{dx}[e^x] = e^x$

Constants: $\frac{d}{dx}[c] = 0$ Identity: $\frac{d}{dx}[x] = 1$

Multiplying Constants $\frac{d}{dx}[cf(x)] = c\frac{d}{dx}[f(x)] = cf'(x)$

Sums and Differences $\frac{d}{dx}[f(x) \pm g(x)] = \frac{d}{dx}[f(x)] \pm \frac{d}{dx}[g(x)] = f'(x) \pm g'(x)$

Higher Derivatives:

$\frac{d^2}{dx^2}(y) = \frac{d^2y}{dx^2} = f^{(2)}(x) = f''(x) = (f'(x))'$ $\frac{d^n}{dx^n}(y) = \frac{d^ny}{dx^n} = f^{(n)}(x)$

1. Find $f'(x)$ and $f''(x)$ for the following:

(a) $f(x) = 2x^3 - 9x + 1$ (b) $f(x) = e^x + \frac{1}{x^3} - \sqrt[4]{x^3}$

2. Find $\frac{dy}{dx}$ for $y = \frac{x^4 - 16}{x^2}$ and $\left.\frac{dy}{dx}\right|_{x=2}$.

3. Find $\frac{ds}{dt}$ and $\frac{d^3s}{dt^3}$ for $s = e^t + t^e + e$.

4. Find the equation of the line tangent to the graph of $y = f(x) = 2x^2$ at the point $x = 3$.

5. For what value of *x*, if any, does the graph of $y = x - e^x$ have a horizontal tangent line?