1. **(3 points)** *Calculate* $\frac{d}{ds}\left(2s^7 - \frac{4}{s^5} + 3e^s\right)$.

We rephrase $\frac{4}{s^5}$ as $4s^{-5}$, and then invoke the power rule and exponential rule:

$$\frac{d}{ds}\left(2s^7 - 4s^{-5} + 3e^s\right) = 14s^6 + 20s^{-6} + 3e^s$$

2. **(5 points)** *If* $y = 3\sec x + 2$, *calculate its second derivative* $\frac{d^2y}{dx^2}$.

First we calculate the derivative $\frac{dy}{dx} = 3\sec x \tan x$; then, to find the second derivative, we will invoke the product rule, since $\frac{dy}{dx}$ is a product:

$$\begin{aligned}\frac{d^2y}{dx^2} &= \frac{d}{dx}(3\sec x\tan x) \\ &= (\frac{d}{dx}3\sec x)\tan x + 3\sec x\frac{d}{dx}\tan x \\ &= 3\sec x\tan x\tan x + 3\sec x\sec^2 x = 3\sec x\tan^2 x + 3\sec^3 x\end{aligned}$$

3. **(4 points)** *If* $f(t) = \frac{t^3+e^t}{t^2-3t}$, *calculate* $f'(t)$.

This is an application of the quotient rule:

$$\begin{aligned}f'(t) &= \frac{d}{dt}\frac{t^3+e^t}{t^2-3t} \\ &= \frac{(t^2-3t)\frac{d}{dt}(t^3+e^t) + (t^3+e^t)\frac{d}{dt}(t^2-3t)}{(t^2-3t)^2} \\ &= \frac{(t^2-3t)(3t^2+e^t) + (t^3+e^t)(2t-3)}{(t^2-3t)^2}\end{aligned}$$

4. **(4 points)** *Calculate* $\frac{d}{dx}\cos(x^3-2x)$.

This is an application of the chain rule. If we denote $x^3 - 2x$ as u, then:

$$\begin{aligned}\frac{d}{dx}\cos(x^3-2x) &= \frac{d}{dx}\cos(u) \\ &= \frac{du}{dx}\frac{d}{du}\cos(u) \\ &= \frac{d}{dx}(x^3-2x)(-\sin u) \\ &= -(x^2-2)\sin(x^3-2x)\end{aligned}$$

5. **(4 points)** *Find the equation of the tangent line to the curve* $y = (2x^2-7x+5)e^x$ *at* $(0,5)$.

Using the product rule, we can determine that

$$\frac{dy}{dx} = \left(\frac{d}{dx}(2x^2-7x+5)\right)e^x + (2x^2-7x+5)\frac{d}{dx}e^x = (4x-7)e^x + (2x^2-7x+5)e^x$$

so when x is 0, $\frac{dy}{dx} = -7e^0 + 5e^0 = -2$. Thus, the tangent line to this curve at $(0,5)$ has slope of -2; since it passes through $(0,5)$, its equation can then be easily seen to be $y = -2x + 5$.