Math 124 Quiz #9 Solutions

1. $f'(x) = 5e^{\sin x} \cdot \cos x$ Note that the $f'(x)$ is defined for all x-values.

To find critical numbers, we must find values for which $f'(x) = 0$.

$$5e^{\sin x} \cdot \cos x = 0 \quad \Rightarrow \quad \cos x = 0 \quad \text{since } 5e^{\sin x} > 0 \text{ for all } x.$$
$$\Rightarrow \quad x = \frac{\pi}{2} \text{ or } x = \frac{3\pi}{2}$$

So, the critical numbers are $x = \frac{\pi}{2}$ or $x = \frac{3\pi}{2}$.

2.
- Finding critical numbers:

$$g'(x) = \frac{(2x^2+8)(1) - x(4x)}{(2x^2+8)^2} = \frac{-2x^2+8}{(2x^2+8)^2}$$

Note that $g'(x)$ is defined for all values since $2x^2 + 8$ is strictly positive for all x-values.

To find where $g'(x) = 0$, we must find where $-2x^2 + 8 = 0 \quad \Rightarrow \quad x^2 = 4 \quad \Rightarrow \quad x = \pm 2$.

Since $x = -2$ is also not in the domain, we only have one critical number $x = 2$.

- Evaluating g at the endpoints and critical numbers:

$g(0) = 0$ $\qquad$ $g(2) = \frac{2}{16} = \frac{1}{8}$

$g(8) = \frac{8}{136} = \frac{1}{17}$

- Stating max and min values:

The absolute maximum value is $\frac{1}{8}$ and it occurs at $x = 2$.
The absolute minimum value is 0 and it occurs at $x = 0$.

3. Note that $\frac{d}{dx}[x^3 + 9x + c] = 3x^2 + 9$ for any constant c.

So, $h(x) = x^3 + 9x + c$ for any constant c. You can pick any value for c, so, for fun, I will pick $c = 5 - \sqrt{2}e^{\pi^2 - 1}$.

$$\Rightarrow \quad h(x) = x^3 + 9x + 5 - \sqrt{2}e^{\pi^2-1} \quad \text{Beautiful!}$$