2. \( f'(x) = \frac{4e^x(3-e^x)-(1+4e^x)(-e^x)}{(3-e^x)^2} = \frac{13e^x}{(3-e^x)^2} \)

6. \( \frac{dy}{dt} = y' = 108t(1+6t^2)^8 \sec(6t) + 6(1+6t^2)^9 \sec(6t) \tan(6t) \)

8. \( h'(t) = \frac{1}{\sqrt{3-5t+\ln(t^2)}} \left( \frac{1}{2}(3-5t)^{\frac{1}{2}}(-5)+\frac{2t}{t^2} \right) = \frac{-\frac{5}{2}(3-5t)^{\frac{1}{2}} + \frac{2}{t}}{\sqrt{3-5t+\ln(t^2)}} \)

10. \( g'(t) = 8te^{4t^2} - 4te^{10-2t^2} = 4t(e^{4t^2} - e^{10-2t^2}) = 0 \Rightarrow t = 0, \quad 2e^{4t^2} - e^{10-2t^2} = 0 \)

The derivative will be zero at the two numbers listed above. Here are the values of the derivative that I used for the number line.

\[
\begin{align*}
g'(2) &= 8e^4 - 16e^4 < 0 \\
g'(-1) &= 4e^8 - 8e^4 > 0 \\
g'(1) &= 8e^4 - 4e^8 < 0 \\
g'(2) &= 16e^4 - 8e^2 > 0
\end{align*}
\]

The increasing/decreasing information for this function is then,

\[
\text{Increase: } -1.2454 < x < 0, \quad 1.2454 < x < \infty \quad \text{Decrease: } -\infty < x < -1.2454, \quad 0 < x < 1.2454
\]

12. \( Q'(t) = \frac{1}{2} - \frac{2t}{1+t^2} = \frac{t^2 - 4t + 1}{1+t^2} \Rightarrow t^2 - 4t + 1 = 0 \rightarrow t = 2 \pm \sqrt{3} = 0.2679, 3.7321 \)

The function will not be changing at the two points listed above.

1. \( g'(z) = 6z^5 \ln(z) + z^6 \left( \frac{1}{z^2} \right) = 6z^5 \ln(z) + z^3 \)
3. \[ h'(x) = -\sin(x) + \frac{4}{\sqrt{1-x^2}} \]

4. \[ R'(y) = \sin^{-1}(y) + \frac{y}{\sqrt{1-y^2}} + \frac{1}{1+y^2} \]

5. \[ g'(z) = \frac{1}{2} (7z)^{-\frac{1}{2}} - 12 \tan^2(z) \sec^2(z) \]

7. \[ g'(w) = \frac{-e^{-w}(w^2 + 4e^6w) - e^{-w}(2w + 24e^6w)}{(w^2 + 4e^6w)^2} = -\left(\frac{w^2 + 2w}{w^2 + 4e^6w}\right)e^{-w} - 28e^{5w} \]

9. \[ T'(x) = -2 \csc(2x^5 - \sin(4x)) \csc(2x^5 - \sin(4x)) \cot(2x^5 - \sin(4x)) \left(10x^4 + 4 \sin(4x)\right) \]

\[ T''(x) = -2 \csc^2(2x^5 - \cos(4x)) \cot(2x^5 - \cos(4x)) \left(10x^4 + 4 \sin(4x)\right) \]

11. We’ll need the derivative and where it is zero.
\[ f''(x) = 4 + 6 \sin(3x) \quad \rightarrow \quad \sin(3x) = -\frac{2}{3} \quad 3x = \sin^{-1}\left(-\frac{2}{3}\right) = -0.7297 \]

A positive angle corresponding to this angle is \( 2\pi - 0.7297 = 5.5535 \) and the second angle is \( \pi + 0.7297 = 3.8713 \). The derivative is therefore zero at the following points.

\[ 3x = 3.8713 + 2\pi n \quad \Rightarrow \quad x = 1.2904 + \frac{2\pi n}{3} \quad n = 0, \pm1, \pm2, \ldots \]

\[ 3x = 5.5535 + 2\pi n \quad \Rightarrow \quad x = 1.8512 + \frac{2\pi n}{3} \quad n = 0, \pm1, \pm2, \ldots \]

In the interval \([-2, 2]\) the derivative will be zero at,

\[ n = -1: \quad x = -0.8040 \quad \text{OR} \quad x = -0.2432 \]
\[ n = 0: \quad x = 1.2904 \quad \text{OR} \quad x = 1.8512 \]

Here are the values of the derivative I used for the number line.

\[ f'(-2) = -1.8 \quad f'(-1) = 9.9 \quad f'(0) = -2 \quad f'(1) = 9.9 \quad f'(2) = -1.8 \]

So, in the interval \([-2, 2]\) we have the following increasing/decreasing information.

Increasing: \(-1.8140 < x < -0.2804, \quad 0.2804 < x < 1.8140\)

Decreasing: \(-2 \leq x < -1.8140, \quad -0.2804 < x < 0.2804, \quad 1.8140 < x \leq 2\)
Note that we CAN NOT go past -2 and 2 here as we have no work past those points and this function most definitely both increases and decreases past either of those two points as is very easy to prove by simply going one more point in either direction.