2. (2pts) $h'(t) = \dfrac{2t\left(1-\ln(t)\right) - t^2\left(-\frac{1}{t}\right)}{\left(1-\ln(t)\right)^2} = \boxed{\dfrac{2t\left(1-\ln(t)\right)+t}{\left(1-\ln(t)\right)^2} = \dfrac{t\left(3-2\ln(t)\right)}{\left(1-\ln(t)\right)^2}}$

4. (2pts) $\boxed{\dfrac{dy}{dx} = -\dfrac{6}{\sqrt{1-z^2}} - \dfrac{1}{1+z^2}}$

6. (2pts) $R'(t) = -\mathbf{e}^{-t}\sec^3(t) + \mathbf{e}^{-t}(3)\sec^2(t)\left(\sec(t)\tan(t)\right) = \boxed{-\mathbf{e}^{-t}\sec^3(t) + 3\mathbf{e}^{-t}\sec^3(t)\tan(t)}$

8. (2pts) $f'(w) = \sec^2\left(\mathbf{e}^{4+w^2} - \ln(5w)\right)\left(2w\mathbf{e}^{4+w^2} - \dfrac{5}{5w}\right) = \boxed{\sec^2\left(\mathbf{e}^{4+w^2} - \ln(5w)\right)\left(2w\mathbf{e}^{4+w^2} - \dfrac{1}{w}\right)}$

12. (2pts) We need the derivative and where it is zero.

$$h'(t) = 8t\mathbf{e}^{1+t^2} - 2t\mathbf{e}^{5-t^2} \quad \rightarrow \quad 2t\left(4\mathbf{e}^{1+t^2} - \mathbf{e}^{5-t^2}\right) = 0$$

From this we can see that one solution is $t = 0$ and for any others we will need to solve,

$$\begin{aligned}
4\mathbf{e}^{1+t^2} - \mathbf{e}^{5-t^2} &= 0 \\
4\mathbf{e}^{1+t^2} &= \mathbf{e}^{5-t^2} \\
4 &= \frac{\mathbf{e}^{5-t^2}}{\mathbf{e}^{1+t^2}} \\
4 &= \mathbf{e}^{4-2t^2} \\
4 - 2t^2 &= \ln(4) \\
2t^2 &= 4 - \ln(4) \qquad \Rightarrow \qquad \boxed{t = \pm\sqrt{\tfrac{1}{2}\left(4-\ln(4)\right)} = \pm 1.1432}
\end{aligned}$$

So, the function is not changing at t=0, t=1.1432 and t= -1.1432.

Not Graded

1. $\boxed{f'(w) = 4\mathbf{e}^{w}\ln(w) + \dfrac{4\mathbf{e}^{w}}{w}}$

3. $\boxed{V'(t) = \cos(t) - 2t\sin^{-1}(t) - \dfrac{t^2}{\sqrt{1-t^2}}}$

5.

$$g(z) = (4z)^{\frac{1}{3}} + 2\ln\left(z^2 - \sin(z)\right)$$

$$g'(z) = \tfrac{1}{3}(4z)^{-\frac{2}{3}}(4) + \frac{2\left(2z - \cos(z)\right)}{z^2 - \sin(z)} = \boxed{\tfrac{4}{3}(4z)^{-\frac{2}{3}} + \frac{2\left(2z - \cos(z)\right)}{z^2 - \sin(z)}}$$

7.

$$\frac{dy}{dx} = \frac{-3\sin(3x)\left(x - \cos(1-x)\right) - \cos(3x)\left(\sin(1-x)(-1)\right)}{\left(x - \cos(1-x)\right)^2}$$

$$= \boxed{\frac{-3\sin(3x)\left(x - \cos(1-x)\right) + \cos(3x)\sin(1-x)}{\left(x - \cos(1-x)\right)^2}}$$

9. $T(x) = \left(10x - \sin^3(4x)\right)^{\frac{1}{2}}$

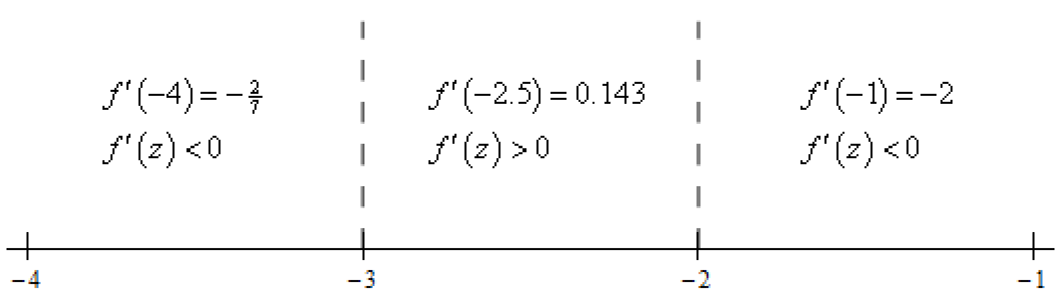
$$T(x) = \tfrac{1}{2}\left(10x - \sin^3(4x)\right)^{-\frac{1}{2}}\left(10 - 3\sin^2(4x)\left[\cos(4x)(4)\right]\right)$$

$$= \boxed{\tfrac{1}{2}\left(10x - \sin^3(4x)\right)^{-\frac{1}{2}}\left(10 - 12\cos(4x)\sin^2(4x)\right)}$$

10. We'll need the derivative and where it is zero first.

$$f'(z) = -1 - \frac{2z+3}{z^2+3z+3} = \frac{-1\left(z^2+3z+3\right) - (2z+3)}{z^2+3z+3} = \frac{-\left(z^2+5z+6\right)}{z^2+3z+3} = \frac{-(z+2)(z+3)}{z^2+3z+3}$$

From this we can see that the derivative will be zero at $z = -2$ and $z = -3$. Here is a number line giving the signs of the derivative.



From this we can see that,

$$\text{Increasing}: \; -3 < z < -2 \qquad \text{Decreasing}: \; -\infty < z < -3, \; -2 < z < \infty$$

11. We'll need the derivative and where it is zero first.

$$f'(x) = 3 + 4\sin\left(\frac{x}{2}\right)\left(\frac{1}{2}\right) = 3 + 2\sin\left(\frac{x}{2}\right) \qquad \Rightarrow \qquad \sin\left(\frac{x}{2}\right) = -\frac{3}{2}$$

Okay, at this point let's take a step back and recall that $-1 \le \sin(\theta) \le 1$ and so we know that the above equation has no solutions. Therefore this function will never stop changing. This doesn't mean that we can't answer the question however. All this means is that the function is either always increasing or always decreasing. To see which it is all we need to do is test a single point : $f'(0) = 3 > 0$. Because the derivative is positive at one point and the function is continuous we know that it must always be positive (if it was negative if would have had to go through zero to get there and it can't…..).

Therefore this function is **always increasing**.