#2. **(2 pts)** $\boxed{g'(z)=\frac{12}{z}-15z^2\mathbf{e}^z-5z^3\mathbf{e}^z}$

#3. **(2 pts)** $\boxed{f'(y)=\dfrac{1}{1+y^2}+2y\sin^{-1}(y)+\dfrac{y^2}{\sqrt{1-y^2}}\sin^{-1}(y)}$

#5. **(2 pts)**

$U'(t)=24\sec^3(t)\left[\sec(t)\tan(t)\right]+7\csc(7t)\cot(7t)=\boxed{24\sec^4(t)\tan(t)+7\csc(7t)\cot(7t)}$

#9. **(2 pts)** $\boxed{f'(x)=-5\cot^4\left(7x+\mathbf{e}^{\sin(5x)}\right)\csc^2\left(7x+\mathbf{e}^{\sin(5x)}\right)\left(7+5\cos(5x)\mathbf{e}^{\sin(5x)}\right)}$

#10. **(2 pts)** $y'=\dfrac{8w^3-3w^2-6w}{2w^4-w^3-3w^2+25}=\dfrac{w\left(8w^2-3w-6\right)}{2w^4-w^3-3w^2+25}$

Rational expressions will be zero if the numerator is zero and so we can see that this function will not be changing at : $w=0$ and $w=\frac{3\pm\sqrt{201}}{16}=-0.6986,\ 1.0736$.

Not Graded

#1. $Q'(w)=\dfrac{\frac{1}{w}\left(2w^5\right)-\left(10w^4\right)\ln(w)}{\left(2w^5\right)^2}=\dfrac{2w^4-10w^4\ln(w)}{4w^{10}}=\boxed{\dfrac{1-5\ln(w)}{2w^6}}$.

#4. $\boxed{y'=-\sin(x)\cos^{-1}(x)-\dfrac{\cos(x)}{\sqrt{1-x^2}}}$

#6.

$$g'(x)=\tfrac{1}{2}(7+3x)^{-\frac{1}{2}}(3)\cos(2-x)+(7+3x)^{\frac{1}{2}}\left[-\sin(2-x)(-1)\right]$$
$$=\boxed{\tfrac{3}{2}(7+3x)^{-\frac{1}{2}}\cos(2-x)+(7+3x)^{\frac{1}{2}}\ \sin(2-x)}$$

#7.

$$\boxed{y'=\frac{3\mathbf{e}^{3t}\left(6t-\sin(4t)\right)-\mathbf{e}^{3t}\left(6-4\cos(4t)\right)}{\left(6t-\sin(4t)\right)^2}}\frac{\mathbf{e}^{3t}}{6t-\sin(4t)}$$

#8. $$\boxed{h'(y) = 4\left[(11y)^{\frac{1}{2}} + \ln\left(3y - \tan(y)\right)\right]^3 \left(\tfrac{11}{2}(11y)^{-\frac{1}{2}} + \frac{3 - \sec^2(y)}{3y - \tan(y)}\right)}$$

#11. $f'(x) = 6 + 4\cos\left(\frac{x}{3}\right) \qquad \Rightarrow \qquad \cos\left(\frac{x}{3}\right) = -\frac{3}{2}$

Now, we know that $-1 \le \cos(x) \le 1$ and so we can see that cosine can never be $-\frac{3}{2}$. Therefore, the derivative will never be zero. Finally, because $f'(0) = 10 > 0$ and the derivative is continuous we can see that the derivative will always be positive and so the function will always be increasing.

Do not get excited about the fact that this function is always increasing. Sometimes that can happen and so we don't want to get excited about it.

#12. $h'(t) = -4t\mathbf{e}^{4-t^2} - 2t^2\mathbf{e}^{4-t^2}(-2t) = 4t\mathbf{e}^{4-t^2}(-1+t^2) = 4t\mathbf{e}^{4-t^2}(t-1)(t+1)$

Now, since we know the exponential will never be zero the derivative will only be zero at : $t = 0$, $t = -1$ and $t = 1$. I'll leave it to verify the number line for this derivative. Here are the values of the derivatives that I used.

$$h'(-2) = 24 \qquad h'\left(-\tfrac{1}{2}\right) = \tfrac{3}{2}\mathbf{e}^{\frac{15}{4}} \qquad h'(1) = -\tfrac{3}{2}\mathbf{e}^{\frac{15}{4}} \qquad h'(2) = 24$$

We now have the following increasing/decreasing information.

$$\text{Increasing : } (-1,0),\ (1,\infty) \qquad \text{Decreasing : } (-\infty,-1),\ (0,1)$$