**6D Differentiating Hyperbolics**

1. Show that $\frac{d}{dx}\left(\sinh(x)\right)=\cosh(x)$
2. Show that $\frac{d}{dx}\left(\cosh(x)\right)=\sinh(x)$
3. Show that $\frac{d}{dx}\left(\tanh(x)\right)=sech^{2} x$
4. Differentiate $\cosh(3x)$ with respect to $x$
5. Differentiate $x^{2}\cosh(4x)$ with respect to $x$
6. Given that:

$$y=Acosh 3x+Bsinh 3x$$

Where $A$ and $B$ are constants, prove that $\frac{d^{2}y}{dx^{2}}=9y$

1. Show that $\frac{d}{dx}\left(arcosh x\right)=\frac{1}{\sqrt{x^{2}-1}}, x>1$
2. Given $y=xarcosh x$, find $\frac{dy}{dx}$
3. Given $y=\left(arcosh x\right)^{2}$, prove that:

$$\left(x^{2}-1\right)\left(\frac{dy}{dx}\right)^{2}=4y$$

1. Show that $\frac{d}{dx}\left(arsinh x\right)=\frac{1}{\sqrt{1+x^{2}}}$
2. Find the first two non-zero terms in the series expansion of $arsinh x$
3. The general term for the series expansion of $arsinh x$ is given by:

$$arsinh x=\sum\_{r=0}^{\infty }\left(\frac{(-1)^{n}\left(2n\right)!}{2^{2n}\left(n!\right)^{2}}\right)\frac{x^{2n+1}}{2n+1}$$

Find, in its simplest terms, the third term in the sequence

1. Use your approximation, up to and including the term in $x^{5}$, to find an approximation for $arsinh 0.5$
2. Calculate the percentage error by using this approximation