**Application problems for Linear approximation.**

1) Find $(1.999)^{4}$ :

Solution: Let $f\left(x\right)=(2-x)^{4}\rightarrow f^{'}\left(x\right)=-4(2-x)^{3} $

When: $x=001; f\left(x\right)= (1.999)^{4} $

 $a=0; f\left(a\right)= 2^{4}=16, and f^{'}\left(a\right)= -4(2^{3})= -32$

Substituting in $f\left(x\right)=f\left(a\right)+f^{'}\left(a\right)\left(x-a\right);we have$;

 $(1.999)^{4}=16-32\left(.001\right)=15.968$

2) Find $\sqrt[3]{1001}:$

Solution: Let $f\left(x\right)=\sqrt[3]{1000+x} = (1000+x)^{\frac{1}{3}} $ $\rightarrow f^{'}\left(x\right)= \frac{1}{3}(1000+x)^{-\frac{2}{3}}$

When: $x=1; f\left(x\right)= \sqrt[3]{1001}$

 $a=0; f\left(a\right)=10 and f^{'}\left(a\right)= \frac{1}{300}$

Substituting in $f\left(x\right)=f\left(a\right)+f^{'}\left(a\right)\left(x-a\right);we have$;

 $\sqrt[3]{1001} =10+\frac{1}{300}\left(1\right)= 10.00333$

3) Find $\cos(29°)$ :

Solution; Let $f\left(x\right)=\cos((\frac{π}{6}+x))\rightarrow f^{'}\left(x\right)= -sin⁡(\frac{π}{6}+x) $

When: $x=-\frac{π}{180};f\left(x\right)=\cos(29°)$

 $a=0; f\left(a\right)=\cos(30°=.866 and f^{'}\left(a\right)= -\sin(30°=-.5))$

Substituting in $f\left(x\right)=f\left(a\right)+f^{'}\left(a\right)\left(x-a\right);we have$;

 $\cos(29°= .866+(-.5)(-\frac{π}{180}))$ = .8747