Key- DiMarco

AB Calculus AB 4.5 – Linearization, Differentials, and Tolerance Review

1) a) Find the linearization, $L(x)$, of $f(x)=x^3-3x^2+2x+1$ at $x=2$.

$f(2)=1$ pt $(2,1)$

$f'(x)=3x^2-6x+2$

$f'(2)=3(2)^2-6(2)+2=2$ slope $=2$

$y-1=2(x-2)$

$\boxed{L(x)=1+2(x-2)}$

or $L(x)=2x-3$

b) Use $L(x)$ to estimate $f(1.98)$.

$f(1.98)\approx L(1.98)=1+2(1.98-2)=\boxed{.96}$

c) What is the exact value of $f(1.98)$?

$f(1.98)=\boxed{.961192}$

d) What is the approximation error?

$|.96-.961192|=\boxed{.001192}$ (less than 10^{-2})

2) Consider the function $y=\ln(x^2+2)$

a) find the differential dy

$\frac{dy}{dx}=\frac{1}{(x^2+2)}\cdot 2x$

$\boxed{dy=\frac{2x\,dx}{x^2+2}}$

b) Evaluate dy for $x=3$ and $dx=0.02$

$dy=\frac{2(3)(.02)}{(3)^2+2}=.01\overline{09}\approx\boxed{.011}$

3) A box has a square base and its height is three times the length of its base edge (x), giving the box volume and surface area equations of:

$V=3x^3$ $\qquad$ $SA=14x^2$

$\frac{dV}{dx}=9x^2$ $\qquad$ $\frac{dA}{dx}=28x$

a) Write a differential formula that estimates the change in volume when x changes from *a* to *a* + *dx*

$\boxed{dV=9a^2\,dx}$

b) Using your fomula, what would the change in volume be if x changes from 10 inches to 10.05 inches?

$a=x=10$

$dx=.05$

$dV=9(10)^2(.05)=\boxed{45\text{ in}^3}$

c) Repeat (a) and (b) for surface area

$\boxed{dA=28a\,dx}$ $\qquad$ $dA=28(10)(.05)=\boxed{14\text{ in}^2}$