Differential

$dy = f'(x)\,dx$ — Change in x; This gives us the change in y when we change x.

Change in y

$A = \pi r^2$

$dA = 2\pi r\,dr$ — Change in radius; Difference or Change in Area

$dA = 2\pi(10)(.1)$

$dA = 2\pi$

$\%\ \text{Change} = \frac{dA}{\text{Area}} = \frac{2\pi}{100\pi} = 2\%$ error

Example 10 pg 227

$S = 4\pi r^2$

$dS = 8\pi r\,dr$

$dS = 8\pi(3959)(.1)$

$dS = 9950\,mi^2$

Example 11 pg 227 $S = 4\pi r^2$

$dS = 8\pi r\,dr$ — Change in Surface Area

$dS < 1\%$ error

$dS < .01\,S$ — We want the change in SA to be less than 1% of the SA

$8\pi r\,dr \le (.01)4\pi r^2$

$dr \le \frac{.01(4\pi)r^2}{2\cancel{8\pi}\,\cancel{r}}$

$dr \le .01\left(\frac{r}{2}\right)$

$dr \le .005r$ or .5%

#39 pg 230

- Diameter = 10 in
- Circumference increased 2 in

} given

- Diameter increased?
- Cross section increase?

} want to find

$C = 2\pi r$ or πD

$C = \pi D$

$\text{Area} = \pi r^2 = \pi\left(\frac{D}{2}\right)^2 = \frac{\pi}{4}D^2$

$dC = \pi\,dD$ — ΔCircumference; ΔDiameter

$2 = \pi\,dD$

$dD = \frac{2}{\pi}$ in

$C = \pi D$

$D = \frac{C}{\pi}$

$A = \frac{\pi}{4}\left(\frac{C}{\pi}\right)^2 \Rightarrow$

$A = \frac{C^2}{4\pi}$

$dA = \frac{2C}{4\pi}\,dC$

$dA = \frac{2(10\pi)}{4\pi}(2)$

$dA = 10\,in^2$

$C = \pi(10)$ — original Diameter ∴ original Circumference