MATH 169 Homework 17 Solutions

Sec 3.8 #8. $y = 1 - 2x^2 \Rightarrow f(0) = 1$.

$\Delta x = dx = -0.1 \Rightarrow \Delta y = f(x+\Delta x) - f(x) = f(0 + (-0.1)) - f(0)$

$= .98 - 1 = \boxed{-0.02 = \Delta y}$

and $dy = f'(x)\,dx \Rightarrow dy = -4 \cdot x\,dx$. When $x = 0$, $\boxed{dy = 0}$ close numbers

#30. x = edge of a cube = 12 in. Volume = $V(x) = x^3$

error = $\Delta x = 0.03$ in $= dx$ propagated error in volume $\cong dV = 3x^2\,dx$

Surface Area = $A(x) = 6x^2$ $\Rightarrow dV = 3 \cdot 12^2 \cdot (\pm 0.03) = \pm 1.296$

$\Rightarrow$ propagated error in Area $\cong dA = 12x\,dx \Rightarrow dA = 12 \cdot 12(\pm 0.03) = \pm 0.432$

#44. Approximate $\sqrt[3]{26}$. Let $y = f(x) = \sqrt[3]{x}$

We know $\sqrt[3]{27} = 3$.

let $x = 27$, $\Delta x = dx = -1$ (because $26 = 27 + (-1)$)

$\Delta y \cong dy = f'(x)dx \Rightarrow dy = \frac{1}{3x^{2/3}} \cdot dx \Rightarrow dy = \frac{1}{3 \cdot 27^{2/3}}(-1) = \frac{-1}{27}$

$\Rightarrow f(26) = \sqrt[3]{26} \cong 3 - \frac{1}{27} = \frac{80}{27} = \boxed{2.962962963}$

actual value = $\boxed{2.962496068}$ pretty close!

Sec 4.1 #24. $\int \left(\sqrt[4]{x^3} + 1\right)dx \overset{\text{rewrite}}{=} \int \left(x^{3/4} + 1\right)dx \overset{\text{integrate}}{=} \frac{x^{3/4+1}}{3/4+1} + x + C = \boxed{\frac{4}{7}x^{7/4} + x + C}$

#28. $\int \frac{x^2 + 2x - 3}{x^4}\,dx \overset{\text{rewrite}}{=} \int \left(x^{-2} + 2x^{-3} - 3x^{-4}\right)dx = \frac{x^{-1}}{-1} + \frac{2x^{-2}}{-2} - \frac{3x^{-3}}{-3} + C$

$= \boxed{-\frac{1}{x} - \frac{1}{x^2} + \frac{1}{x^3} + C}$

#40. $\int \sec y(\tan y - \sec y)\,dy \overset{\text{rewrite}}{=} \int (\sec y \tan y - \sec^2 y)\,dy \overset{\text{integrate}}{=} \boxed{\sec y - \tan y + C}$

#72. Initial height = $h(0) = 1800$ meters

initial velocity = $v(0) = 0$ meters/sec

gravitational acceleration = $9.8\ m/sec^2$

$v(t) = \int -9.8\,dt = -9.8t + C$

Since $v(0) = 0$, $C = 0$ so $v(t) = -9.8t$

$h(t) = \int v(t)dt = \int -9.8t\,dt$

$\Rightarrow h(t) = -9.8\frac{t^2}{2} + C$

Since $h(0) = 1800$, $C = 1800$.

So, $h(t) = -4.9t^2 + 1800$

$h(t) = 0 \Rightarrow t = \sqrt{\frac{1800}{4.9}} \cong 19$ seconds (rock hits the ground)