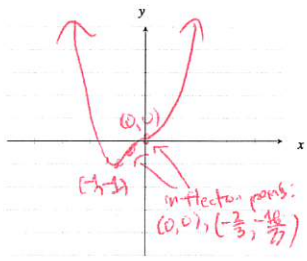
Name: Solution

Quiz 4
MATH 022, Section 004
University of California, Riverside
November 8, 2018

This quiz is worth 15 points. You have 30 minutes to complete the quiz. If you need more space, continue your work on the back side of the page and write "see back" next to your work on the front side of the page accordingly.

(5 pts) 1. Sketch the graph of $y = 3x^4 + 4x^3$. Label any intercepts, relative extrema, points of infection, and asymptotes.



x-ints
set $y=0$
$0 = 3x^4 + 4x^3$
$= x^3(3x+4)$
$x = 0, -\frac{3}{4}$
$\boxed{(0,0), (-\frac{3}{4}, 0)}$

y-ints
set $x=0$
$y = 3(0)^4 + 4(0)^3 = 0$
$(0,0)$

$\frac{dy}{dx} = 12x^3 + 12x^2$
$= 12x^2(x+1)$
set $\frac{dy}{dx} = 0$
$0 = 12x^2(x+1)$
critical points: $x=0, x=-1$

extremes:
$(-1,-1)$
(relative minimum)

$y(0)=0$
$y(-1) = 3(-1)^4 + 4(-1)^3 = -1$

$\frac{d^2y}{dx^2} = 36x^2 + 24x$
$= 12x(3x+2)$
set $\frac{d^2y}{dx^2} = 0$
$0 = 12x(3x+2)$
$x = 0, x = -\frac{2}{3}$
$y(0) = 0$. $y(-\frac{2}{3}) = 3(-\frac{2}{3})^4 + 4(-\frac{2}{3})^3$
$= 3 \cdot \frac{16}{81} + 4 \cdot (-\frac{8}{27})$
$= \frac{16}{27} - \frac{32}{27} = \boxed{-\frac{16}{27}}$

(2 pts) 2. The revenue R for a company selling x units is $R = 900 - 0.1x^2$. Use differentials to approximate the change in revenue as the sales increase from 3000 units to 3100 units.

$\frac{dR}{dx} = -0.2x$

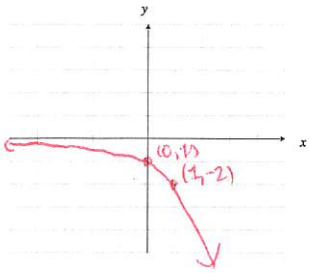
$dx = 100, \quad x = 3000$

$dR = -0.2x \, dx$

At $x = 3000$, $dx = 100$

$dR = -0.2(3000)(100)$
$= -1500(100)$
$= \boxed{-150{,}000 \text{ units}}$

(3 pts) 3. Sketch the graph of $y = -2^x$.



(3 pts) 4. Find the derivative of $f(x) = \dfrac{e^x + 1}{e^x - 1}$.

$f'(x) = \frac{d}{dx}\left(\frac{e^x+1}{e^x-1}\right)$
$= \boxed{\frac{(e^x-1)e^x - (e^x+1)e^x}{(e^x-1)^2}}$
$= \boxed{-\frac{2e^x}{(e^x-1)^2}}$

(2 pts) 5. Use the propertities of logarithms to rewrite the expression as a sum, difference, or multiple of $\ln \sqrt[3]{2x+7}$.

$\ln \sqrt[3]{2x+7} = \ln (2x+7)^{\frac{1}{3}}$
$= \boxed{\frac{1}{3} \ln (2x+7)}$