Week-in-Review 6: Chapter 3.1 - 3.4
(Rules of derivatives, Product Rule, Quotient Rule, Chain Rule)

Problem 1. Find the derivatives for the following:

a $f(x) = 3x - 2\sqrt{1-x} + \dfrac{1}{2\sqrt{1-x}}$

b $f(x) = x \sin^2 x \cos x$

c $f(x) = (\sin x + \cos x)(x^2 - \tan x)$

d $f(x) = \sqrt{x^2 + 3x + 1} - x$

e $f(x) = \dfrac{4 - x^2}{\sqrt{x}}$

f $f(x) = (x^3 - 5)^{10}$

g $f(x) = \dfrac{(2x+3)^3}{(4x^2+1)^8}$

h $f(x) = \dfrac{x^2 e^x}{x^2 + 3e^x}$

i $f(x) = \sqrt{2 + e^x + \sin^2 x}$

j $f(x) = \dfrac{4+x}{xe^x}$

k $f(x) = \tan(\sec(\sin(7x^3)))$

l $f(x) = 2^{e^x}$

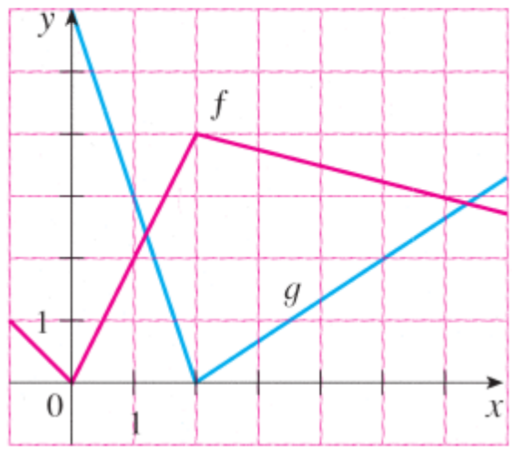
Problem 2. If $\vec{r}(t) =< 4\sin t, 4\cos t >$ is the position vector of a moving particle at time t, find the velocity and speed of the particle at the point $(2, -2\sqrt{3})$. What is the particle's acceleration at this point?

Problem 3. Find the equation of the tangent line to the curve $y = x^4 + 2e^x$ at the point $(0, 2)$.

Problem 4. Find the equation of the tangent line to the curve $y = 2xe^x$ at the point $(0, 0)$.

Problem 5. Given that $f(2) = 10$ and $f'(x) = x^2 f(x)$ for all x, find $f''(2)$.

Problem 6. If we define $u(x) = f(g(x))$, $v(x) = g(f(x))$ and $w(x) = g(g(x))$, use the graph below to find the values of $u'(1)$, $v'(1)$ and $w'(1)$.



Problem 7. Find the equation of the tangent line for $f(x) = 2x\sin(x)$ at the point $(\pi/2, \pi)$.

Problem 8. If $g(x) = (2 - x^2)^6$, find $g(0), g'(0), g''(0)$ and $g^3(0)$.

Problem 9. Find the second derivatives for the following

a $f(u) = \dfrac{1}{\sqrt{1-u}}$.

b $f(x) = e^x - 5x^2$.

c $f(t) = (t^3 + 1)e^t$

Problem 10. Find all the values of x where the tangent line to the function $f(x) = 2\ \sin x + \sin^2 x$ is horizontal.

Problem 11. Given that $f(x) = x\sin(x)$, find the 35^{th} derivative of $f(x)$.

Problem 12. Find the n^{th} derivative for the function $y = \dfrac{1}{x^2}$