Week 4 Worksheet Tuesday - Rules of Derivatives

Instructions. Discuss with your group mates and do the following problems. You are not expected to finish all the problems. :)

Topic: Derivative Computing

Common Derivatives that we learned so far:

$(x^n)' =$ nx^{n-1} $\quad \frac{d}{dx}[e^x] =$ e^x

$(fg)' =$ $f'g + fg'$ $\quad (\frac{f}{g})' =$ $\frac{f'g - g'f}{g^2}$

1. Compute the Derivatives of the following functions (No need to use definition.)

(a) $y = 5x^3 + \sqrt{x} + \frac{1}{2x^3}$

(a) $y = 5x^3 + x^{\frac{1}{2}} + \frac{1}{2}x^{-3}$

$y' = 15x^2 + \frac{1}{2}x^{-\frac{1}{2}} - \frac{3}{2}x^{-4}$

(b) $f(x) = \sqrt{x^3}e^x$

(b) $f(x) = x^{\frac{3}{2}}e^x$

$f'(x) = \frac{3}{2}x^{\frac{1}{2}}e^x + x^{\frac{3}{2}}e^x$

(c) $f(r) = (r^2 - 2r)e^r$

(c) $f'(r) = (2r-2)e^r + (r^2-2r)e^r$

(d) $f(t) = (t + e^t)(3 - \sqrt{t})$

(d) $f'(t) = (1+e^t)(3-\sqrt{t}) + (t+e^t)\cdot(-\frac{1}{2}t^{-\frac{1}{2}})$

(e) $f(x) = \frac{x+1}{e^x}$

(e) $f'(x) = \frac{e^x - e^x(x+1)}{e^{2x}}$

(f) $y = \frac{x}{x^2+3}$

(f) $y' = \frac{x^2+3 - 2x\cdot x}{(x^2+3)^2} = \frac{-x^2+3}{(x^2+3)^2}$

(g) $y = (3x^2 - \sqrt{x} + 1)^5$

(g) $y' = 5(3x^2 - \sqrt{x} + 1)^4 \cdot (6x - \frac{1}{2}x^{-\frac{1}{2}})$

(h) $y = \sqrt{1 + x^3}$

(h) $y = (1+x^3)^{\frac{1}{3}}$

$y' = \frac{1}{3}(1+x^3)^{-\frac{2}{3}} \cdot 3x^2$

(i) $y = e^{3x} - e^{-10x}$

(i) $y' = e^{3x}\cdot 3 - e^{-10x}\cdot(-10)$

(j) $f(x) = e^{2x^2+1} - e^2$

(j) $f'(x) = e^{2x^2+1}\cdot 4x$

(k) $f(x) = e^{\sqrt{t^2+2}}$

(k) $f'(x) = e^{\sqrt{t^2+2}}\ \frac{1}{2}(t^2+2)^{-\frac{1}{2}}\cdot 2t$

(l) $f(x) = e^{-\frac{10}{x^2}} = e^{-10x^{-2}}$

(l) $f'(x) = e^{\frac{-10}{x^2}}\cdot 20x^{-3}$

(m) $f(x) = (e^x + 1)^2(1 + x^2)$

(m) $f'(x) = 2(e^x+1)e^x(1+x^2) + (e^x+1)^2\cdot 2x$

(n) $y = \left(e^{-x^2} + 4\right)^3$

(n) $y' = 3(e^{-x^2}+4)^2\cdot e^{-x^2}\cdot(-2x)$

(o) $\frac{d}{dx}[xy]$ and $\frac{d}{dx}y^2$

(o) $\frac{d}{dx}[xy] = y + x\frac{dy}{dx}$

$\frac{d}{dx}y^2 = 2y\frac{dy}{dx}$

(p) $y = x(10x + 6)^{2017}$

(p) $y' = (10x+6)^{2017} + x\cdot 2017(10x+6)^{2016}\cdot 10$

(q) $y = \sqrt{\frac{1+x}{2-x}}$

(q) $y' = \frac{1}{2}(\frac{1+x}{2-x})^{-\frac{1}{2}}\ \frac{2-x+x+1}{(2-x)^2}$

(r) $y = e^{\sqrt{x^2+1}}$

(r) $y' = e^{\sqrt{x^2+1}}\ \frac{1}{2}(x^2+1)^{-\frac{1}{2}}\cdot 2x$

(s) $y = x^2e^{3x^2-5x}$

(s) $y' = 2xe^{3x^2-5x} + x^2e^{3x^2-5x}\cdot(6x-5)$