Math 131 - February 12, 2015
Solutions

Warm-up Problems

1. Algebraically expand the following:

   (a) $(x+h)^2 = x^2 + 2xh + h^2$

   (b) $(x+h)^3 = x^3 + 3x^2h + 3xh^2 + h^3$

   (c) $(x+h)^4 = x^4 + 4x^3h + 6x^2h^2 + 4xh^3 + h^4$

   (d) $(x+h)^5 = x^5 + 5x^4h + 10x^3h^2 + 10x^2h^3 + 5xh^4 + h^5$

2. Using the limit definition of derivative, find $f'(x)$.

   (a) $f(x) = 4$. $f'(x) = 0$

   (b) $f(x) = \pi$. $f'(x) = 0$

   (c) $f(x) = 4x$. $f'(x) = 4$

   (d) $f(x) = -12x$. $f'(x) = -12$

3. Using the limit definition of derivative, find $f'(x)$.

   (a) $f(x) = 3x^2 - 2x$. $f'(x) = 6x - 2$

   (b) $f(x) = \frac{1}{x^2}$. $f'(x) = -\frac{2}{x^3}$

Lecture Problems

4. Find the following derivatives

   (a) $\frac{d}{dx}\left(849x^{102}\right) = (849)(102)x^{101}$

   (b) $\frac{d}{dx}\left(4x^3 - 12x + 1\right) = 12x^2 - 12$

   (c) $\frac{d}{dx}\left(\frac{1}{x^6} - \sqrt{x}\right) = -6x^{-7} - \frac{1}{2}x^{-1/2}$

   (d) $\frac{d}{dx}\left(\frac{4x^2}{\sqrt{x}} + 4x\right) = (4)(3/2)x^{1/2} + 4$

   (e) $\frac{d}{dx}\left(\frac{4x^2+2x-1}{x^3}\right) = -4x^{-2} - 4x^{-3} + 3x^{-4}$

   (f) $\frac{d}{dx}\left(\frac{4x^2+2x-1}{\sqrt{x}}\right) = 4(3/2)x^{1/2} + x^{-1/2} + (1/2)x^{-3/2}$

   (g) $\frac{d}{dx}\left(\frac{4x^2+2x-1}{x-3}\right) =$???

   (h) $\frac{d}{dx}\left(\frac{4x^2+2x-1}{x^2+2}\right) =$???

5. Find the following derivatives

   (a) $\frac{d}{dx}\left(4e^x + 2x\right) = 4e^x + 2$

   (b) $\frac{d}{dx}\left(13x^2 + 5e^x\right) = 26x + 5e^x$

   (c) $\frac{d}{dx}\left(12xe^x\right) =$???

   (d) $\frac{d}{dx}\left(12e^{2x} - 4x\right) =$???