Section 5.3 / 5.4 (Inverse Functions / Exponential Functions)

Much of section 5.3 involves a review of inverse functions, their meaning and derivation; so we'll do an example to review the steps in finding inverse functions and apply Theorem 5.5 concerning the derivative of an inverse function

Example: Find the inverse function ($f^{-1}(x)$) of $f(x) = 8x^3 - 17$ (how are the graphs related?)

If f has an inverse function $f^{-1}(x) = g(x)$, then $\boxed{g`(x) = \frac{1}{f'(g(x))}}$, $f`(g(x)) \neq 0$

Example: Find $f`(x)$, $f(-1)$, $f^{-1}(-1)$, $f`(f^{-1}(-1))$, and $(f^{-1})`(x)$ when $x = -1$

Recall that the natural log function (ln x) and exponential function (e^x) are inverses and $\ln(e^x) = x = e^{\ln(x)}$

Example: Use the method of switching between logarithmic and exponential form to solve the following equations

$\ln(3x - 1) = 17$ $30 = e^{x+2}$

One of the more interesting and used derivatives in Calculus involves the natural exponential function $\boxed{\frac{d}{dx} e^x = e^x}$

Examples: Find the derivative (wrt. x) of $y = e^{3x+3}$ and $y = e^{-2/x}$

Example: Find the relative extrema of $f(x) = 3xe^x$ (review example 5 with time)

With the derivative of $e^u = e^u \frac{du}{dx}$, it follows that the antiderivative is $\boxed{\int e^u du = e^u + C}$

Examples: Find the following integrals…

$\int e^{2x+1} dx$ $\int 4xe^{-x^2} dx$ $\int \cos(x) e^{\sin(x)} dx$ $\int_{-2}^{1} e^x \sin(e^x) dx$

Homework problems: (5.3) 1,3,23,63,65 (5.4) 4,13,34,35,37,41,45,51,93,99,110,111 (recommended)