# Warm-up Problems - January 20, 2006
# Solutions

1. Are the following "integral computations" correct? If not, why not and what is the correct integral?

   (a) $\int x^3\,dx = \frac{x^4}{4} + C$
   **Solution:** This is correct, this is the power rule.

   (b) $\int 3^x\,dx = \frac{3^{x+1}}{x+1} + C$
   **Solution:** This is not correct the power rule does not work when $x$ is in the exponent.
   $\int 3^x\,dx = \frac{1}{\ln 3}3^x + C$

   (c) $\int \ln x\,dx = \frac{1}{x} + C$
   **Solution:** Not correct! $\int \ln x \; dx$ is a bit difficult and we will see this when we learn integration by parts.

   (d) $\int x^3(x^2+1)\,dx = \frac{x^4}{4}\left(\frac{x^3}{3} + x\right) + C$
   **Solution:** Not correct, it is not correct to take the integral of a product like this! The correct integral would be:
   $\int x^3(x^2+1)\,dx = \int (x^5 + x^3)\,dx = \frac{x^6}{6} + \frac{x^4}{4} + C$

## Lecture Problems

2. (a) Compute the integral using the Fundamental Theorem of Calculus:
$\int_4^8 \sqrt{2x-7}\,dx$
**Solution:**

$$\int_4^8 \sqrt{2x-7}\,dx = \frac{1}{3}(2x-7)^{3/2}\Big|_4^8 = \frac{26}{3}$$

(b) Compute an approximation for the previous integral using a left hand sum with 3 rectangles.
**Solution:** In this case, we divide the interval $[4,8]$ into 3 subintervals:
$[4,16/3]$, $[16/3,20/3]$, $[20/3,8]$. The left hand sum is then:

$$\begin{aligned} L_3 =& f(4)\left(\frac{4}{3}\right) + f(16/3)\left(\frac{4}{3}\right) + f(20/3)\left(\frac{4}{3}\right) \\ =& \sqrt{2(4)-7}\left(\frac{4}{3}\right) + \sqrt{2(16/3)-7}\left(\frac{4}{3}\right) + \sqrt{2(20/3)-7}\left(\frac{4}{3}\right) \\ \approx& 8.709957104 \end{aligned}$$