Practice with Derivatives and Anti-Derivatives

1. Take the derivative of the following functions:
   
   (a) $f(x) = \frac{1}{x}$

   (b) $f(x) = \ln(x)$

   (c) $f(x) = \sqrt{x} + 4x^{3/2}$

   (d) $f(x) = x^2 \sin x$

   (e) $f(x) = \sin(x^2)$

2. Find the following anti-derivatives:

   $\int 4x \, dx \quad (1)$

   $\int 4 \, dx \quad (2)$

   $\int (y + y^2 + y^3) \, dy \quad (3)$

   $\int 2 \sin(x) \, dx \quad (4)$

   $\int 4t \, dt \quad (5)$
3. Find the following definite integrals:

\[ \int_{0}^{4} x \, dx \] \hspace{1cm} (6)

\[ \int_{0}^{2\pi} \cos(x) \, dx \] \hspace{1cm} (7)

\[ \int_{2}^{3} e^x \, dx \] \hspace{1cm} (8)

\[ \int_{-2}^{2} y^3 \, dy \] \hspace{1cm} (9)

\[ \int_{0}^{4} t \, dt \] \hspace{1cm} (10)

4. What to you notice about integrals 6 and 10? Discuss.