MATH 150 **Review** **Exam 4**

1. Find the derivative of the following:

   (a) $y = x^x$

   $$x^x(1 + ln\ x)$$

   (b) $y = ln\ (\frac{x^2-4}{2x+5})$

   $$\frac{2x}{x^2-4} - \frac{2}{2x+5}$$

   (c) $y^x = x^y$

   $$\frac{ln\ y - \frac{y}{x}}{ln\ x - \frac{x}{y}}$$

   (d) $f(x) = sinh^3\ x$

   $$3(sinh\ x)^2(cosh\ x)$$

   (e) $f(x) = ln(sinh\ x)$

   $$\frac{cosh\ x}{sinh\ x}$$

   (f) $y = (sinx)^x$

   $$(sin\ x)^x[x\ cot\ x + ln(sin\ x)]$$

2. The radius of a sphere is found to be 21 cm with a possible error in measurement of at most .05 cm. What is the maximum error in using this value of the radius to compute the volume of the sphere? (**HINT:** use differentials)

$$r = 21 \ , \ dr = .05 \ , \ V = \frac{4}{3}\pi r^3 \ , \ dV = 4\pi r^2 dr$$

$$\text{so } dV = 4\pi(21)^2(.05) \approx 277 \ cm^3$$

3. A baseball diamond is a square with each side being 90 feet. A batter hits the ball and runs toward first base with a speed of 24 ft/s. At what rate is his distance from second base decreasing when he is halfway to first base?

$$\approx 10.7\frac{ft}{sec}$$

4. **Show** that $coshx + sinhx = e^x$

use the exponential definitions on the LHS

5. The altitude of a triangle is increasing at a rate of 1 cm/min while the area of the triangle is increasing at a rate of 2 cm^2/min. At what rate is the base of the triangle changing when the altitude is 10 cm and the area is 100 cm^2?

$$A = \frac{1}{2}ba$$

$$\frac{dA}{dt} = \frac{1}{2}\left[b\frac{da}{dt} + a\frac{db}{dt}\right]$$

$$\ldots \frac{db}{dt} = -\frac{8}{5}\frac{cm}{s}$$