Assignment #9 ***Math 180*** ***Name:***

1. Differentiate the following functions:

a) $f\left(x\right)=\sinh^3\left(\sqrt{7x^3+1}\right)\tanh^{-1}\left(x^4+2\right)$

b) $y=\left[\cos\left(3x^2+1\right)\right]^{7x^3+2}$

2. Determine $\frac{dy}{dx}$ of the equation: $\tanh^3\left(x^2+3y^3\right)+e^{x^3y^4}=3$

3. Prove the following statements:

a) $\sinh(x+y) = \sinh x \cosh y + \cosh x \sinh y$

b) $\sinh(2x) = 2\sinh x \cosh x$

c) $\cosh(2x) = \cosh^2 x + \sinh^2 x$

4. Find extrema of the following function over the given intervals:

a) $f(x) = 4x^3 - 15x^2 + 12x + 7$ *over* $[0,3]$

b) $f(x) = \sin x + \cos x$ *over* $\left[0, \frac{\pi}{3}\right]$

5. a) Show that the equation $3\sin(2x) = 7x + 5$ has exactly one real root.

b) Show that the equation $5x^4 = 7x + 5$ has at most two real roots.

6. Sketch a possible a graph of f(x) satisfies the following conditions:

$f'(5) = 0;\ \ f'(x) < 0$ *when* $x < 5,\ \ f'(x) > 0$ *when* $x > 5,\ f''(2) = 0,\ f''(8) = 0$

$f''(x) < 0$ *when* $x < 2$ *or* $x > 8.\ \ f''(x) > 0$ *for* $2 < x < 8,\ \lim_{x \to \infty} f(x) = 3,\ \lim_{x \to -\infty} f(x) = 3$