**Math 171** **Final (Version 2)**

**Name.....SSN.....Score.....**

**Show all work**

1. Find the limits (16)
   (a). $\lim_{x\to\infty} \frac{\sqrt{x^6+5}}{2x^3-1}$; (b). $\lim_{x\to 4^-} \frac{x-4}{|x-4|}$;
   (c). $\lim_{x\to 0}(x^2)^{1-\cos x}$; (d). $\lim_{x\to 1} \frac{sin(x-1)}{x^2-1}$.

2. Find the derivatives of $y = f(x)$ with respect to $x$ (16)
   (a). $f(x) = x(\csc(x+1))$; (b). $f(x) = \frac{x}{\sqrt{1-x^2}}$;
   (c). $f(x) = \sqrt{\sin x + sin\sqrt{x}}$; (d). $y^2 + x\sin y = x^2$.

3. Find the integrals (20)
   (a). $\int \frac{sec^2 x}{(1+\tan x)^2}\,dx$; (b). $\int[4x^5 - 3x^2 + x^{-\frac{1}{7}}]\,dx$;
   (c). $\int_0^1 x\sqrt{x^2+9}\,dx$; (d). $\int_{-3}^0[x + |x+2|]\,dx$.

4. If $f(x) = \frac{x^2-4x+4}{x^2-x-2}$, find $D(f)$, and classify each of the discontinuities as a vertical assymptote, jump discontinuity or removable discontinuity.(5)

5. Use a linear approximation to estimate the following values (10)
   (a). $\sqrt{15}$; (b). $\cos 31^0$.

6. A ladder 10 ft long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a speed of 2 ft/s, how fast is the angle between the top of ladder and the wall changing when the angle is $\pi/4$ rad? (5)

7. An open box is to be made from a 3ft by 4ft rectangular piece of sheet metal by cutting out squares of equal size from the four corners and bending up the sides. Find the maximum volume that the box can have.(10)

8. Sketch the graph of $y = \frac{x^2}{x^2-1}$. Find x- and y- intercepts, horizontal and vertical asymptotes; plot the stationary points and the inflection points; determine the intervals where y is increasing and decreasing, where the graph is concave up and concave down.(10)

9. Use the second part of fundamental theorem of calculus:(8)
   (a) Find the derivative $\frac{d}{dx}\int_{x^3}^{cosx} sint^2\,dt$;
   (b) Prove that the function $F(x) = \int_x^{4x} \frac{-2}{t}\,dt$ is a constant on the interval $(-\infty, 0)$.