Math 120: Final Exam Formulas

Exponential/log integrals/derivatives:

1. $\frac{d}{dx}\left(b^x\right) = b^x \ln b$
2. $\int b^x \; dx = \frac{b^x}{\ln b} + C$
3. $\int e^{kx} \; dx = \frac{e^{kx}}{k} + C$

Trig Rules:

1. $\sin^2 x + \cos^2 x = 1$
2. $\sec^2 x - \tan^2 x = 1$
3. $\sin^2 x = \frac{1}{2}(1 - \cos(2x))$
4. $\cos^2 x = \frac{1}{2}(1 + \cos(2x))$
5. $\sin x \cos x = \frac{1}{2}\sin(2x)$

Trig integrals:

1. $\int \sin x \; dx = -\cos x + C$
2. $\int \cos x \; dx = \sin x + C$
3. $\int \tan x \; dx = -\ln|\cos x| + C$
4. $\int \sec x \; dx = \ln|\sec x + \tan x| + C$
5. $\int \cot x \; dx = \ln|\sin x| + C$
6. $\int \csc x \; dx = \ln|\csc x - \cot x| + C$
7. $\int \sec^2 x \; dx = \tan x + C$
8. $\int \csc^2 x \; dx = -\cot x + C$
9. $\int \sec x \tan x \; dx = \sec x + C$
10. $\int \csc x \cot x \; dx = -\csc x + C$

Trig derivatives:

1. $\frac{d}{dx}\left(\sin(x)\right) = \cos(x)$
2. $\frac{d}{dx}\left(\cos(x)\right) = -\sin(x)$
3. $\frac{d}{dx}\left(\tan(x)\right) = \sec^2(x)$
4. $\frac{d}{dx}\left(\csc(x)\right) = -\csc(x)\cot(x)$
5. $\frac{d}{dx}\left(\sec(x)\right) = \sec(x)\tan(x)$
6. $\frac{d}{dx}\left(\cot(x)\right) = -\csc^2(x)$

Inverse trig derivatives:

1. $\frac{d}{dx}\left(\sin^{-1}(x)\right) = \frac{1}{\sqrt{1-x^2}}$
2. $\frac{d}{dx}\left(\cos^{-1}(x)\right) = -\frac{1}{\sqrt{1-x^2}}$
3. $\frac{d}{dx}\left(\tan^{-1}(x)\right) = \frac{1}{1+x^2}$
4. $\frac{d}{dx}\left(\csc^{-1}(x)\right) = -\frac{1}{x\sqrt{x^2-1}}$
5. $\frac{d}{dx}\left(\sec^{-1}(x)\right) = \frac{1}{x\sqrt{x^2-1}}$
6. $\frac{d}{dx}\left(\cot^{-1}(x)\right) = -\frac{1}{1+x^2}$

Hyperbolic:

1. $\cosh(x) = \frac{1}{2}(e^x + e^{-x})$
2. $\sinh(x) = \frac{1}{2}(e^x - e^{-x})$
3. $\frac{d}{dx}\left(\sinh(x)\right) = \cosh(x)$
4. $\frac{d}{dx}\left(\cosh(x)\right) = \sinh(x)$
5. $\frac{d}{dx}\left(\tanh(x)\right) = \operatorname{sech}^2(x)$
6. $\frac{d}{dx}\left(\operatorname{csch}(x)\right) = -\operatorname{csch}(x)\coth(x)$
7. $\frac{d}{dx}\left(\operatorname{sech}(x)\right) = -\operatorname{sech}(x)\tanh(x)$
8. $\frac{d}{dx}\left(\coth(x)\right) = -\operatorname{csc}^2(x)$

Inverse Hyperbolic:

1. $\frac{d}{dx}\left(\sinh^{-1}(x)\right) = \frac{1}{\sqrt{1+x^2}}$
2. $\frac{d}{dx}\left(\cosh^{-1}(x)\right) = \frac{1}{\sqrt{x^2-1}}$
3. $\frac{d}{dx}\left(\tanh^{-1}(x)\right) = \frac{1}{1-x^2}$
4. $\frac{d}{dx}\left(\operatorname{csch}^{-1}(x)\right) = -\frac{1}{|x|\sqrt{x^2+1}}$
5. $\frac{d}{dx}\left(\operatorname{sech}^{-1}(x)\right) = -\frac{1}{x\sqrt{1-x^2}}$
6. $\frac{d}{dx}\left(\coth^{-1}(x)\right) = \frac{1}{1-x^2}$

A few sums:

1. $\sum_{i=1}^{n} i = \frac{(n+1)n}{2}$
2. $\sum_{i=1}^{n} i^2 = \frac{(2n+1)(n+1)n}{6}$
3. $\sum_{i=1}^{n} i^3 = \left(\frac{(n+1)n}{2}\right)^2$