Study review.

Know theorems and proof of:

Pythagorean Theorem

angle addition Formula.

Limit laws

Derivative rules

Know statement of

Fundamental theorem of Calculus part I & II

Mean value theorem for integrals

Mean value theorem for derivatives

Know proof of:

Continuity of $f(x) = \frac{1}{x}, \sqrt{x}, x^2, 5x$ using the ε-δ definition.

Derivative of $f(x) = \frac{1}{x}, \sqrt{x}, x^2, 5x$ using the limit definition.

The integration rule

$$\int_a^b f(g(x))g'(x)\,dx = \int_{g(a)}^{g(b)} f(x)\,dx$$ using the fundamental theorem and chain rule.

The sum, product and quotient rules for differentiation using limit laws.

The sum and product limit laws using ε-δ or ε-N definitions of limit.

Proof that $\lim_{\theta \to 0} \frac{\sin\theta}{\theta} = 1$ using geometric argument to get an inequality.

Math 181 Final Review Sheet A

1. State the following integration and differentiation formula:

$$\int_a^b \sin x\,dx = \boxed{}$$

$$\int_a^b \arcsin x\,dx = \boxed{}$$

assuming $-1 \leq a < b \leq 1$

$$\int_a^b \cos x\,dx = \boxed{}$$

$$\int_a^b \arccos x\,dx = \boxed{}$$

assuming $-1 \leq a < b \leq 1$

$$\int_a^b x^\alpha\,dx = \boxed{}$$

assuming $\alpha \neq -1$

$$\int_a^b \frac{1}{\sqrt{1-x^2}}\,dx = \boxed{}$$

assuming $-1 < a < b < 1$

$$\int_a^b \ln x\,dx = \boxed{}$$

assuming $0 < a < b$

$$\int_a^b \frac{1}{x}\,dx = \boxed{}$$

assuming $0 < a < b$

$$\int_a^b \frac{1}{1+x^2}\,dx = \boxed{}$$

$$\int_a^b \arctan x\,dx = \boxed{}$$

$$\int_a^b 5^x\,dx = \boxed{}$$

$$\frac{d}{dx}\ln x = \boxed{}$$

assuming $x > 0$

$$\frac{d}{dx}\sin x = \boxed{}$$

$$\frac{d}{dx}\arcsin x = \boxed{}$$

assuming $-1 < x < 1$

$$\frac{d}{dx}\cos x = \boxed{}$$

$$\frac{d}{dx}\arccos x = \boxed{}$$

assuming $-1 < x < 1$

$$\frac{d}{dx}x^\alpha = \boxed{}$$

$$\frac{d}{dx}7^x = \boxed{}$$

$$\frac{d}{dx}\arctan x = \boxed{}$$

$$\frac{d}{dx}|x| = \boxed{}$$

assuming $x \neq 0$

Show that using induction.

$$1+3+5+7+\cdots(2n-1) = \sum_{k=1}^{n}(2k-1) = n^2$$

Show using the limit definition of derivative that $\frac{d}{dx}(f(x)g(x)) = \frac{df(x)}{dx}\cdot g(x) + f(x)\cdot\frac{dg(x)}{dx}$.

State and prove the Pythagorean theorem.

Convert $.0\overline{7}$ into a fraction.

Find a formula for the sum

$$\sum_{k=7}^{n} (k^2+1)$$

Prove using δ-ε that $f(x)=\sqrt{x}$ is continuous at $x_0=4$.

Find a formula for the sum

$$\sum_{k=n}^{2n} \frac{1}{3^k} =$$

State the Fundamental Theorem of Calculus.

Part I

Part II

Show using ε and N and the definition of limit that if $\lim_{n\to\infty} a_n = L$ and $\lim_{n\to\infty} b_n = M$ Then $\lim_{n\to\infty}(a_n+b_n) = L+M$.

Integrals

$$\int_0^1 \left(x^5 + \ln(x+1)\right)dx =$$

$$\int_0^1 7^{2x+1}\, dx =$$

$$\int_0^{\sqrt{\pi}} x \sin(x^2)\, dx =$$

Derivatives

$$\frac{d}{dx}\sqrt[3]{x} =$$

$$\frac{d}{dx}(x\arctan x) =$$

$$\frac{d}{dx}|\sin x|^3 =$$

$$\frac{d}{dx}\frac{x}{x^2+1} =$$

Find the limits.

$$\lim_{x \to 2} \frac{x^2-4}{x-2} =$$

$$\lim_{\theta \to 1} \frac{\theta-1}{\sin(\theta-1)} =$$

$$\lim_{n \to \infty} n(\sqrt[n]{3}-1) =$$

$$\lim_{n \to \infty} \left(1+\frac{5}{n}\right)^n =$$

Integrate

$$\int_0^{\pi/6} \sin^2 x \, dx$$

$$\int_0^5 |x-1| \, dx$$

$$\int_0^6 \frac{1}{9+x^2} \, dx$$