

S212 Exam 1 Review Sheet

Definitions and statements of theorems to know:

Limit, Derivative, Continuity, Fundamental Theorem of Calculus (FTC),
Mean Value Theorem (MVT).

Techniques to know:

Computing limits involving absolute values.

Differentiation of functions using FTC, product rule, quotient rule and/or chain rule.

Computing derivatives of an inverse function f^{-1} , knowing the derivative of f .

How to use MVT to estimate $|f(b) - f(a)|$ or to show certain special x -values exist (see, for example, problems assigned from section 4.2)

Know definition, domain, range, graph, derivative of $\arcsin x$, $\arctan x$ and $\operatorname{arcsec} x$.

How to determine the domain or range of a given function, especially those involving compositions of trig, inverse trig, natural log and/or exponential functions.

Substitution method for integration: setting up “dictionary” and using it to convert to new variable of integration. Changing limits of integration when substituting in a definite integral.

Trig integration with sines and cosines: Know how to handle $\int \sin^m x \cos^n x dx$ for all possibilities of the positive integers m and n .

Trig integration with tangents and secants: Know the good/bad cases of $\int \tan^m x \sec^n x dx$.

Also know what to do with $\int \frac{\tan^m x}{\sec^n x} dx$ or $\int \frac{\sec^n x}{\tan^m x} dx$.

Integration by parts: know when to expect it, e.g. $\int x^p f(x) dx$ where you know how to integrate f . Be comfortable with more than one integration by parts, e.g. previous example with $p = 2$. Also know how to handle $\int e^{ax} \cos bx dx$ or $\int e^{ax} \sin bx dx$, $\int \ln x dx$ and other special cases you can find in your textbook.

Integration by trig substitution: know how to handle integrands involving $\sqrt{a^2 - x^2}$, $\sqrt{x^2 + a^2}$ and $\sqrt{x^2 - a^2}$ and their variants, e.g. $(3 - 4x^2)^{3/2}$, etc.

Integration by partial fractions: know how to find the PFE for $\int \frac{P(x)}{Q(x)} dx$ where Q factors into a product of linear factors with multiplicity one or higher. Know how to reduce the problem by long division if degree $P(x) \geq$ degree $Q(x)$.

Trig identities to memorize: $\cos^2 x + \sin^2 x = 1$, $1 + \tan^2 x = \sec^2 x$,
 $\cos^2 x = \frac{1}{2}(1 + \cos 2x)$, $\sin^2 x = \frac{1}{2}(1 - \cos 2x)$, $\sin(2x) = 2 \cos x \sin x$.