Calculus Study Guide

Integral Rules

Constant Rule:
∫ k dx = kx + C, where k is constant.

Constant Multiple Rule:
∫ k f(x) dx = k ∫ f(x) dx, where k is constant.

Sum/Difference Rule:
∫ [f(x) ± g(x)] dx = ∫ f(x) dx ± ∫ g(x) dx.

Power Rule:
∫ x^n dx = x^(n+1) / (n+1) + C, for n ≠ -1.

Log Rule:
∫ (1/x) dx = ln|x| + C, for x ≠ 0.

Exponent Rule:
∫ a^x dx = a^x / ln(a) + C, for x ≠ 0 and a > 0.

Trig Rules:
∫ sin(x) dx = -cos(x) + C
∫ cos(x) dx = sin(x) + C
∫ sec^2(x) dx = tan(x) + C
∫ sec(x) tan(x) dx = sec(x) + C
∫ csc^2(x) dx = -cot(x) + C
∫ csc(x) cot(x) dx = -csc(x) + C

Special Integrals:
∫ dx / (1 + x^2) = arctan(x) + C
∫ dx / √(1 - x^2) = arcsin(x) + C

Trigonometric Identities

Reciprocal Identities
sin(x) = 1 / csc(x)

cos(x) = 1 / sec(x)

tan(x) = 1 / cot(x)

cot(x) = 1 / tan(x)

sec(x) = 1 / cos(x)

csc(x) = 1 / sin(x)

Quotient Identities
tan(x) = sin(x) / cos(x)

cot(x) = cos(x) / sin(x)

Pythagorean Identities
sin^2(x) + cos^2(x) = 1

1 + tan^2(x) = sec^2(x)

1 + cot^2(x) = csc^2(x)

sin^2(x) = 1 - cos^2(x)

cos^2(x) = 1 - sin^2(x)

tan^2(x) = sec^2(x) - 1

cot^2(x) = csc^2(x) - 1

Sum or Difference Identities
sin(x ± y) = sin(x) cos(y) ± cos(x) sin(y)

cos(x ± y) = cos(x) cos(y) ∓ sin(x) sin(y)

tan(x ± y) = (tan(x) ± tan(y)) / (1 ∓ tan(x) tan(y))

Derivative Rules
d/dx (sin(x)) = cos(x)

d/dx (cos(x)) = -sin(x)

d/dx (tan(x)) = sec^2(x)

d/dx (sec(x)) = sec(x) tan(x)

d/dx (cot(x)) = -csc^2(x)

d/dx (csc(x)) = -csc(x) cot(x)