

Math 3280: highlights of expected algebra and calculus

Not every formula you should know is listed here; this is instead meant as a guide to the sort of knowledge required.

Algebra and Pre-Calculus

- Trigonometric identities:

$$\sin(A + B) = \sin(A) \cos(B) + \sin(B) \cos(A)$$

$$\cos(A + B) = \cos(A) \cos(B) - \sin(A) \sin(B)$$

$$\sin^2(A) + \cos^2(A) = 1$$

- Exponentials and logarithms

$$e^{(A+B)} = e^A e^B \quad (\text{Multiplied not added!})$$

$$\log(AB) = \log(A) + \log(B) \quad \text{and} \quad A \log(B) = \log(B^A)$$

Calculus

- $\int e^{ax} dx = \frac{e^{ax}}{a} + C$
- $\int \frac{1}{ax+b} dx = \frac{1}{a} \ln(ax+b) + C$ (Only works for this function!)
- $\int \sin(ax) dx = -\frac{1}{a} \cos(ax) + C$ (... and the 15 or so other standard integrals)
- $\int u \frac{dv}{dx} dx = uv - \int v \frac{du}{dx} dx$ (Integration by parts)
- The Taylor series of $f(x)$ around $x = a$ for an analytic function:

$$f(x) = \sum \frac{f^{(n)}(a)}{n!} (x-a)^n = f(a) + f'(a)(x-a) + \frac{1}{2} f''(a)(x-a)^2 + \frac{1}{6} f'''(a)(x-a)^3 \dots$$

- Simpson's Rule (for even n):

$$\int_{x_0}^{x_n} f dx \approx \frac{\Delta x}{3} (f(x_0) + 4f(x_0 + \Delta x) + 2f(x_0 + 2\Delta x) + \dots + 2f(x_n - 2\Delta x) + 4f(x_n - \Delta x) + f(x_n))$$

Common mistakes to avoid

- $\int \frac{1}{f(x)} dx$ IS NOT EQUAL to $\log(f(x)) + C$ unless $f(x) = x + b$.
- $\sqrt{a^2 + b^2}$ IS NOT EQUAL to $a + b$.
- $e^{a \ln(b)}$ IS NOT EQUAL to ab , it is equal to b^a .