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.

Common mistakes to avoid

- $\displaystyle\int \frac{1}{f(x)}\,dx$ 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.

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

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

  $\log(AB) = \log(A) + \log(B)$ and $A\log(B) = \log(B^A)$

- Partial Fraction Decomposition

Calculus

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

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