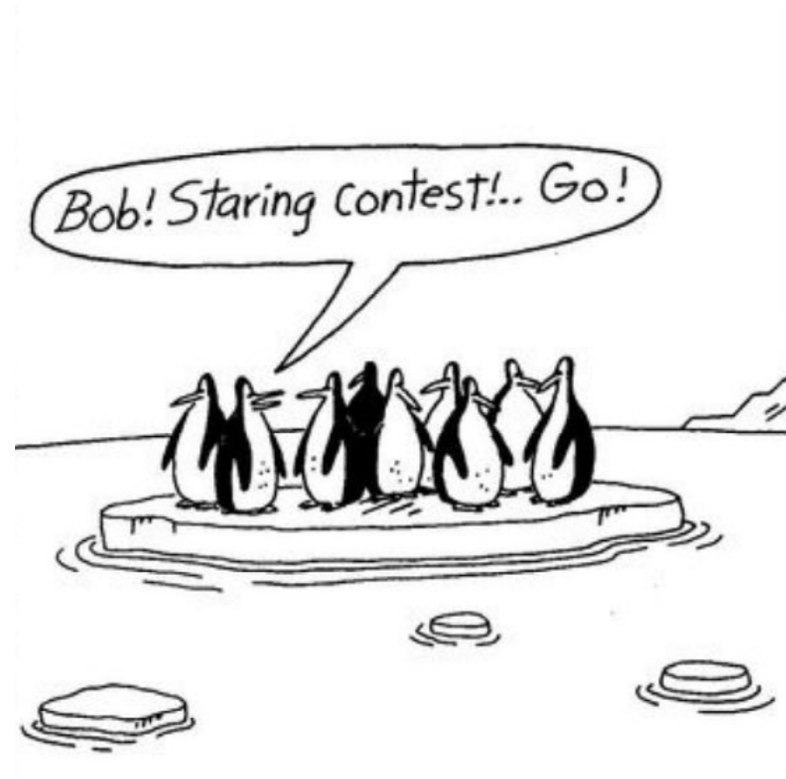# Strategy for Integration

1. **Quote.** "A math student's best friend is BOB (the Back Of the Book), but remember that BOB doesn't come to school on test days."

   (Joshua Folb, High School Teacher, Winchester, Virginia)

2. **Quote.** "It is the duty of all teachers, and of teachers of mathematics in particular, to expose their students to problems much more than to facts,"

   (Paul Halmos, Mathematician, California)

3. **Table of Integration Formulas.**

Constants of integration have been omitted.   You should know this table!

$$\int x^n \, dx = \frac{x^{n+1}}{n+1}, (n \neq -1)$$

$$\int \frac{dx}{x} = \ln|x|$$

$$\int e^x \, dx = e^x$$

$$\int a^x \, dx = \frac{a^x}{\ln a}$$

$$\int \sin x \, dx = -\cos x$$

$$\int \cos x \, dx = \sin x$$

$$\int \sec^2 x \, dx = \tan x$$

$$\int \csc^2 x \, dx = -\cot x$$

$$\int \sec x \tan x \, dx = \sec x$$

$$\int \csc x \cot x \, dx = -\csc x$$

$$\int \sec x \, dx = \ln|\sec x + \tan x|$$

$$\int \csc x \, dx = \ln|\csc x - \cot x|$$

$$\int \tan x \, dx = \ln|\sec x|$$

$$\int \cot x \, dx = \ln|\sin x|$$

$$\int \sinh x \, dx = \cosh x$$

$$\int \cosh x \, dx = \sinh x$$

$$\int \frac{dx}{x^2 + a^2} = \frac{1}{a} \arctan\left(\frac{x}{a}\right)$$

$$\int \frac{dx}{\sqrt{a^2 - x^2}} = \arcsin\left(\frac{x}{a}\right)$$

$$\int \frac{dx}{x^2 - a^2} = \frac{1}{2a} \ln\left|\frac{x-a}{x+a}\right|$$

$$\int \frac{dx}{\sqrt{x^2 \pm a^2}} = \ln\left|x + \sqrt{x^2 \pm a^2}\right|$$

4. **Final Exam - Summer 2004.** Integrate

(a) $\displaystyle\int \frac{x+4}{x^3+x}dx$

(b) $\displaystyle\int_0^{\pi/2} \sin^4 x \cos^3 x\, dx$

(c) $\displaystyle\int e^x \sin(2x)\, dx$

5. **Final Exam - Fall 2005.** Integrate

(a) $\displaystyle\int_1^e \frac{\ln x}{x} dx$

(b) $\displaystyle\int \cos^2(5x) dx$

(c) $\displaystyle\int x^3 \ln x\, dx$

(d) $\int x \sec(x^2) \tan(x^2) dx$

(e) $\int \dfrac{3x + 1}{x(x + 1)} dx$

6. **Final Exam - Spring 2006.** Integrate

(a) $\int x^2 (\ln x)^2 dx$

(b) $\int_0^{\pi/2} \cos^3 x \sin(2x) dx$

(c) $\int \dfrac{3}{x^{-1/2}(x^{3/2} - x^{1/2})} dx$

(d) $\int \dfrac{\sqrt{x^2 - 1}}{x}\, dx$ hint: Use the substitution $x = \sec \theta$.

(e) $\int_0^3 \dfrac{dx}{x^2 - 3x - 4}$

7. **Final Exam - Summer 2006.** Integrate

(a) $\displaystyle\int x^5 e^{-x^3} dx$

(b) $\displaystyle\int_1^5 \sqrt{-x^2 + 6x - 5}\ dx$

(c) $\displaystyle\int \frac{\sqrt{1+x}}{\sqrt{1-x}} dx$

(d) $\displaystyle\int \frac{\cos x}{4 - \sin^2 x}\,dx$

(e) $\displaystyle\int \frac{dx}{\sqrt{1 + x^2}}$ hint: Use the substitution $x = \tan\theta$.