Name _____

Student ID _____ TA/Section (circle): Jimmy 8am-B06 9am-B07 10am-B08 4pm-B01; Brandon 5pm-B02 6pm-B03 7pm-B04 8pm-B05

Math 20B (Section B), Fall 2009, Final Examination Formulas

- ***Show all of your work to receive full credit.***
- *Read each question carefully.*
- *Answer each question completely.*
- *Write your answers and work clearly and legibly; no credit will be given for illegible solutions.*
- *You are allowed one notebook-sized sheet of handwritten notes (written on both sides).*
- *No calculators are allowed during the exam.*
- *Go back and check your answers if you finish early.*

Some trigonometric identities:

$$\sin(x+y) = \sin x \cos y + \cos x \sin y \qquad \cos(x+y) = \cos x \cos y - \sin x \sin y$$

$$\sin 2x = 2 \sin x \cos x \qquad \cos 2x = \cos^2 x - \sin^2 x$$

$$\sin^2 x = \frac{1}{2}(1 - \cos 2x) \qquad \cos^2 x = \frac{1}{2}(1 + \cos 2x)$$

Some Formulas:

$$\int \sin^n x\,dx = -\tfrac{1}{n}\sin^{n-1} x \cos x + \tfrac{n-1}{n}\int \sin^{n-2} x\,dx$$
$$\int \cos^n x\,dx = \tfrac{1}{n}\cos^{n-1} x \sin x + \tfrac{n-1}{n}\int \cos^{n-2} x\,dx$$
$$\int \sec x\,dx = \ln|\sec x + \tan x| + C$$
$$\int \sec^m x\,dx = \tfrac{1}{m-1}\tan x \sec^{m-2} x + \tfrac{m-2}{m-1}\int \sec^{m-2} x\,dx$$

Binomial coefficient:

$$\binom{a}{n} = \frac{a(a-1)(a-2)\cdots(a-n+1)}{n!}, \qquad \binom{a}{0} = 1$$

Newton's Law of Cooling:

$$\frac{dy}{dt} = -k(y-b), \text{ where } k > 0, \text{ has general solution } y(t) = b + Ce^{-kt}$$

The logistic equation and its general nonequilibrium solution are

$$\frac{dy}{dt} = ky\left(1 - \frac{y}{A}\right), \qquad y(t) = \frac{A}{1 - e^{-kt}/C}$$

Some Maclaurin Series:

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!} = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots$$

$$\sin x = \sum_{n=0}^{\infty} \frac{(-1)^n x^{2n+1}}{(2n+1)!} = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots$$

$$\cos x = \sum_{n=0}^{\infty} \frac{(-1)^n x^{2n}}{(2n)!} = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \cdots$$

$$\frac{1}{1-x} = \sum_{n=0}^{\infty} x^n = 1 + x + x^2 + x^3 + x^4 + \cdots$$

$$\frac{1}{1+x} = \sum_{n=0}^{\infty} (-1)^n x^n = 1 - x + x^2 - x^3 + x^4 - \cdots$$

$$\ln(1+x) = \sum_{n=1}^{\infty} \frac{(-1)^{n-1} x^n}{n} = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots$$

$$\tan^{-1} x = \sum_{n=0}^{\infty} \frac{(-1)^n x^{2n+1}}{2n+1} = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \cdots$$

$$(1+x)^a = \sum_{n=0}^{\infty} \binom{a}{n} x^n = 1 + ax + \frac{a(a-1)}{2!}x^2 + \frac{a(a-1)(a-2)}{3!}x^3 + \cdots$$