Formula sheet for the second exam in Math 135:F2, summer 2006

Function	**Derivative**
k (const.)	0
x^n	nx^{n-1}
e^x	e^x
$\ln x$	$1/x$
a^x	$a^x \ln(a)$
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$(\sec x)^2$

Function	**Derivative**
$Cf(x)$	$Cf'(x)$ (C const.)
$f(x)+g(x)$	$f'(x)+g'(x)$
$f(x)\cdot g(x)$	$f'(x)\cdot g(x)+f(x)\cdot g'(x)$
$\dfrac{f(x)}{g(x)}$	$\dfrac{f'(x)g(x)-g'(x)f(x)}{g(x)^2}$
$f(g(x))$	$f'(g(x))\cdot g'(x)$

Exponential properties

$a^{b+c}=a^b\cdot a^c \quad a^{-b}=1/a^b$

$\left(a^b\right)^c=a^{bc} \quad e\approx 2.718$

$a^0=1 \quad e^{\ln a}=a$ if $a>0$

Logarithm properties

$\ln(a\cdot b)=\ln a+\ln b \quad \ln(a^b)=b\ln(a)$

$\ln(a/b)=\ln(a)-\ln(b) \quad \ln\left(\frac{1}{b}\right)=-\ln(b)$

$\ln(e^a)=a \quad \ln(1)=0 \quad \ln(e)=1$

Miscellaneous formulas

If $a\neq 0$, the **roots** of $ax^2+bx+c=0$ are $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$.

Distance between (a,b) and (c,d): $\sqrt{(a-c)^2+(b-d)^2}$.

Circle center (h,k) and radius r: $(x-h)^2+(y-k)^2=r^2$.

f is **continuous** at w if $\lim_{x\to w} f(x)$ exists and equals $f(w)$.

Intermediate Value Theorem

If $f(x)$ is continuous in $a\le x\le b$, then $f(x)$'s values include all numbers between $f(a)$ and $f(b)$.

$f'(x)$, the **derivative of** f **at** x, is defined to be $\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$.

Mean Value Theorem

If $f(x)$ is differentiable in $a\le x\le b$, then there is at least one c between a and b so that $f'(c)=\frac{f(b)-f(a)}{b-a}$.

Area and Volume Formulas

Rectangle $A=$ LENGTH·WIDTH

Circle $A=\pi$ RADIUS^2

Triangle $A=\frac{1}{2}$ BASE·HEIGHT

Box $V=$ LENGTH·WIDTH·HEIGHT

Cylinder $V=\pi$ RADIUS^2·HEIGHT

Sphere $V=\frac{4}{3}\pi$ RADIUS^3

Special values of trig functions

θ	$\sin\theta$	$\cos\theta$	$\tan\theta$
0	0	1	0
$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$
$\frac{\pi}{4}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	1
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
$\frac{\pi}{2}$	1	0	Undefined