

Math 160 Formula Sheet

Differentiation Formulas:	
$\frac{d}{dx} x^k = k x^{k-1}$ where k is any real number.	$\frac{d}{dx} f(g(x)) = f'(g(x))g'(x)$
$\frac{d}{dx} c = 0$ where c is any real number.	$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$
$\frac{d}{dx} c f(x) = c \frac{d}{dx} f(x)$	$\frac{d}{dx} e^{f(x)} = e^{f(x)} \cdot f'(x)$
$\frac{d}{dx} (f(x) + g(x)) = \frac{d}{dx} f(x) + \frac{d}{dx} g(x)$	$\frac{d}{dx} \ln f(x) = \frac{1}{f(x)} \cdot f'(x)$
$\frac{d}{dx} (f(x)g(x)) = g(x)f'(x) + f(x)g'(x)$	$\frac{d}{dx} a^x = (\ln a)a^x$
$\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$	$\frac{d}{dx} \log_a x = \frac{1}{\ln a} \cdot \frac{1}{x}$ where $x > 0$

If $\frac{dP}{dt} = kP$, then $P(t) = P_0 e^{kt}$.

The rate of exponential growth k and the doubling time T are related by the equation $T = \frac{\ln 2}{k}$

The elasticity of demand E is given as a function of price x by $E = \frac{-x \cdot D'(x)}{D(x)}$ where $D(x)$ is the demand function.

Integral Formulas:	
$\int x^n dx = \frac{x^{n+1}}{n+1} + C$ where $n \neq -1$	$\int u dv = uv - \int v du$
$\int \frac{dx}{x} = \ln x + C$ when $x > 0$	$\int e^{ax} dx = \frac{1}{a} e^{ax} + C$

The area under the graph of a nonnegative function is $\int_a^b f(x) dx = F(b) - F(a)$ where $F'(x) = f(x)$

The area bounded by the functions f and g where $f(x) \geq g(x)$ over $[a, b]$ is given by $Area = \int_a^b [f(x) - g(x)] dx$.

Equilibrium points occur when the demand function is equal to the supply function, i.e. when $D(x) = S(x)$. The consumer surplus at a point (Q, P) is $\int_0^Q D(x) dx - QP$. The producer surplus at a point (Q, P) is $QP - \int_0^Q S(x) dx$.

D-Test: If (a, b) is a critical point of $f(x, y)$, and $D = f_{xx}(a, b)f_{yy}(a, b) - [f_{xy}(a, b)]^2$ then:

Case 1: If $D > 0$ and $f_{xx}(a, b) < 0$, then f has a maximum at (a, b) .

Case 2: If $D > 0$ and $f_{xx}(a, b) > 0$, then f has a minimum at (a, b) .

Case 3: If $D < 0$, then f has a saddlepoint at (a, b) .

Case 4: If $D = 0$, then the test is not applicable.