General Calculus
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Formulas for Exams 2 and 3

1. **Derivatives.**

y	x^n	e^x	b^x	$\ln x$	$\log_b x$	$\sin x$	$\cos x$
y'	nx^{n-1}	e^x	$b^x \ln b$	$\frac{1}{x}$	$\frac{1}{x} \cdot \frac{1}{\ln b}$	$\cos x$	$-\sin x$

2. **Rules of Differentiation.**

   (a) Product rule.
   $$\text{If} \quad y = f \cdot g, \quad \text{then} \quad y' = f' \cdot g + g' \cdot f$$

   (b) Quotient rule.
   $$\text{If} \quad y = \frac{f}{g}, \quad \text{then} \quad y' = \frac{f' \cdot g - g' \cdot f}{g^2}$$

   (c) Chain rule.
   $$\text{If} \quad y = f(g(x)), \quad \text{then} \quad y' = f'(g(x)) \cdot g'(x)$$

3. **Linear Approximation.**
   $$f(a+h) \approx f(a) + f'(a)h \quad \text{or} \quad f(x) \approx f(a) + f'(a)(x-a)$$

4. **Tangent Line.** $y_0 = f(x_0)$, $m = f'(x_0)$
   $$y - y_0 = m(x - x_0)$$

5. **Average and instantaneous rate of change.**

   (a) The average rate of change of $f(x)$ over $[a, b]$:
   $$\frac{f(b) - f(a)}{b - a}$$

   (b) The instantaneous rate of change of $f(x)$ at $x = a$: $f'(a)$.

6. **Applications.** The velocity $v(t) = s'(t) = \frac{ds}{dt}$ and the acceleration $a(t) = v'(t) = \frac{dv}{dt} = s''(t) = \frac{d^2s}{dt^2}$.