

Cheatsheet: b , c , and n are constants; u and v are functions of x .

$$D_x \ln x = \frac{1}{x}; \quad D_x(\log_b x) = \frac{1}{x \ln b}; \quad D_x(x^n) = nx^{n-1}; \quad D_x e^x = e^x;$$

$$D_x(b^x) = b^x \ln b; \quad D_x(uv) = u'v + uv'; \quad D_x\left(\frac{u}{v}\right) = \frac{u'v - uv'}{v^2};$$

$$D_x u(v(x)) = u'(v(x)) \cdot v'(x); \quad \int \frac{1}{x} dx = \ln|x| + c$$

(9 pts) 1.) Recall Δy is the actual change in y and dy is the differential approximation. Let $y = 5 - 4x + 3x^2 - 2x^3$

(a.) Find dy .

(b.) Evaluate dy for $x = 1$ and $\Delta x = dx = 0.2$.

(c.) Find Δy for the same conditions as b.

(7 pts.) 2.) How many years will it take for \$10,000 to triple in value if it is compounded continuously at an annual rate of 6.5%? (Recall $A = Pe^{rt}$)

(8pts.) 3.) Find the equation of the line tangent to the graph of $f(x) = \ln x$ at $x=1$.

(8 pts.) 4.) Find the absolute minimum of $f(x) = x \ln x - 3x$ for $x > 0$.

(30 pts.) 5.) Find the derivatives for each of the following:

(a.) $f(x) = x^2 \ln x$

(b.) $y = \sqrt{1 + e^x}$

(c.) $h(x) = \frac{x^2 + 4}{e^x}$

(d.) $g(x) = \ln(x^2 - 2)^3$

(e.) $k(x) = \sqrt{\ln x^3}$

(f.) $l(x) = 5^{1-x^2}$

(7 pts.) 6.) Find $\frac{dy}{dx}$ for the following equation.
 $(1 + y)^3 + y = x + 7$

(7 pts.) 7.) A company is manufacturing a new video game and can sell all it manufactures. The daily revenue (in dollars) is given by $R = 36x - \frac{x^2}{20}$ where x is the number of games produced per day. If production is increasing at a rate of 10 games per day find the rate of increased revenue when $x = 250$.

(15 pts.) 8.) Evaluate the following:

(a.) $\int (x + 2e^{3x}) dx$

(b.) $\int_4^9 (\sqrt{x} + \frac{1}{x^2}) dx$

(c.) $f(x)$ when $f'(x) = \frac{x^2 + x^3}{x^3}$ where $f(1) = 2$

(9 pts.) 9.) Find the area bounded by the graphs of the indicated equations.

$$y = x^3 + 1; \quad y = 0; \quad x = -1; \quad x = 1$$