

Calculus I. Fall '18 Test 2 Review.

Make sure you also study all the quizzes, the derivative handout, then notes and homework examples!

1. Short derivatives. These are just for quick review; they may be seen as part of a test question.

Power Rule:

$$y = x^2$$

$$y = 7x^{-3}$$

$$y = \sqrt[5]{x^7}$$

$$y = x^{\sqrt{3}}$$

Exponential:

$$y = e^x$$

$$y = 3^x$$

$$y = (\ln 2)^x$$

Logs:

$$y = \ln x$$

$$y = \log_5 x$$

$$y = \log_{2\pi} x$$

Find $y' = \frac{dy}{dx}$ for these functions and relations involving: sums, products, quotients, compositions.

You may need to use implicit differentiation and/or logarithmic differentiation.

2. Find y' . Don't simplify.

a) $y = \frac{x^4 - \sqrt{x}}{\sin 3x}$

b) $y = \frac{1}{\sqrt[7]{x^5}}$

c) $y = e^x \cos^3(2^x)$

d) $y = \sec(\log_2(x))$

e) $y = \frac{\tan x}{e^x - \sqrt{x}}$

f) $x3^y = (x+1)y$

g) $xy = \csc y$

h) $y = x^{(\frac{5}{x})}$

i) $y = \sin(x^{(\frac{5}{x})})$

j) $y = \sin^{-1}(2^r)$

k) $y = \cos^{-1}(3^x \sin x)$

l) $y = x + 3^y$

m) $y^y = (x-y)^x$

$$\text{n)} \quad y = \frac{x+1}{1+x^2e^x}$$

$$\text{o)} \quad y = x^5e^x5^x$$

$$\text{p)} \quad y = \sec(e^x5^x)\tan x^2$$

$$\text{q)} \quad y = \sec(5x+7)\tan^2 x$$

$$\text{r)} \quad y = 2^{(\tan^{-1} 4x)}$$

$$\text{s)} \quad y = \log_3 2x \log_7 5x$$

$$\text{t)} \quad y = 7^{(\ln(2x+1))}$$

$$\text{u)} \quad y = 7^x \ln(2x+1)$$

$$\text{v)} \quad xy^2 = yx^3 + 1$$

3. Find the tangent slope to $y = \frac{7^x}{\sin(e^x)}$ at $x = 3$.
4. Find the tangent line to the curve given by $xy + y = 7^x$ at $(x, y) = (0, 1)$.
5. Find the linearization $L(x)$ to $f(x) = x^3 + 4x$ at $x_1 = 1$. Use it to approximate $f(1.01)$. Also give the differentials dx and dy .
6. Estimate $\ln(1.01)$ and $\ln(0.98)$ using linearization at $x = 1$.
7. Let the functions $f(x)$ and $g(x)$ be given such that $f(2) = 1$, $f'(2) = 3$, $g(2) = -1$, $g'(2) = 5$.
- a) If $y = f(x)g(x) + g(x) - \frac{g(x)}{f(x)}$ find the value of the derivative y' at $x = 2$.
- b) If $y = \sin(\pi g(x))$ find the value of the derivative y' at $x = 2$.
8. A particle is moving along the curve given by $xy + 1 = 2y^3e^{(x-1)}$. At the point $(1, 1)$ the x -coordinate is increasing at the rate 5 m/s. Find the rate of change in the y -coordinate.
9. A light on a 3 ft pole shines on a 1 inch mouse running away at 2 ft/s. How fast is the tip of the mouse shadow moving when the mouse is 4 ft away from the base of the pole?
10. A cylindrical tank with radius 5 m is being filled at a rate of $3 \text{ m}^3/\text{min}$. How fast is the height of the water increasing?