

There will be 4 or 5 problems on the actual test. All of them will be similar to the problems shown here.

1) Find the derivatives of the following functions.

a) $y = (1 + x)^{\sin x}$

b) $y = \arccos(4x^3)$

c) $y = 3^{3x} \cosh x$

d) $y = \log_5 \left(\frac{4x-3}{2-x^2} \right)$

2) Find the integrals.

a) $\int \cot^3 x \csc^2 x \, dx$

b) $\int \frac{2-3x}{4x^2+25} \, dx$

c) $\int x\sqrt{2-5x} \, dx$

d) $\int \frac{x^2+1}{e^{x^3+3x}} \, dx$

e) $\int \frac{1-\sec^2 x}{x-\tan x} \, dx$

f) $\int e^x \operatorname{sech}^2(e^x) \, dx$

g) $\int \frac{2x^3+2x^2-5}{x+1} \, dx$

3) Find $f'(x)$ given that

$$f(x) = \int_x^{e^x} \sin(\ln t) dt$$

4) Find the average value of the function over the given interval, and find all values of x for which the function equals its average value.

$$f(x) = \frac{2x(x-4)}{3x^2}, \quad [3, 5]$$

5) Find the derivative of the function using logarithmic differentiation.

$$f(x) = \frac{2x^3 \sqrt{3x^4 - x}}{\tan(2x) (2x - 1)^5}$$

6) Find the area under the curve $f(x) = e^{\sin x} (\cos x)$ between $x = 0$ and $x = \frac{\pi}{2}$.