

Opportunity I

Here you go! This is your chance to show me what you've learned so far this semester. No calculators are allowed. If you have any questions, please ask me. Explaining your reasoning will help you earn partial credit if your answer isn't entirely correct. Please write clearly and legibly; scratch paper will be available.

1. (7 pts) Here you see the graph of the function $g(x) = \sinh(x)$. On the same set of axes, draw the graph of its inverse function, $g^{-1}(x)$.

2. (8 pts)

Suppose $f(x)$ is a one-to-one function, $f(2) = 4$ and $f'(2) = 1/4$.

Name a point on the graph of $f^{-1}(x)$.

What is the slope of f^{-1} at that point? Draw a picture which illustrates *all* of this information on the axes given.

3. (15 pts)

Let $f(x) = \arctan(x)$.

What is $f(\sqrt{3})$?

Prove that $f'(x) = \frac{1}{1+x^2}$.

If $g(x) = \arctan(x^2)$, what's $g'(x)$?

4. (5 pts each)

For each of the following, find y' .

a) $y = \ln x + \ln \frac{1}{x}$ (simplify your answer)

b) $y = e^{\sin x}$

c) $y = \frac{\ln(x^2)}{\cos x}$

d) $y = \sqrt{\arcsin x}$

5. (5 pts each)

Integrate each of the following. Your answer should be in terms of x .

a) $\int \cos x e^{\sin x} dx$

b) $\int \arctan x dx$

c) $\int x \sin(x^2) dx$

d) $\int x \sin(x) dx$

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

f) $\int x \sqrt{1+x^2} dx$

g) $\int \frac{x^3}{\sqrt{2-x^2}} dx$

Draw your favorite Superhero here.

6. (15 pts)

Here is the formula for integration by parts:

$$\int f(x)g'(x) dx = f(x)g(x) - \int g(x)f'(x) dx$$

(note: it is sometimes also written $\int u dv = uv - \int v du$)

Explain why this formula is true. Be sure to explicitly mention any theorems you use.

Bonus Questions: (2 pts each)

How many Iraqis are estimated by the US Military to have died in the 3 month Gulf War?

How many Americans died in the two decade-long Vietnam War?