<div align="center">

OPPORTUNITY $-2e^{i\pi}$

</div>

No calculators or cell phones are allowed. If you have any questions, please ask Simon or Dave. 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. Find derivatives of the following functions:

a) $y = \cos(x^2)$
    b) $y = \frac{\sqrt{1-x}}{\sin x}$

c) $y = x^{\frac{1}{2005}}$
    d) $y = \frac{\cot x}{\csc x}$

e) $y = \sqrt{\sqrt{\sqrt{x} - 2} - 2}$
    f) What's your major and why?

2. Find y'.

a) $xy - 2y = \cos x$

b) $y^4 + y \sin x = x^2$

3. Suppose f and g have the following properties:

x	1	2	3	4
$f(x)$	1	2	4	3
$f'(x)$	2	1	3	4
$g(x)$	4	3	2	1
$g'(x)$	3	4	2	1

If $h(x) = f(g(x))$ and $j(x) = f(f(x))$.

Find the following:

$h(2)$

$h'(1)$

$j(3)$

$j'(4)$.

The derivative of $j(g(x))$ at $x = 1$

4. Let $g(x) = x + \frac{1}{x}$. Find $g'(x)$ in three different ways (including one which directly uses the definition of the derivative). For the other two, specifically state what rules you are using.

Method 1 (Definition of the derivative.)

Method 2.

Method 3

5. Here is the graph of a function $h(x)$. On the axes below, graph $h'(x)$ and $h''(x)$.

6. There's a nasty flu bug going around these days and lots of people are taking medication to control fevers. Suppose that one hour after taking x mg of medicine, your temperature (in degrees Farhenheit) will be modeled by the function

$$T(x) = 102 - \frac{1}{6}x^2(1 - \frac{x}{9}).$$

a) Find $T(2)$ (including units) and explain what it means.

b) Find $T'(2)$ (including units) and explain what it means.

Extra Credit: Within two percentage points, what portion of the US Federal Budget goes to:
the US Military?
Foreign aid?
Education?