You may keep this page of questions. Turn in all of your work with your answers on the colored paper and the graph paper. Except where explicitly noted, **calculators are not allowed.**

1) 8 Points. Find $f'(x)$ if $f(x) = -2x^5 + 3x - 8/5^7$.

2) 8 Points. Find $g'(x)$ if $g(x) = e^{-2x} \cos(5x)$.

3) 8 Points. Find the most general antiderivative for $h(x)$ if $h(x) = 5x^2 + 16$.

4) 12 Points. In the following table, values are given for $f(x), g(x), f'(x)$ and $g'(x)$. Let $q(x) = f(x)/g(x)$ be the quotient and $\text{cmp}(x) = f(g(x))$ be the composition.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$f(x)$</th>
<th>$g(x)$</th>
<th>$f'(x)$</th>
<th>$g'(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>4.0</td>
<td>4.0</td>
<td>-2.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2.0</td>
<td>3.2</td>
<td>3.0</td>
<td>-1.6</td>
<td>-0.3</td>
</tr>
<tr>
<td>3.0</td>
<td>3.0</td>
<td>2.0</td>
<td>0.6</td>
<td>-1.4</td>
</tr>
<tr>
<td>4.0</td>
<td>5.0</td>
<td>1.0</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>5.0</td>
<td>6.0</td>
<td>2.0</td>
<td>0.5</td>
<td>0.6</td>
</tr>
</tbody>
</table>

a) Find $q'(3.0)$. b) Find $\text{cmp}'(5.0)$.

5) 16 Points. a) State the **definition** for the derivative function $f'(x)$ of a function $f(x)$. (There are two common variations of the definition and either form is fine.)

b) Use the definition of the derivative function in part a) to find $f'(x)$ if $f(x) = 4/(x^2 + 3)$. Show your work! You may use theorems to check your answer but you will receive little or no partial credit for this part of the question if I cannot see that you are using the definition to find $f'(x)$.

6) 12 Points. On the graph paper, sketch a graph of a function $f$ that has all of the following properties. (Be sure to label axes and indicate units on each axis.)

(i) $f$ has domain $(-\infty, -3) \cup (-3, \infty)$ and has range $(-\infty, \infty)$.

(ii) $f(0) = f(-4) = 0$.

(iii) $\lim_{x \to \infty} f(x) = 4$, $\lim_{x \to -\infty} f(x) = -2$, $\lim_{x \to -3^-} f(x) = \infty$ and $\lim_{x \to -3^+} f(x) = -\infty$.

(iv) $f'(x) > 0$ for every $x$ except $x = -3$.

(v) $f''(x) > 0$ if $x < -3$ and $f''(x) < 0$ if $x > -3$. 

7) 12 Points. If \( f(x) = 2x^3 - 5x^2 + 3 \) determine where the graph of \( y = f(x) \) is increasing and where it is decreasing.

8) 12 Points. Find an equation for the straight line which is tangent to the curve \( x^2y^3 - 3y = 2x^3 \) at the point \((1, 2)\).

9) 12 Points. You will need to use your calculator for the final question. After you have finished with the questions above, you will turn in that work and receive a different colored page for this last question. You are not allowed to use your calculator until after you have turned in work for the questions above.

Use your calculator to numerically approximate the value of

\[
\lim_{x \to 1} \frac{2^{x-1} + \cos(\pi x)}{\sin^{-1}(x - 1)}.
\]

For full credit your approximation for this limit should be accurate to the nearest thousandth. For partial credit, you should show enough of your work that I can follow your reasoning or else you should explain how you arrived at your answer.