Your task is to design a test, taking into account learning objectives and problem difficulty. To keep this homework to a reasonable size, we will aim for a 20-minute test. Below is a sample/template.

Test Design

- Designer: ...name...
- Design Date: September 25, 2013

Test Objectives

- This test is for the course ...MATH 2301 Calculus [or other 1xxx or 2xxx].
- We use the textbook: *Essential Calculus: Early Transcendentals.* by James Stewart, 2nd edition, Cengage, 2013. [There are various textbooks in 415 Morton you can use.]
- The test covers:
  - Section 2.2 The Derivative as a Function
  - Section 2.3 Basic Differentiation Formulas

[Choose just enough to test on.]

- For these sections there are two learning objectives:
  - Conceptual: Students should understand the relationship between a function, its tangent lines, and the derivative of the function.
  - Computational: Students should be able to compute simple derivatives from the definition and use the power rule and derivatives of sin and cos.

[Have one Conceptual and one Computational.]

Problems

[Make your own.]

1. Let $f(x) = -x^2 + 3.$
   
   (a) State the definition of the derivative as a limit.
   
   (b) Using this definition, compute $f'(x)$.
   
   (c) Find the equation for the tangent line at $x = 2$. 
(d) Graph $f(x)$ and the tangent line.

2. The graph of a function $f$ is given in each part below. On the same axes, sketch the graph of $f'$.

3. Compute the following derivatives:

   (a) $f(x) = 2 + x - 5x^7 + 3\sin(x) \Rightarrow f'(x) = \ldots$

   (b) $\frac{d}{dx} \left[ \frac{3}{x} - \sqrt{x} + x^{3/4} + \cot(x) - \sin(7) \right] = \ldots$

**Problem Analysis**

We analyze the problems with respect to the objectives and difficulty.

<table>
<thead>
<tr>
<th></th>
<th>Easy</th>
<th>Hard</th>
<th>Row point total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual</td>
<td>1.(a) 5 points</td>
<td></td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>1.(c) 5 points</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.(d) 5 points</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. 20 points</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computational</td>
<td>1.(b) 5 points</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>3.(a) 10 points</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.(b) 10 points</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Column point total</td>
<td>30</td>
<td>30</td>
<td>60</td>
</tr>
</tbody>
</table>

I think this is an appropriate mix because ....