This homework is, once again, mostly about sign charts and graphing. You will also answer some WebAssign questions. These questions will have limited submissions and penalty scoring.

1. Learn new vocabulary:
   - $f$ is **concave up** wherever $f'$ is increasing. This is the same as $f'' > 0$.
   - $f$ is **concave down** wherever $f'$ is decreasing. This is the same as $f'' < 0$.
   - An **inflection point** is an input location where the concavity of $f$ changes.

   Khan academy has nice videos for the vocabulary:
   - [Concavity](#)
   - [Inflection Points](#)

   Patrick JMT has some [worked examples](#).

2. Know the four basic graph shapes, based on $f'$ data:
   - If $f' > 0$ and $f'$ increasing, $f$ looks like $\uparrow$
   - If $f' > 0$ and $f'$ decreasing, $f$ looks like $\nearrow$
   - If $f' < 0$ and $f'$ increasing, $f$ looks like $\searrow$
   - If $f' < 0$ and $f'$ decreasing, $f$ looks like $\downarrow$

3. Given one point on $f$ and lots of $f'$ data, sketch a **good** graph of $f$. Here is the process you should follow:
   - Locate all places where where $f'(x) = 0$ or $f'(x)$ does not exist.
   - Determine where $f'$ is positive and where it is negative.
   - Locate all places where where $f''(x) = 0$ or $f''(x)$ does not exist.
   - Determine where the $f'$ is increasing and where it is decreasing.

   **NOTE:** This is the same as knowing where $f''$ is positive or negative.
   - It is also the same as knowing where $f$ is concave up or concave down.
Organize all of the above information into a three-row sign chart.

- **Row 1** has $f'$ pos/neg data.
- **Row 2** has $f'$ inc/dec data.
- **Row 3** shows the shape of $f$.

There is a sample chart below.

Finally, sketch a graph of $f$ using the shapes from your chart. Make sure your graph passes through the one given point.

4. Be able to do this given any of the following sources for your $f'$ data:

- A formula for $f'$.
- A graph of $f'$.
- A formula for $f$. (Just compute $f'$, then throw away $f$.)

### Sample Sign Chart:

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f'$ is ±?</td>
<td>− − −</td>
<td>++++</td>
<td>++++</td>
</tr>
<tr>
<td>$f'$ inc/dec?</td>
<td>Inc</td>
<td>Inc</td>
<td>Dec</td>
</tr>
<tr>
<td>Shape of $f$?</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

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$x$