MA104 - Differential Calculus
Lesson 16: Derivatives and the Shapes Of Curves

1. Fill out the following chart. Then, for each line, draw a sketch of a function f with the desired properties.

Behavior of f	**Behavior of f'**	**Behavior of f''**
	$f'(x) > 0$,	$f''(x) > 0$
	$f'(x) < 0$,	$f''(x) > 0$
Increasing, Concave Down	,	
Decreasing, Concave Down	,	

2. Using the First and/or Second Derivative Tests, classify the critical points of $f(x) = x^4 - 2x^2 + 3$ as local max, local min, or neither.

3. Do the following for the function $f(x) = x^2 e^x$ on the interval $[-5, 1]$, without the help of a graph.

   (a) Find the intervals on which f is increasing or decreasing.

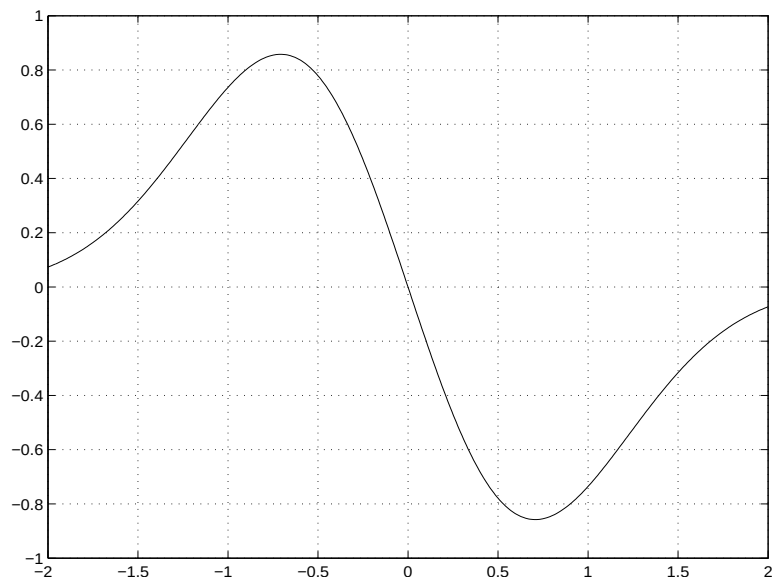
   (b) Find the intervals on which f is concave up or concave down.

   (c) Find the local maximum and minimum values of f.

   (d) Find the inflection points.

   (e) Now graph the function in Mathematica and make sure your answers agree with the plot.

4. The figure below is a graph of $f'(x)$ (**not** $f(x)$ **!**). Use it to answer the following questions.



(a) Find the intervals on which f is increasing or decreasing.

(b) Find the intervals on which f is concave up or concave down.

(c) Find the local maximum and minimum values of f.

(d) Find the inflection points.

(e) Use your answers to plot a graph of f.