AP Calculus Applications of Derivatives Packet. Name:_____

1. Let $h(x) = 2x^3 - x^4$
   a) Determine the critical numbers of $h(x)$

   b) Determine the intervals where $h(x)$ is increasing and/or decreasing.

   c) Determine the relative extrema of $h(x)$. Justify your answer.

   d) Determine the interval(s) where $h(x)$ is concave up and/or concave down.

   e) Determine the x-values of each point of inflection on $h(x)$. Justify your answer.

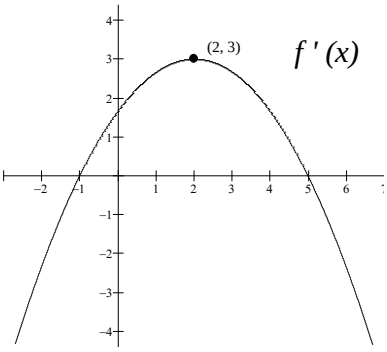
2. Let $f(x) = \dfrac{x^2}{1-x^2}$

   a) Determine the critical number of $f(x)$.

   b) Determine the interval(s) where $f(x)$ is increasing and/or decreasing.

   c) Find and justify any relative extrema.

3. Consider the graph of $f'(x)$ and answer the following.



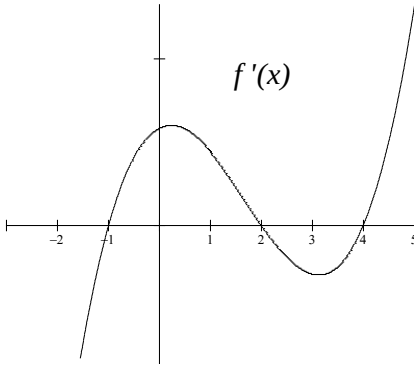
   a) Determine the interval(s) where $f(x)$ is decreasing. Justify your answer.

   b) Determine the interval(s) where $f(x)$ is increasing. Justify your answer.

   c) Determine the interval(s) where $f(x)$ is concave up. Justify your answer.

   d) Determine the interval(s) where $f(x)$ is concave down. Justify your answer.

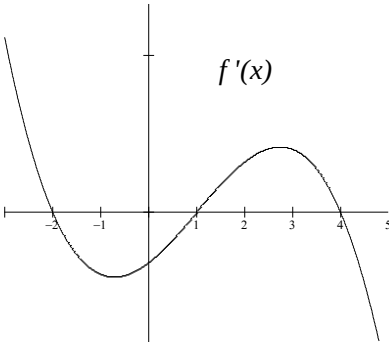
4. Given the graph of the **derivative** of $f(x)$, determine the following.

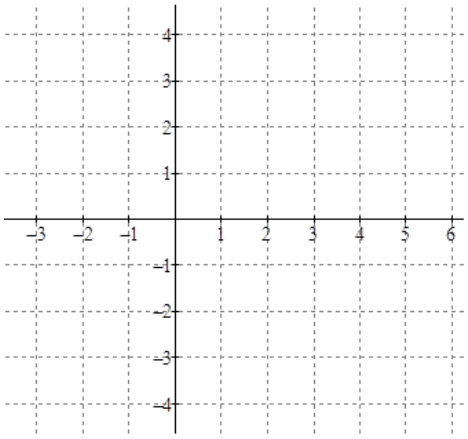


   a) Determine the *x*-coordinate(s) of each relative maximum of $f(x)$. Justify your answer.

   b) Determine the *x*-coordinate(s) of each relative minimum of $f(x)$. Justify your answer.

5. Given the graph of the **derivative** of $f(x)$, **<u>sketch</u>** a possible graph of $f(x)$.

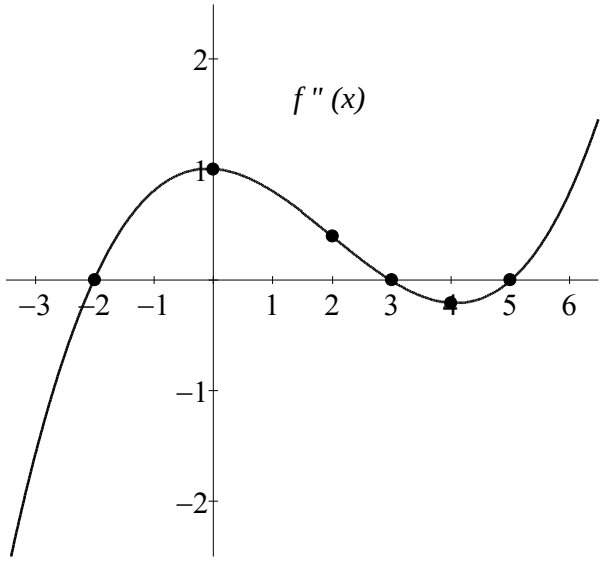




   a) Determine the *x*-coordinate(s) of each relative maximum of $f(x)$. Justify your answer.

   b) Determine the *x*-coordinate(s) of each relative minimum of $f(x)$. Justify your answer.

6. The graph to the right is the graph of $y = f''(x)$, where $f''(x)$ has a point of inflection at $x = 2$. Use interval notation where appropriate.



a) For what values of x is f concave up?

b) For what values of x is f' concave up?

c) For what values of x is f'' concave up?

d) For what values of x is f' increasing?

e) For what values of x is f'' increasing?

f) For what values of x does f have a point of inflection?

g) For what values of x does f' have a point of inflection?

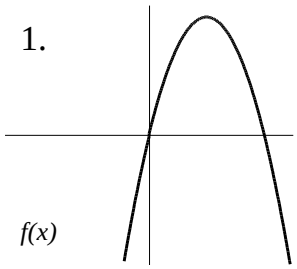
h) For what values of x does f'' have a point of inflection?

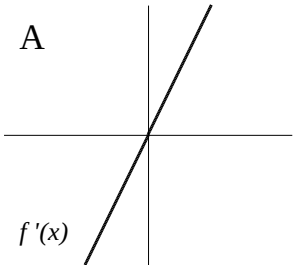
i) For what values of x does f' have a relative minimum?

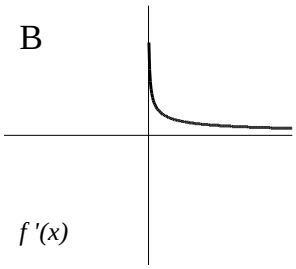
j) For what values of x does f'' have a relative minimum?

7. In the left-hand column below are graphs of several functions. In the right-hand columns, in a different order, are graphs of the associated derivative functions. Match each function with its derivative.

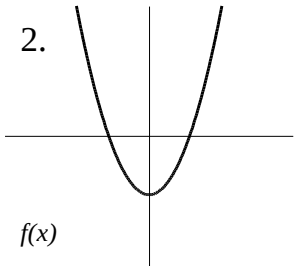
1.___

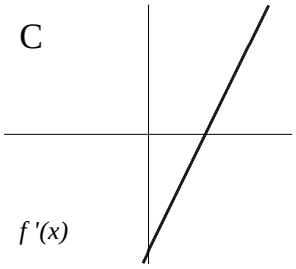


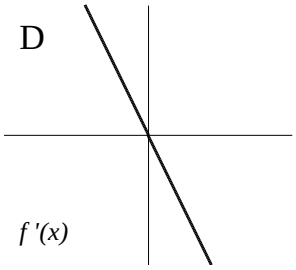




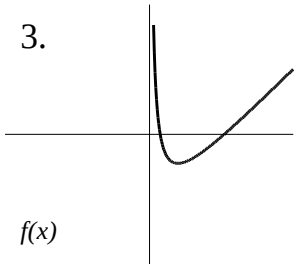
2.___

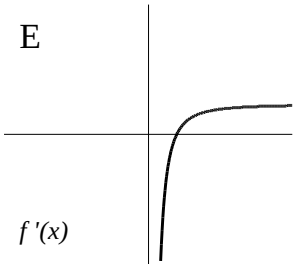


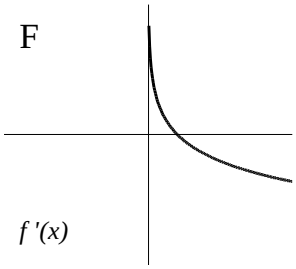




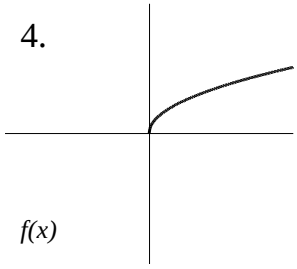
3.___

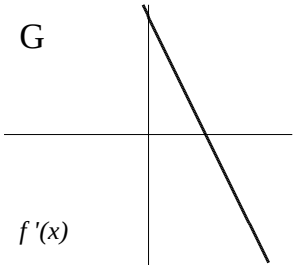


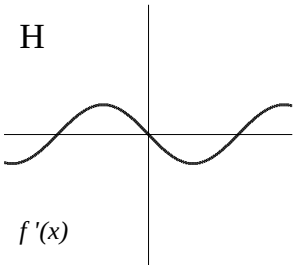




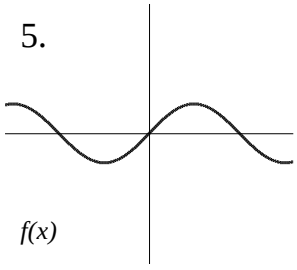
4.___

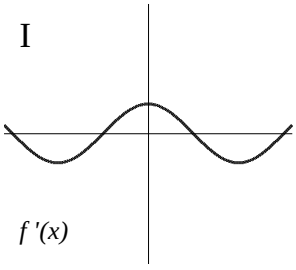


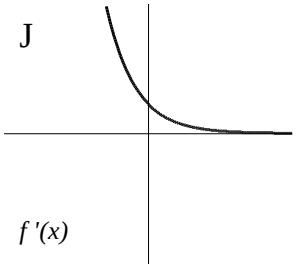




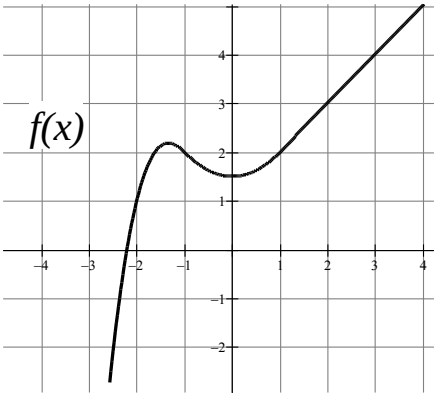
5. ___

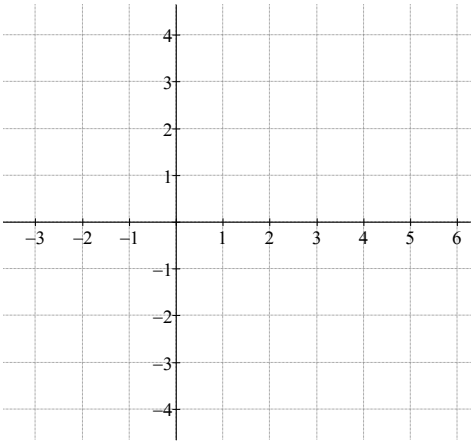






8. Sketch the derivative of the given function.



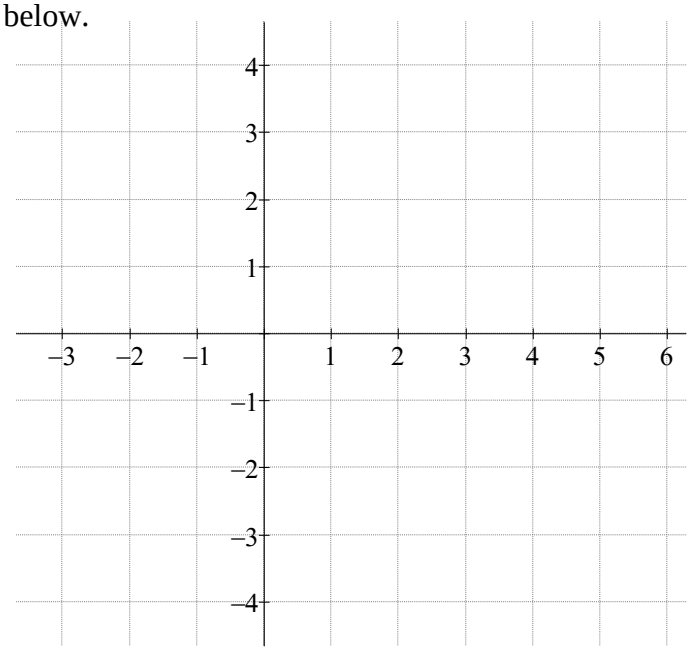


9. Let f be a function that is continuous. The function f and its derivatives have the properties indicated in the table below.

x	$x<3$	3	$x>3$
$f(x)$	pos.	2	pos
$f'(x)$	pos.	und.	neg.
$f''(x)$	pos.	und.	pos.

a) Determine the coordinates of the relative maximum. Justify your answer.

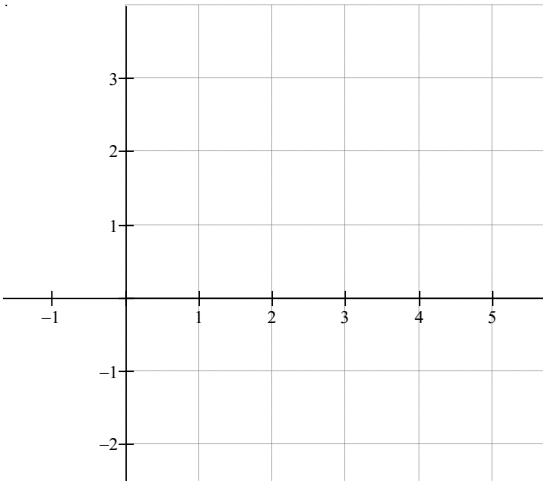
b) Sketch a possible graph of f on the graph below.



10. Let *f* be a function that is continuous on the closed interval [0, 3]. The function *f* and its derivatives have the properties indicated in the table below.

x	0	0<x<1	1	1<x<2	2	2<x<3	3
f(x)	1	Pos.	2	Pos.	3	Pos.	2
f '(x)	Und.	Pos.	0	Pos.	Und.	Neg.	Und.
f ''(x)	Und.	Neg.	0	Pos.	Und.	Pos.	Und.

(a) Find the x-coordinate of each point at which *f* attains a relative maximum value or a relative minimum value. For each x-coordinate you give, state whether *f* attains a max. or a min.



(b) Find the absolute maximum and absolute minimum value of *f* on [0, 3]

(c) In the xy-plane provided sketch the graph of a function with all the given characteristics of *f*.