Chapter 5 Review – graphs and their derivatives

1. f is continuous on [0, 3] and satisfies the following

x	0	1	2	3
f	0	2	0	-2
f'	3	0	does not exist	-3
f''	0	-1	does not exist	0

x	$0 < x < 1$	$1 < x < 2$	$2 < x < 3$
f	+	+	-
f'	+	-	-
f''	-	-	-

(a) Find the absolute extrema of f and where they occur.
(b) Find any points of inflection.
(c) Sketch a possible graph of f.

2. Sketch a smooth curve of $y = f(x)$ through the origin with the properties that

$f''(x) < 0$ for $x < 0$ and $f''(x) > 0$ for $x > 0$.

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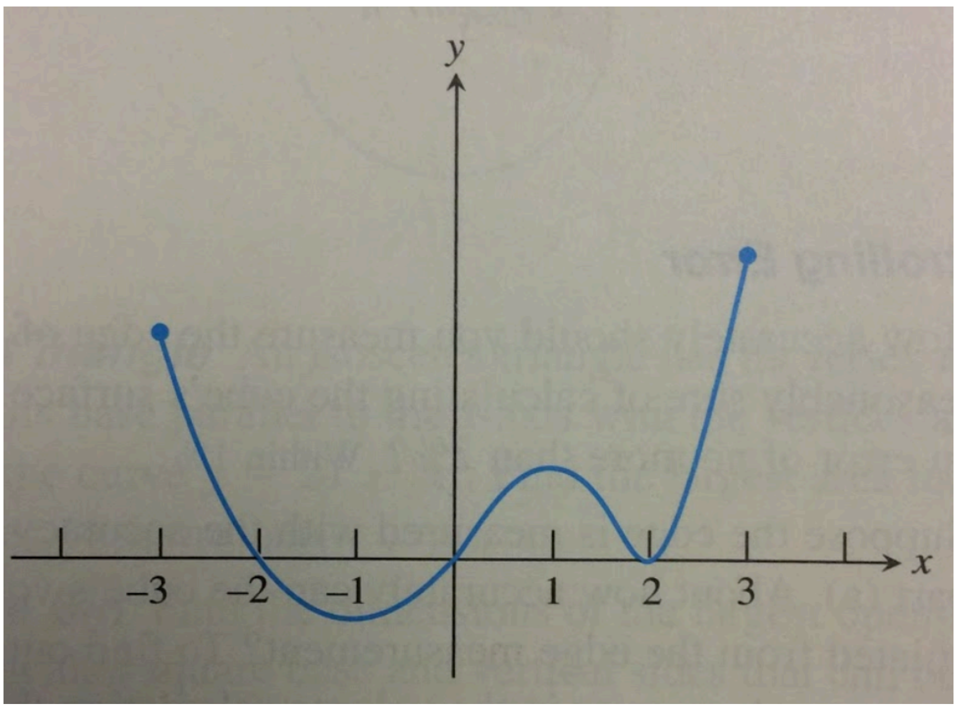
3. The accompanying figure shows the graph of the derivative of a function *f*. The domain of *f* is the closed interval [-3, 3].

(a) For what values of x in the open interval (-3, 3) does *f* have a relative maximum? Justify your answer.

(b) For what values of x in the open interval (-3, 3) does *f* have a relative minimum? Justify your answer.

(c) For what values of x is the graph of *f* concave up? Justify your answer.

(d) Suppose $f(-3) = 0$. Sketch a possible graph of *f* on the domain [-3, 3].



4. The volume V of a cone is increasing at the rate of 4π cubic inches per second. At the instant when the radius of the cone is 2 inches, its volume is 8π cubic inches and the radius is increasing at 1/3 inch per second.

(a) At the instant when the radius of the cone is 2 inches, what is the rate of change of the area of its base?

(b) At the instant when the radius of the cone is 2 inches, what is the rate of change of its height h?

(c) At the instant when the radius of the cone is 2 inches, what is the instantaneous rate of change of the area of its base with respect to its height h?

5. A piece of wire 60 inches long is cut into six sections, two of length a and four of length b. Each of the two sections of length a is bent into the form of a circle, and the circles are then joined by the four sections of length b to make a frame for a model of a right circular cylinder.

(a) Find the values of a and b that will make the cylinder of maximum volume.

(b) Use differential calculus to justify your answer in part (a).