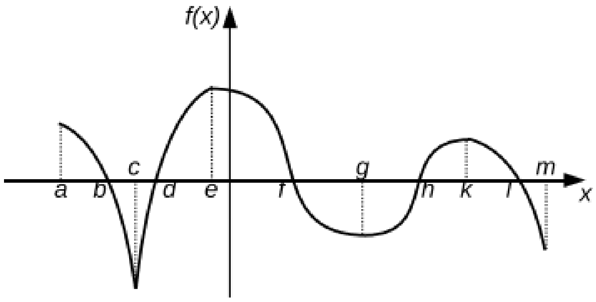
Chapter 5. **Applications of differentiation**
Section 5.1 **What does f' say about f?**

- If $f'(x) > 0$ on an interval, then f is increasing on that interval
- If $f'(x) < 0$ on an interval, then f is decreasing on that interval
- f has a local maximum at the point, where its derivative changes from positive to negative.
- f has a local minimum at the point, where its derivative changes from negative to positive.

Example 1. Given the graph of the function f.



(a.) What are the x-coordinate(s) of the points where $f'(x)$ does not exist? $x = c$

(b.) Identify intervals on which [redacted] $f'(x) > 0$ (f is increasing)

$(c, e) \cup (g, k)$

[redacted] $f'(x) < 0$ (f is decreasing)

$(a, c) \cup (e, g) \cup (k, m)$

(c.) Identify the x coordinates of the points where $f(x)$ has a local maximum.

$x = e$, $x = k$

A local minimum. $x = c$, $x = g$

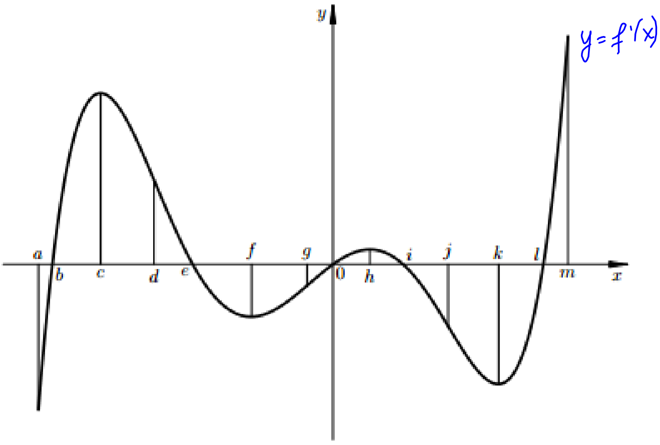
What does f'' say about f?

- If $f''(x) > 0$ on an interval, then f is **concave upward (CU)** on that interval, f' is increasing
- If $f''(x) < 0$ on an interval, then f is **concave downward (CD)** on that interval, f' is decreasing

Definition. A point where curve changes its direction of concavity is called an **inflection point** (local min/max for f').

Use the following graph of the derivative, $f'(x)$, of the function $y = f(x)$ to answer questions 1-5:

Example 2. Given the graph of $f'(x)$.



(a.) Identify intervals on which f is increasing. $(f'>0)$

$(a,e) \cup (0,i) \cup (l,m)$

Is decreasing. $(f'<0)$

$(a,b) \cup (e,0) \cup (i,l)$

(b.) Identify the x coordinates of the points where f has a local maximum. f' changes from + to −

$x=e,\ x=i$

A local minimum. f' changes from − to + .

$x=b,\ x=0,\ x=l$

(c.) Identify intervals on which f is concave upward. f' is increasing

$(a,c)\cup(f,h)\cup(k,m)$

Concave downward. f' is decreasing

$(c,f)\cup(h,k)$

(d.) Find the x-coordinates of inflection points.

$x=c,\ x=f,\ x=h,\ x=k.$