

1. (2 points each) For each of the following, circle *all* statements which **MUST** be true.

(a) Let  $f$  be a non-decreasing differentiable function defined for all  $x$ .

- $f'(x) \geq 0$  for all  $x$ .
- $f''(x) \geq 0$  for all  $x$ .
- $f(x) = 0$  for some  $x$ .

(b) Let  $f$  and  $g$  be continuous at  $x = -1$ , with  $f(-1) = 0$  and  $g(-1) = 3$ .

- $f \cdot g$  is continuous at  $x = -1$ .
- $\frac{g}{f}$  is continuous at  $x = -1$ .
- $\frac{f}{g}$  is continuous at  $x = -1$ .

(c) Let  $f$  be differentiable at  $x = 2$ , with  $f(2) = 17$ .

- $\lim_{x \rightarrow 2} f(x) = 17$ .
- $\lim_{h \rightarrow 0} \frac{f(2+h) - f(2)}{h} = 17$ .
- $\lim_{h \rightarrow 0} \frac{f(2+h) - f(2)}{h}$  exists.

(d) Let  $f$  be defined on  $[a, b]$  and differentiable on  $(a, b)$ , with  $f'(x) < 0$  for all  $x$  in  $(a, b)$ .

- If  $a < c < d < b$ , then  $f(c) > f(d)$ .
- $f''(x) > 0$  for some  $x$  in  $(a, b)$ .
- $f$  is continuous on  $(a, b)$ .

(e) Let  $f$  be a twice-differentiable function that is concave-up on  $(a, b)$ , with  $f(a) = 4$  and  $f(b) = 1$ .

- For some  $x$  in  $(a, b)$ ,  $f(x) = 2.5$ .
- For all  $x$  in  $(a, b)$ ,  $f''(x) \geq 0$ .
- $f'(a) \leq f'(b)$ .