## Essentials of Calculus

## Homework 2.4 The second derivative

1. Suppose that the number $D$ of deer in a forest in $t$ years have the following values:
$D$ (deer) $\quad 50 \quad 100 \quad 150 \quad 220 \quad 300$ $t$ (years) $\begin{array}{llllllll} & 0 & 1 & 2 & 3 & 4 & \text { Find esti- }\end{array}$ mates for $D^{\prime}$ and $\overline{D^{\prime \prime}}$ (and note their units) for any values of $t$ that you can.
2. Suppose that the cost $C$ in dollars of making $x$ items have the following values: | $C$ (cost) | 50 | 80 | 100 | 110 | 120 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $x$ (items) | 10 | 20 | 30 | 40 | 50 | Find estimates for $C^{\prime}$ and $C^{\prime \prime}$ (and note their units) for any values of $x$ that you can.
3. Let $f$ be the function with the following graph.


Determine if $f^{\prime}(x), f^{\prime \prime}(x)$ are positive or negative for $x=0,1,2$.
4. Let $f$ be the function with the following graph.


Determine if $f^{\prime}(x), f^{\prime \prime}(x)$ are positive or negative for $x=0,1,2$.
5. Let $f$ be the function with the following graph.


Determine the intervals where $f^{\prime}$ is positive and the intervals where $f^{\prime}$ is negative. Do the same for $f^{\prime \prime}$.
6. Let $f$ be the function with the following graph.


Determine the intervals where $f^{\prime}$ is positive and the intervals where $f^{\prime}$ is negative. Do the same for $f^{\prime \prime}$.
7. Draw the graph of a function $f$ that satisfies the following:

- $f^{\prime}(x)>0$ for $0<x<3$
- $f^{\prime}(x)<0$ for $3<x<5$
- $f^{\prime \prime}(x)>0$ for $0<x<2$
- $f^{\prime \prime}(x)<0$ for $2<x<4$
- $f^{\prime \prime}(x)>0$ for $4<x<5$

8. Draw the graph of a function $f$ that satisfies the following:

- $f^{\prime}(x)<0$ for $0<x<2$
- $f^{\prime}(x)>0$ for $2<x<5$
- $f^{\prime \prime}(x)>0$ for $0<x<4$
- $f^{\prime \prime}(x)<0$ for $4<x<5$

