

Instructions: This quiz is closed book, closed note, and an individual effort. Electronic devices other than approved calculators are not allowed on your person (e.g., no cell phones or calculators with CAS). Answer each question. **Show all work to receive full credit.** Unless the question specifies, you may provide either an exact answer or round to two decimal places. If you get stuck, please attempt to explain what you want to do. This may give more partial credit.

1. Let $f(x)$ be a function with respect to x , $f(0) > 0$, $f'(0) > 0$, and $f''(0) < 0$.
 - (a) Determine if $f(x)$ is positive or negative at $x = 0$. Explain.

 - (b) Determine if $f(x)$ is increasing or decreasing at $x = 0$. Explain.

 - (c) Determine if $f(x)$ is concave up or concave down at $x = 0$. Explain.

2. Let $H(t)$ be a function relating the height of a tree in feet, H , to n , the number of leaves. Also let $H(200) = 30$, and $H'(200) = 2$.
 - (a) Interpret the meaning of $H'(200) = 2$.

 - (b) Approximate $H(2.01)$ using tangent line approximation.

3. For each of the cases below, draw a function for which it is true. Label what is needed to show the function represents the below.

a. $f'(a) = 0$, $f'(b) > 0$ for $b > a$

b. $f(a) > 0$, $f'(b) < 0$ for $b > a$

c. $f''(a) > 0$, $f'(a) > 0$, $f(a) < 0$

d. $f''(a) < 0$, $f''(b) = 0$, and $f''(c) > 0$ for $a < b < c$

e. $f''(a) > 0$, $f'(b) = 0$, $f(c) > 0$ for $a < b < c$

4. Joe Mahma owns a rocking chair business. It costs Joe $C(q)$ to produce q chairs and he makes $R(q)$ for q chairs. Let $C(150) = 10000$ and $R(150) = 15000$.

(a) Determine the profit for a quantity of 150 chairs. (Show work)

(b) Suppose $C'(150) = 12.3$ and $R'(150) = 11.2$. Should the company increase or decrease production? Explain.

(c) Estimate the change in profit when producing 151 chairs instead of 150 chairs.

5. Let $C(q)$ be the solid line, $R(q)$ be the semi-dotted line, and the dotted line be when $q = 50$ in the graph below.

- (a) Draw the tangent lines with slopes equal to the marginal revenue and marginal cost functions on the graph when $q = 50$ (Be sure to label them MR and MC).
- (b) Should the company construct and sell the 51st unit? Explain.

