1. Let $R(x)$ represent the revenue (in dollars) from renting $x$ apartments. Interpret each of the following statements using everyday language.
   a. $R(14) = 32250$

   b. $R'(14) = 2400$

2. Suppose a company’s revenue from car sales, $R$ (in thousands of dollars), is a function of advertising expenditure, $a$ (in thousands of dollars), so $R = f(a)$.
   a. What does the company hope is true about the sign of $f'$? Why?

   b. What does the statement $f'(50) = 2$ mean in practical terms? Be sure to include units in your explanation.

3. Find the points where the function $f(x) = 3x^3 + 7x^2 - 8x + 15$ has a horizontal tangent line. Explain your reasoning.
4. The following data represent the price and quantity demanded in 2004 for IBM personal computers. The price per computer is given in hundreds of dollars.

<table>
<thead>
<tr>
<th>Price, $p$</th>
<th>10</th>
<th>12</th>
<th>13</th>
<th>15</th>
<th>17</th>
<th>20</th>
<th>23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity, $q$</td>
<td>189</td>
<td>180</td>
<td>176</td>
<td>171</td>
<td>164</td>
<td>159</td>
<td>152</td>
</tr>
</tbody>
</table>

a. Find the average rate of change in quantity demanded between $p = 10$ and $p = 23$.

b. Estimate the instantaneous rate of change when $p = 15$. Interpret your answer.

5. Suppose that $f(x)$ is a function with $f(30) = 200$ and $f'(30) = -12$.
   a. Estimate $f(32)$.

b. If the actual value is $f(32) = 180$, what does your answer in (a) tell you about the concavity of $f(x)$ close to $x = 30$?

6. With a yearly inflation rate of 3%, prices are described by $P = P_0(1.03)^t$, where $P_0$ is the price in dollars when $t = 0$ and $t$ is time in years. If $P_0 = 1.2$, how fast are prices rising (in dollars/year) when $t = 15$?
7. Suppose a function is given by a table of values as follows:

<table>
<thead>
<tr>
<th>x</th>
<th>1.1</th>
<th>1.3</th>
<th>1.5</th>
<th>1.7</th>
<th>1.9</th>
<th>2.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>f(x)</td>
<td>12</td>
<td>15</td>
<td>21</td>
<td>23</td>
<td>24</td>
<td>25</td>
</tr>
</tbody>
</table>

a. Estimate \( f'(1.7) \).

b. Write an equation of the tangent line to \( f \) at \( x = 1.7 \).

8. At a production level of 2000 for a product, marginal revenue is $4 per unit and marginal cost is $3.25 per unit. Do you expect maximum profit to occur at a production level above or below 2000? Explain your answer.

9. Fill in the blank with positive, negative, increasing, decreasing, concave up, concave down, or unknown.

If \( f'(x) \) is increasing then \( f(x) \) is ____________________.

If \( f(x) \) is increasing then \( f'(x) \) is ____________________.

If \( f''(x) \) is negative then \( f'(x) \) is ____________________.

If \( f'(x) \) is decreasing then \( f''(x) \) is ____________________.
10. Given the following graph of $f(x)$, find the graph of $f''(x)$.

![Graph of f(x)](image)

11. Given the following graph of $f'(x)$, find the intervals over which $f(x)$ is increasing, decreasing, concave up, and concave down.

![Graph of f'(x)](image)

At what point(s) does $f(x)$ have a local maximum? How can you tell?
12. Find the equation of the tangent line to the graph of \( f(x) = \frac{x^2 - 2}{x + 1} \) at the point at which \( x = 1 \).

13. The price in dollars of a house during a period of mild inflation is described by the formula \( P(t) = 80000e^{0.05t} \), where \( t \) is the number of years after 1990.
   a. What is the value of the house in the year 2000?
   
   b. At what rate (in dollars/year) will the value of the house be increasing in the year 2000?
   
   c. How long will it take the house to double in value?
   
   d. When will the house be increasing in value at a rate of $10,000 per year?
14. Find the derivative $f'(x)$.

\[ f(x) = 7 \ln(x) + 5^x - \frac{2}{3x^4} \]

15. Find the derivative $f'(x)$.

\[ f(x) = 7^{4x^2+5x-1} \]

16. Find the derivative $f'(x)$.

\[ f(x) = \frac{x^5 + e^{2x}}{x^3 - x} \]

17. Find the derivative $f'(x)$.

\[ f(x) = (x^9 - 3x^4 + 4)^7(\ln(x) + 3x)^3 \]
18. Find the derivative $f'(x)$.
   \[ f(x) = e^{x^5 - 7} + \ln(x^4 - 5x^3 + 2) \]

19. Find the derivative $f'(x)$.
   \[ f(x) = (\sqrt[3]{x} - 4x^6 + 2x^2)^{15} \]

20. Find the derivative $f'(x)$.
   \[ f(x) = \left( x + \frac{1}{x^7} \right) \left( \frac{3x + 1}{x^2 - 1} \right) \]

21. Find the derivative $f'(x)$.
   \[ f(x) = \left( \frac{x^2 + 1}{3x^3 + x} \right)^4 \]
22. Determine the critical points and identify each as a local minimum, local maximum or neither.

\[ f(x) = \frac{1}{3}x^3 - \frac{13}{2}x^2 - 30x + 15 \]

23. Determine the intervals over which \( f(x) \) is increasing, decreasing, concave up, and concave down.

\[ f(x) = x^3 - 6x^2 + 9x + 3 \]

24. Determine the global maximum and global minimum of \( f(x) \) over the given interval.

\[ f(x) = 2x^3 - 3x^2 - 12x + 1 \text{ over } [-2, 4] \]