1. A cardiac monitor is used to measure the heart rate of a patient after surgery. It compiles the number of heartbeats after $t$ minutes. When the data in the table are graphed, the slope of the tangent line represents the heart rate in beats per minute.

<table>
<thead>
<tr>
<th>$t$ (min)</th>
<th>36</th>
<th>38</th>
<th>40</th>
<th>42</th>
<th>44</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heartbeats</td>
<td>2307</td>
<td>2438</td>
<td>2567</td>
<td>2693</td>
<td>2819</td>
</tr>
</tbody>
</table>

The monitor estimates this value by calculating the slope of a secant line. Use the data to estimate the patient's heart rate after 42 minutes using the secant line between the point with $t = 42$ and the point with $t = 44$.

a. 64.5  
b. 63  
c. 66  
d. 61.5  
e. 60

2. The point $P\left(1, \frac{1}{2}\right)$ lies on the curve $y = \frac{x}{x + 1}$. If $Q$ is the point $\left(x, \frac{x}{x + 1}\right)$, use your calculator to find the slope of the secant line $PQ$ (rounding to six decimal places) for the following values of $x$.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$m_{PQ}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>0.99</td>
<td></td>
</tr>
<tr>
<td>0.999</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td></td>
</tr>
</tbody>
</table>
3.

If an arrow is shot upward on the moon with a velocity of $51 \text{ m/s}$, its height in meters after $t$ seconds is given by $h = 51t - 0.83t^2$. Find the average velocity over the given time intervals. Round to the nearest hundredth.

<table>
<thead>
<tr>
<th>$t$</th>
<th>$v(\text{m/s})$</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1, 2]</td>
<td></td>
</tr>
<tr>
<td>[1, 1.5]</td>
<td></td>
</tr>
<tr>
<td>[1, 1.1]</td>
<td></td>
</tr>
<tr>
<td>[1, 1.01]</td>
<td></td>
</tr>
<tr>
<td>[1, 1.001]</td>
<td></td>
</tr>
</tbody>
</table>

4.

The position of a car is given by the values in the table.

<table>
<thead>
<tr>
<th>$t$ (seconds)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$s$ (feet)</td>
<td>0</td>
<td>11</td>
<td>31</td>
<td>70</td>
<td>120</td>
<td>175</td>
</tr>
</tbody>
</table>

Find the average velocity (rounding to the nearest tenth, if necessary) for the time period beginning when $t = 0$ and lasting

(a) 3 seconds $\underline{?}$ ft/s

(b) 2 seconds $\underline{?}$ ft/s

(c) 1 second $\underline{?}$ ft/s

5.

For the function $f$ whose graph is given, state the value of each quantity, if it exists. If it doesn't exist, explain why.
6.

For the function \( g \) whose graph is given, state the value of the given quantity, if it exists. If it does not exist indicate it.

\[
\begin{align*}
\lim_{{x \to 3^-}} f(x) & = \underline{\quad} \\
\lim_{{x \to 3^+}} f(x) & = \underline{\quad} \\
\lim_{{x \to 3}} f(x) & = \underline{\quad} \\
\lim_{{x \to 0}} f(x) & = \underline{\quad} \\
f(3) & = \underline{\quad}
\end{align*}
\]
Match each limit in the left column with the corresponding value in the right column.

| g(0) | 0 |
| \( \lim_{{x \to 4^+}} g(x) \) | 3 |
| \( \lim_{{x \to 0}} g(x) \) | 6 |
| \( \lim_{{x \to -4^+}} g(x) \) | doesn't exist |

7.

For the function \( f \) whose graph is shown below, determine which of the following statements are true.

\[
\text{a. } \lim_{{x \to -4}} f(x) = \infty
\]
b. \( \lim_{{x \to 6^+}} f(x) = \infty \)

c. Equations of the vertical asymptotes are \( x = -7, x = -4, x = 0, \) and \( x = 6. \)

d. \( \lim_{{x \to -4}} f(x) = -\infty \)

e. \( \lim_{{x \to 0}} f(x) = -\infty \)

8. Which of the following limits are equal to \( \infty \)?

a. \( \lim_{{x \to 2^+}} \frac{7}{x - 2} \)

b. \( \lim_{{x \to 0}} \frac{x - 2}{x^2 (x + 8)} \)

c. \( \lim_{{x \to 2^-}} \frac{7}{x - 2} \)

d. \( \lim_{{x \to 4}} \frac{7 - x}{(x - 4)^2} \)

e. \( \lim_{{x \to 7\pi^+}} \cot x \)

9. The slope of the tangent line to the graph of the exponential function \( y = 11^x \) at the point \( (0, 1) \) is \( \lim_{{x \to 0}} \frac{11^x - 1}{x} \). Estimate the slope of this tangent line.

a. 2.52
b. 2.44
c. 2.56
d. 2.48
e. 2.40
Given that

\[ \lim_{x \to a} f(x) = -6 \quad \lim_{x \to a} h(x) = 9 \]

find the limit

\[ \lim_{x \to a} [f(x) + h(x)]. \]

11.
Given that

\[ \lim_{x \to a} f(x) = -1 \]

find the limit

\[ \lim_{x \to a} [f(x)]^2. \]

12.
Given that

\[ \lim_{x \to a} f(x) = -2 \quad \lim_{x \to a} g(x) = 0 \]

find the limit

\[ \lim_{x \to a} \frac{g(x)}{f(x)}. \]

13.
Given that

\[ \lim_{x \to a} f(x) = -2 \quad \lim_{x \to a} h(x) = 5 \]

find the limit

\[ \lim_{x \to a} \frac{2f(x)}{h(x) - f(x)} . \]

14.

The graphs of \( f \) and \( g \) are given. Use them to evaluate each limit, if it exists.

\( y = f(x) \)
\( y = g(x) \)

(a) \( \lim_{x \to -2} [f(x) + g(x)] \)

(b) \( \lim_{x \to 1} [f(x) + g(x)] \)

(c) \( \lim_{x \to 0} [f(x)g(x)] \)

(d) \( \lim_{x \to -1} \frac{f(x)}{g(x)} \)
15. Evaluate the limit.

$$\lim_{x \to 2} \left( 2x^4 + 3x^2 - x + 4 \right)$$

16. Evaluate the limit.

$$\lim_{x \to 8} \frac{x^2 + 9x + 8}{x^2 + 7x - 8}$$

17. Find the limit.

$$\lim_{x \to -2} \frac{x^2 + 3x + 2}{x^2 + x - 2}$$

a. \( \frac{7}{5} \)
b. \( \frac{13}{14} \)
c. \( \frac{2}{3} \)
d. \( \frac{1}{3} \)
e. \( \frac{13}{8} \)

18.
Find \( \lim_{{h \to 0}} \frac{(3 + h)^2 - 9}{h} \).

a. 12  
b. 8  
c. 10  
d. 6  
e. 14

19. Evaluate the limit. Simplify.

\( \lim_{{x \to 1}} \frac{x^3 - 1}{x^2 - 1} \)

20. Evaluate the limit.

\( \lim_{{h \to 0}} \frac{(4 + h)^3 - 64}{h} \)