1. (10 pts.) Use algebra to evaluate \( \lim_{h \to 0} \frac{f(a + h) - f(a)}{h} \), where \( f(x) = 5x^2 + 3x \).

\[
\begin{align*}
\lim_{h \to 0} \frac{f(a + h) - f(a)}{h} &= \lim_{h \to 0} \frac{5(a + h)^2 + 3(a + h) - 5a^2 - 3a}{h} \\
&= \lim_{h \to 0} \frac{5a^2 + 2ah + h^2 + 3a + 3h - 5a^2 - 3a}{h} \\
&= \lim_{h \to 0} \frac{5(2ah + h^2) + 3h}{h} \\
&= \lim_{h \to 0} \frac{h(10a + 5h + 3)}{h} \\
&= \lim_{h \to 0} 10a + 5h + 3 \quad \text{(6 points for calculations to this point)} \\
&= 5a + 3. \quad \text{(2 points)}
\end{align*}
\]

2. (10 pts.) The following indicates the graph of a function \( y = f(x) \) which extends to the left and right as indicated. Evaluate the following limits (answers are real numbers, \( \infty \), \(-\infty \), or “N” if none of these):

\[
\begin{align*}
\lim_{x \to -\infty} f(x) &= \infty \\
\lim_{x \to \infty} f(x) &= -\infty \\
\lim_{x \to 3^-} f(x) &= 9 \\
\lim_{x \to 3^+} f(x) &= -13 \\
\lim_{x \to 3} f(x) &= N \quad \text{(2 points each)}
\end{align*}
\]

Comment: More information was needed to calculate the first. No points deducted for any answer.
1. (10 pts.) Use algebra to evaluate \( \lim_{h \to 0} \frac{f(a + h) - f(a)}{h} \), where \( f(x) = 3x^2 + 4x \).

\[
\lim_{h \to 0} \frac{f(a + h) - f(a)}{h} = \lim_{h \to 0} \frac{[3(a + h)^2 + 4(a + h)] - [3a^2 + 4a]}{h} \\
= \lim_{h \to 0} \frac{[3a^2 + 2ah + h^2 + 4a + 4h] - [3a^2 + 4a]}{h} \\
= \lim_{h \to 0} \frac{3(2ah + h^2) + 4h}{h} \\
= \lim_{h \to 0} \frac{h(6a + 3h + 4)}{h} \\
= \lim_{h \to 0} 6a + 3h + 4 \quad \text{(6 points for calculations to this point)} \\
= 6a + 4. \quad \text{(2 points)}
\]

2. (10 pts.) The following indicates the graph of a function \( y = f(x) \) which extends to the left and right as indicated. Evaluate the following limits (answers are real numbers, \( \infty \), \( -\infty \), or “N” if none of these):

\[
\lim_{x \to -\infty} f(x) = \infty \quad \lim_{x \to -3^+} f(x) = -11
\]

\[
\lim_{x \to -3^-} f(x) = 8 \quad \lim_{x \to 3} f(x) = \text{N} \quad \text{(2 points each)}
\]

*Comment:* More information was needed to calculate the first. No points deducted for any answer.