1. Differentiate \( y = \frac{x-2}{x+3} \) and simplify.
\[
y' = \frac{(x+3) \frac{d}{dx}(x-2) - (x-2) \frac{d}{dx}(x+3)}{(x+3)^2} = \frac{(x+3)(1) - (x-2)(1)}{(x+3)^2} = \frac{5}{(x+3)^2}
\]

2. Differentiate \( y = 3(1-2x)^5 \).
\[
y' = 3 \frac{d}{dx}(1-2x)^5 = 3(5)(1-2x)^4 \frac{d}{dx}(1-2x) = 18(1-2x)^4(-2) = -36(1-2x)^4
\]
So, \( y' = -36(1-2x)^4 \)

3. The position of an object is \( s(t) = \sqrt{t^2 + 21} \) meters where \( t \) is the time in seconds. Find the velocity of the object at time \( t = 2 \) seconds.
\[
\begin{align*}
\theta(t) &= (t^2 + 21)^{\frac{1}{2}} \\
\text{The velocity is } v(t) &= \frac{1}{2} (t^2 + 21)^{-\frac{1}{2}} \frac{d}{dt}(t^2 + 21) \\
&= \frac{1}{2} (t^2 + 21)^{-\frac{1}{2}} (2t) = \frac{t}{\sqrt{t^2 + 21}}.
\end{align*}
\]
So, \( v(2) = \frac{2}{\sqrt{2^2 + 21}} = \frac{2}{5} \) meters/sec

4. Determine the slant asymptote of \( y = \frac{3x^2 - 2}{x+1} \).
\[
\begin{align*}
\frac{3x-3}{x+1} = \frac{3x^2+0x-2}{3x^2+3x} - \frac{-3x-2}{-3x-3} &\Rightarrow y = 3x-3+\frac{1}{x+1}.
\end{align*}
\]
As \( x \to \infty \), \( \frac{1}{x+1} \to 0 \)
We see the curve approaches the slant asymptote \( y = 3x-3 \) as \( x \to \infty \).
5. Use a calculator to approximate the area under the curve \( y = 4x^3 + 1 \) on \([0,2]\) using the right endpoints of 25 rectangles. Express your answer to two decimal places.

\[
\Delta x = \frac{x_2 - x_0}{25} = \frac{2}{100} = 0.08 \\
x_i = x_0 + i \Delta x = 0 + 0.08i = 0.08i \\
f(x_i) = 4x_i^3 + 1 = 4(0.08i)^3 + 1 \\
\text{Area} \approx \sum_{i=1}^{25} f(x_i) \Delta x = 0.08 \sum_{i=1}^{25} \left[ 4(0.08i)^3 + 1 \right] = 19.3056 \\
\text{Thus, to two decimal places,} \\
\text{Area} \approx 19.31
1. Differentiate \( y = \frac{x + 3}{x - 2} \) and simplify.

\[
y' = \frac{(x-2)\frac{d}{dx}(x-3) - (x+3)\frac{d}{dx}(x-2)}{(x-2)^2}
\]

\[
= \frac{(x-2)(1) - (x+3)(1)}{(x-2)^2} = \frac{x-2-x-3}{(x-2)^2} = \frac{-5}{(x-2)^2}
\]

2. Differentiate \( y = 4(2-3x)^3 \).

\[
y' = 4(3)(2-3x)^2 \frac{d}{dx}(2-3x) = 20(2-3x)^2(-3)
\]

So, \( y' = -60(2-3x)^4 \)

3. The position of an object is \( s(t) = \sqrt{t^2 + 16} \) meters where \( t \) is the time in seconds. Find the velocity of the object at time \( t = 3 \) seconds.

Velocity at time \( t \):

\[
\frac{d}{dt}(t^2 + 16)^{\frac{1}{2}} \]

\[
= \frac{1}{2}(t^2 + 16)^{-\frac{1}{2}} \frac{d}{dt}(t^2 + 16)
\]

\[
= \frac{1}{2\sqrt{t^2 + 16}} \cdot 2t
\]

So \( \frac{d}{dt}(t^2 + 16) = \frac{t}{\sqrt{t^2 + 16}} \)

Therefore, \( s'(3) = \frac{3}{\sqrt{3^2 + 16}} = \frac{3}{5} \) meters per second

4. Determine the slant asymptote of \( y = \frac{2x^2 + 3}{x - 1} \).

\[
\frac{2x + 2}{x - 1} \frac{2x^2 + 3}{2x^2 - 2x}
\]

\[
\Rightarrow y = 2x + 2 + \frac{5}{x - 1}
\]

For very large \( x \), \( \frac{5}{x-1} \to 0 \). It follows that \( y = 2x + 2 \) is a slant asymptote.
5. Use a calculator to approximate the area under the curve \( y = x^3 + 2 \) on \([0, 3]\) using the right endpoints of 25 rectangles. Express your answer to two decimal places. (10 pts)

\[ \Delta x = \frac{3 - 0}{25} = \frac{12}{100} = 0.12 \]

\[ x_i^* = x_0 + i \Delta x = 0 + i (0.12) \quad \Rightarrow \quad x_i^* = 0.12 i \]

\[
\text{Area} \approx \sum_{i=1}^{25} f(x_i) \Delta x \quad \text{where} \quad f(x) = x^3 + 2
\]

\[
= \sum_{i=1}^{25} (x_i^3 + 2)(0.12)
= 0.12 \sum_{i=1}^{25} [ (0.12i)^3 + 2 ]
= 24.9024
\]

\[
\text{Area} \approx 24.90
\]