\[ \frac{A_n}{r^{n+1}} = \frac{\binom{n+1}{k+1}}{n+2} \]

\[ r \approx \frac{2r}{c} \]

\[ x \approx \frac{2r}{c} \]

\[ x = \infty \]

\[ \sin \frac{\pi}{2} \cdot 2\cos\left(\frac{\pi}{2}\right) = 0 \]

\[ \text{as } n \to \infty, \sin\left(\frac{n\pi}{2}\right) = 0 \]

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\[ \frac{\pi}{2} \cdot 2\sin\left(\frac{\pi}{2}\right) = 0. \]
S. Consider the function graphed below.

- $y = \frac{1}{x}$
- $y = -1$
- $y = \frac{1}{x} - 1$
- $y = 0$
- $y = \frac{1}{x} + 5$
- $y = \frac{1}{x} - 2$
4. (c) Suppose $f(x)$ is a piecewise-defined function.

$$f(x) = \begin{cases} 
    2x & \text{if } x < -1 \\
    x^2 + 1 & \text{if } x \geq -1
\end{cases}$$

Find a formula for the constant $c$ in the piecewise function $f(x)$ at $x = -1$.

$$\frac{d}{dx} f(x) = \begin{cases} 
    2 & \text{if } x < -1 \\
    2x & \text{if } x \geq -1
\end{cases}$$

If $f(x)$ is continuous at $x = -1$, then

$$\lim_{x \to -1^-} f(x) = \lim_{x \to -1^+} f(x) = c$$

$$c = \frac{1}{2}$$
1. (a) Given: The position of a falling object is given by the function:

\[ x(t) = 100 + 100t + 5t^2 \]

(b) The velocity of the object at time \( t \) can be found by taking the derivative:

\[ v(t) = \frac{dx(t)}{dt} = 100 + 100t + 10t^2 \]

\[ v(t) = 100 + 100t + 10t^2 \]

\[ v(t) = 100 + 100t + 10t^2 \]

\[ v(t) = 10 + 10t + 10t^2 \]

(c) The average velocity over the interval \([0, 2]\) is given by:

\[ \bar{v} = \frac{v(2) - v(0)}{2 - 0} \]

\[ \bar{v} = \frac{(10 + 10(2) + 10(2)^2) - (10 + 10(0) + 10(0)^2)}{2 - 0} \]

\[ \bar{v} = \frac{(10 + 20 + 40) - (10 + 0 + 0)}{2} \]

\[ \bar{v} = \frac{70 - 10}{2} \]

\[ \bar{v} = \frac{60}{2} \]

\[ \bar{v} = 30 \]

(d) The instantaneous velocity at \( t = 2 \) is given by:

\[ v(2) = 10 + 10(2) + 10(2)^2 \]

\[ v(2) = 10 + 20 + 40 \]

\[ v(2) = 70 \]

2. (a) The area under the graph of the function \( f(x) \) from \( x = a \) to \( x = b \) is given by:

\[ A = \int_a^b f(x) \, dx \]

(b) The derivative of the function \( f(x) \) at \( x = c \) is given by:

\[ f'(c) = \lim_{h \to 0} \frac{f(c+h) - f(c)}{h} \]

(c) The definite integral of the function \( f(x) \) from \( x = a \) to \( x = b \) is given by:

\[ \int_a^b f(x) \, dx \]

3. (a) The limit of the function \( f(x) \) as \( x \) approaches \( c \) is given by:

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

(b) The derivative of the function \( f(x) \) at \( x = c \) is given by:

\[ f'(c) = \lim_{h \to 0} \frac{f(c+h) - f(c)}{h} \]

(c) The definite integral of the function \( f(x) \) from \( x = a \) to \( x = b \) is given by:

\[ \int_a^b f(x) \, dx \]

4. (a) The limit of the function \( f(x) \) as \( x \) approaches \( c \) is given by:

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

(b) The derivative of the function \( f(x) \) at \( x = c \) is given by:

\[ f'(c) = \lim_{h \to 0} \frac{f(c+h) - f(c)}{h} \]

(c) The definite integral of the function \( f(x) \) from \( x = a \) to \( x = b \) is given by:

\[ \int_a^b f(x) \, dx \]
4. \( f(x) = \frac{1}{x} \)

(a) Find all the horizontal asymptotes of \( f(x) \).

\[
\lim_{x \to \pm \infty} f(x) = \frac{1}{x} \to 0
\]

Horizontal asymptotes at \( y = 0 \).

(b) Find all the vertical asymptotes of \( f(x) \).

\[
\lim_{x \to 0^+} f(x) = \frac{1}{x} \to \infty
\]

Thus there is a vertical asymptote at \( x = 0 \).

\[
\lim_{x \to 0^-} f(x) = \frac{1}{x} \to -\infty
\]

Thus there is another vertical asymptote at \( x = 0 \).

Note: \( f(x) \) has only a removable discontinuity at \( x = 0 \).