Calculus Formulas

Limit Definitions of a Derivative

The derivative of \( f \) at \( x \) is given by:

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

The derivative of \( f \) at \( c \) is given by:

\[
f'(c) = \lim_{x \to c} \frac{f(x) - f(c)}{x - c}
\]

Position/Velocity/Acceleration Formulas

If \( s(t) \) gives the position at time \( t \) of an object moving in a straight line, then the **average velocity** of the object over the interval \([t, t+\Delta t]\) is given by:

\[
\text{average velocity} = \frac{\Delta x}{\Delta t} = \frac{s(t + \Delta t) - s(t)}{\Delta t}
\]

If \( s=s(t) \) is the position function for an object moving along a straight line, then the **velocity** of the object at time \( t \) is given by:

\[
v(t) = \lim_{\Delta t \to 0} \frac{s(t + \Delta t) - s(t)}{\Delta t} = s'(t)
\]

If \( s \) is the position function for an object moving along a straight line, then the **acceleration** of the object at time \( t \) is given by:

\[
a(t) = v'(t)
\]

Summation of Position/Velocity/Acceleration

\[
s(t) = \text{position}
\]

\[
v(t) = \text{velocity} = s'(t)
\]

\[
a(t) = \text{acceleration} = v'(t) = s''(t)
\]