
\[
\lim_{x \to 0} \frac{x^2}{x^3 + 0} + ^{4+1} = 0
\]

\[
\lim_{x \to 0} \frac{x^3}{x^2} = 0
\]

\[
\lim_{x \to 0} \frac{x^2}{3x^2} = 1
\]

\[
\lim_{x \to 0} \frac{3x^2(x^4 + 1)}{x^2} = 3x^6 + 3x^2
\]

\[
\lim_{x \to 0} \frac{2x}{18x^5 + 6x} = 2
\]

\[
\lim_{x \to 0} \frac{90x^4 + 6}{6} = \frac{1}{3}
\]

The limit of \(\frac{x^2}{x^3 + 0} dt\) is equal to \(\frac{1}{3}\). The limit was found by using the Fundamental Theorem of Calculus and l'Hospital's Rule.
a) \( \int \sqrt{1-x^2} \, dx = \int \cos^2(t) \, dt \) when \( x = \sin(t) \)

\[
= \int \sqrt{1-\sin^2(t)} \cdot \cos(t) \, dt
= \int \sqrt{\cos^2(t)} \cdot \cos(t) \, dt
= \int \cos(t) \cdot \cos(t) \, dt
= \int \cos^2(t) \, dt \checkmark
\]

By substituting \( \sin(t) \) in for \( x \) and then distributing the squared term to the outside (\( \sin^2(t) \)), we get a trig function under the radical, \( 1-\sin^2(t) = \cos^2(t) \) which came from \( \cos^2(t) + \sin^2(t) = 1 \). This simplifies our equation and allows the square root to cancel with the squared cosine term. Using the \( \cos(t) \, dt \) function as a substitute for \( dx \), the function works itself out into \( \cos^3(t) \, dt \) (university calculus)

b) \( \int \cos^3(t) \neq \frac{1}{3} \cos^3(t) + C \)

If we take the derivative of \( \frac{1}{3} \cos^3(t) + C \), we should expect to get something not equal to \( \cos^2(t) \, dt \):

\[
f(t) = \frac{1}{3} \cos^3(t) + C \quad \text{constant will go to zero.}

f'(t) = \frac{2}{3} \cos^2(t) \cdot -\sin(t) \checkmark
\]

\[
f(t) \neq \int \cos^2(t) \sin(t) \neq \int \cos^2(t) \checkmark
\]

\( \checkmark \): There should not be an integral sine.

The integral of \( \cos^3(t) \, dt \) doesn't equal \( \frac{1}{3} \cos^3(t) \) because you have to use chain rule if you work backwards and take the derivative of \( \frac{1}{3} \cos^3(t) \). When you do this, you get \( \int -\cos^2(t) \sin(t) \), which is not the same as \( \int \cos^3(t) \, dt \) (university calculus).