1. Use a substitution to evaluate the indefinite integral
\[ \int \frac{\sin(x)}{1 + \cos^2(x)} \, dx. \]

2. Use differentiation to check whether or not the answer you obtained in part 1 is correct. Have you found that your answer is correct or incorrect?

You must show your procedures in order to receive any credit. You will not receive credit if you just write down an answer without showing how that answer was obtained.

**Solution**

1. To evaluate this indefinite integral, we use the substitution
\[ u = \cos(x) \]
\[ du = -\sin(x) \, dx. \]

This gives us
\[ \int \frac{\sin(x)}{1 + \cos^2(x)} \, dx = -\int \frac{1}{1 + u^2} \, du \]
\[ = -\arctan(u) + C \]
\[ = -\arctan(\cos(x)) + C \]

2. Show the check of your answer here. Do you find that your answer is correct or incorrect?
\[
\frac{d}{dx} (-\arctan (\cos (x))) = -\frac{d}{dx} (\arctan (\cos (x)))
\]
\[
= -\frac{1}{1 + \cos^2 (x)} \cdot \frac{d}{dx} (\cos (x))
\]
\[
= -\frac{1}{1 + \cos^2 (x)} \cdot (-\sin (x))
\]
\[
= \frac{\sin (x)}{1 + \cos^2 (x)}
\]

shows that our answer is correct.