1) (4 points) Evaluate \( \int_0^\frac{\pi}{2} \sin^2 x \, dx \)

\[
\int_0^\frac{\pi}{2} \sin^2 x \, dx = \frac{1}{2} \int_0^\frac{\pi}{2} 1 - \cos (2x) \, dx
\]

\[
= \frac{1}{2} \left[ x - \frac{1}{2} \sin (2x) \right]_0^\frac{\pi}{2}
\]

\[
= \frac{1}{2} \left[ \left( \frac{\pi}{2} - \frac{1}{2} \sin (\pi) \right) - (0 - \frac{1}{2} \sin 0) \right]
\]

\[
= \frac{1}{2} \left[ \frac{\pi}{2} - \frac{1}{2} \left( \frac{\sqrt{3}}{2} \right) \right]
\]

2) (6 points) Make the appropriate substitution and set up, but do not evaluate, the resulting integral (and simplify the integrand) to compute \( \int \frac{\sqrt{x^2 - 36}}{x} \, dx \)

\[
x = \sec \theta \Rightarrow x = 6 \sec \theta \Rightarrow dx = 6 \sec \theta \tan \theta \, d\theta
\]

\[
\frac{\sqrt{x^2 - 36}}{6} = \tan \theta \Rightarrow \sqrt{x^2 - 36} = 6 \tan \theta
\]

\[
\int \frac{\sqrt{x^2 - 36}}{x} \, dx = \int \frac{6 \tan \theta}{6 \sec \theta} 6 \sec \theta \tan \theta \, d\theta
\]

\[
= \int \tan^2 \theta \, d\theta
\]