Practice using Substitution & FTC

Recall the steps for Integration by Substitution:

1. Make a *choice* for u, say $u = g(x)$.
2. Compute $\frac{du}{dx} = g'(x)$ (which I often write as $du = g'(x)dx$).
3. Make the substitution $u = g(x)$, $du = g'(x)dx$, and *change your limits of integration.* At this state, the *entire* integral must be in terms of u; no x's should remain. If this is not the case, try a different choice of u.
4. Evaluate the resulting integral using the Fundamental Theorem of Calculus. If you still are unable to find an antiderivative consider doing a second substitution or start over with a different choice of u.

Find the following exactly (no estimation) using Substitution & the Fundamental Theorem of Calculus.

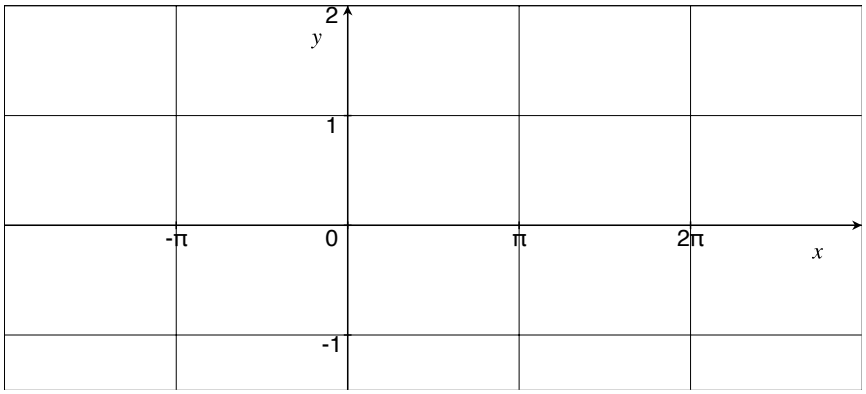
1. $\displaystyle\int_{-2}^{0} (x^2+1)^{50} 2x\, dx$

2. $\displaystyle\int_{1}^{4} \frac{\cos(\sqrt{x})}{\sqrt{x}}\, dx$

3. $\displaystyle\int_0^2 \frac{x}{\sqrt{4-5x^2}}\,dx$

4. $\displaystyle\int_0^{\pi} \sin 2x\,dx$

(a) Draw the graph of $\sin 2x$ on the axes below. Does your answer above make sense?



(b) Can you find $\displaystyle\int_0^{2\pi} \sin 2x\,dx$ (exactly) without using either Substitution or the Fundamental Theorem of Calculus?