SECTION 5.5: SUBSTITUTION (I.E. UNDOING THE CHAIN RULE)

Goals: (i) Practice u-substitution (ii) Practice *sophisticated* u-substitution (iii) Practice substitution with both indefinite and definite integrals (iv) Develop intuition about how to choose u.

1. (a) Verify that the formula is correct: $\int \dfrac{2x}{\sqrt{x^2-1}}\, dx = 2\sqrt{x^2-1} + C$

   (b) Use the substitution $u = x^2 - 1$ to rewrite *the entire integral* in terms of u. Then integrate the integral with the new variables.

2. Explain why the formula is not correct: $\int \sqrt{x^2+1}\, dx = \dfrac{1}{3}(x^2+1)^{3/2} + C$

3. $\displaystyle \int t^3 \cos(t^4 + 1)\, dt$

4. $\displaystyle \int 5\sin^2(x)\cos(x)\, dx$

5. $\displaystyle\int \frac{dx}{(8-5x)^3}$

6. $\displaystyle\int \sin\left(\frac{\pi x}{4}\right)\, dx$

7. $\displaystyle\int_0^1 (x-1)(x^2-2x)^{10}\, dx$

8. $\displaystyle\int_0^{\pi/4} \tan^3(\theta)\sec^2(\theta)\, d\theta$

9. $\displaystyle\int (x^4-5)^{1/3} x^7\, dx$