Goal: To evaluate integrals of the form $\int \sin^m x \cos^n x \, dx$.

1. $\int \sin x \, \cos^4 x \, dx$

2. $\int \sin^3 x \, dx$ (*Hint: Use the identity* $\sin^2 x + \cos^2 x = 1$*, then do a u-substitution.)*

3. $\int \sin^5 x \, \cos^2 x \, dx$ (*Hint: write* $\sin^5 x = (\sin^2 x)^2 \sin x$*.*)

4. Use the same strategy as the previous problem. (The algebra gets hairy, so stop once you do the substitution.)

   $$\int \sin^7 x \, \cos^4 x \, dx$$

5. Describe your strategy to evaluate any integral of the form $\int \sin^m x \cos^n x \, dx$ where m is odd.

6. The same type of trick works if the power on $\cos x$ is odd. What trig identity and u-sub would you use to evaluate the following integral?

   $$\int \sin^2 x \cos^3 x \, dx$$

7. Describe your strategy to evaluate any integral of the form $\int \sin^m x \cos^n x \, dx$ where n is odd.

If you don't have an odd power of $\sin x$ or $\cos x$, the previous strategies don't work.

8. Evaluate $\int \sin^2 x\, dx$ using the following strategies.

   (a) Use the identity $\sin^2 x = \frac{1}{2}\big(1 - \cos(2x)\big)$.

   (b) Integrate by parts using $u = \sin x$ and $dv = \sin x\, dx$.

   (c) Use a trig identity to show that your answers from part (a) and (b) are the same!

9. How would you integrate $\int \cos^2 x\, dx$? What about $\int \cos^4 x\, dx$ or $\int \sin^2 x \cos^2 x\, dx$?