In this worksheet will work out how to integrate $\sin^n x$ for all positive integers $n$. It turns out the general strategy is different depending on whether $n$ is odd or even. We begin with the odd cases.

**Problem 1.** Evaluate $\int \sin x \, dx$.

**Problem 2.** Evaluate $\int \sin^3 x \, dx$. *Hint: Write* $\sin^3 x = \sin x(1 - \cos^2 x)$ *and then do a* $u$-substitution.*

**Problem 3.** Evaluate $\int \sin^5 x \, dx$.

**Problem 4.** Describe how you would integrate $\sin^n x$ when $n$ is odd and bigger than 5. It might be useful to write $n = 2k + 1$, where $k$ is a positive integer.

**Problem 5.** Evaluate $\int \sin^2 x \, dx$. *Hint: Use a trig identity.*
Problem 6. Evaluate $\int \sin^4 x \, dx$. Hint: Write $\sin^4 x = (\sin^2 x)^2$ and then use a trig identity.

Problem 7. Describe a general strategy for evaluating $\int \sin^n x \, dx$ when $n$ is even and bigger than 4. It might be helpful to write $n = 2k$, where $k$ is a positive integer.

Problem 8. How, if at all, does the general strategy change if you were to repeat the above with $\cos x$ in place of $\sin x$?

Problem 9. Describe a general strategy for integrating $\cos^n x \sin^m x$, where $n$ and $m$ are positive integers. Hint: Consider three cases: (1) where $m, n$ are both odd; (2) where $m, n$ are both even; (3) where $m, n$ have opposite parity.