WORKSHEET: INTEGRATION BY SIMPLIFYING SUBSTITUTIONS

Names and student IDs: ____________________________________________________

The problems on this worksheet are intended to be done by substitutions which obviously make the integrand simpler. (It is sometimes useful to use substitutions which apparently make the integrand more complicated. For example, $\int \sqrt{1-x^2} \, dx$ is done with the substitution $x = \sin(u)$, which is the same as $u = \arcsin(x)$.)

1. $\int (2x+5)^{7/3} \, dx =$

2. $\int x^2(2x^3+11)^{29} \, dx =$

3. $\int \frac{[\arctan(x)]^3}{1+x^2} \, dx =$

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4. \[
\int \frac{e^{2\arcsin(x)}}{\sqrt{1-x^2}} \, dx =
\]

5. Define
\[
c(x) = \begin{cases} 
  x(x^2 - 3)^{92} & x \leq 2 \\
  x & x > 2.
\end{cases}
\]
Find
\[
\int_{1}^{4} c(x) \, dx.
\]
Hint: Write this integral as a sum of two integrals over suitably chosen shorter intervals.

6. John Doe proposes to find \( \int e^{x^2} \, dx \) by using the substitution \( u = x^2 \). What goes wrong when he tries this?
   (It turns out that none of the other methods we will learn helps either: this antiderivative is not an elementary function.)