1. Evaluate $\int \frac{\sin(\sqrt{x})}{\sqrt{x}} \, dx$. Be sure to show all work for full credit.

2. Consider $\int \sin(x) \cos(x) \, dx$.
   
   (a) Evaluate the integral using substitution with $u = \sin(x)$.

   (b) Evaluate the integral using substitution with $u = \cos(x)$.

   (c) Use the Pythagorean Identity to show that your results from parts (a) and (b) are equivalent.
3. Consider $\int_{-3}^{0} \sqrt{9 - x^2} \, dx$ to answer the following

(a) Why do the substitution methods we have learned in class not ‘work’ for evaluating the integral?

(b) Find the exact value of the integral using geometry. Justify your answer. The use of technology is not accepted for this problem.

4. Consider the region bounded by $F(x) = x + 1$, $G(x) = (x - 1)^2$, and $x = 2$ as shown in the graph below.

(a) Write the integral that will give the area of the shaded region.

(b) Evaluate the integral you wrote in part (a).
5. Find the combined area of the shaded regions illustrated in the graphic below:
6. All parts of this problem are based on the function \( f(x) = \frac{1}{x^P} \) for \( P > 0 \). The graph of \( f(x) \) is provided below.

Let \( P \neq 1 \). Set up and evaluate an integral for the area between \( f(x) \) and the \( x \)-axis for \( x = 1 \) to \( x = \odot \) for some constant \( \odot > 1 \).

Simplify your result. Fill in the boxes with the appropriate exponent on \( \odot \) and the subtracted constant for your final answer:

\[
\frac{1}{-P + 1} \left( \odot - \square \right)
\]

(a) What happens if \( P = 1 \)?

(b) Let \( P > 1 \). Then the quantity \((-P + 1)\) is positive / negative (circle one).

What happens to the area as \( \odot \to \infty \)? (i.e. Take the limit as \( \odot \to \infty \))

(c) Let \( 0 < P < 1 \). Then the quantity \((-P + 1)\) is positive / negative (circle one).

What happens to the area as \( \odot \to \infty \)?