3. [7 points] The function $g$ defined by $g(x) = \ln(x^2 + 1)$ is differentiable for all $x$ in $(-\infty, \infty)$.

For all $x > 0$, the function $B(x) = \frac{1}{x} \int_0^x \ln(t^2 + 1) \, dt$ gives the average value of $g(x)$ over the interval $[0, x]$.

Note: Your answers may require one or more integral signs. However, neither the letter $g$ nor the letter $B$ should appear in your answers.

a. [4 points] Calculate $B'(x)$.

Answer: $B'(x) =$

b. [3 points] Write a formula for the average value of $g'$ over the interval $[0, x]$.

Answer: Average value of $g'$ over $[0, x]$ equals

4. [5 points] Determine whether the integral $\int_0^3 \frac{1}{x^{\pi/4}} \, dx$ converges or diverges.

- If the integral converges, circle “Converges”, find its exact value, and write the exact value on the answer blank provided.

- If the integral diverges, circle “Diverges” and carefully justify your answer.

In either case, you must show all your work and use proper notation. Evaluation of integrals must be done without using a calculator.

Note that $\frac{1}{x^{\pi/4}} = x^{-\pi/4}$.

Circle one:

$\int_0^3 \frac{1}{x^{\pi/4}} \, dx$ converges to $\text{______________}$ or $\int_0^3 \frac{1}{x^{\pi/4}} \, dx$ diverges