

1. False. Continuous functions always have antiderivatives.
2. False. Left endpoints will overestimate when the function is decreasing, but this is not generally true.
3. The antiderivative is $F(x) = e^{e^{x^2}} + \ln(|\sin(x)|) + C$. (I did not take off for forgetting the absolute value.)
4. The area is $f(0)\frac{2\pi}{4} + f(\frac{\pi}{2})\frac{2\pi}{4} + f(\pi)\frac{2\pi}{4} + f(\frac{3\pi}{2})\frac{2\pi}{4} = \frac{2\pi}{4} + 0 + \frac{2\pi}{4} + 0 = \pi$