Fundamental Chain Reactions

Evaluate the following:

1. $\dfrac{d}{dx} \displaystyle\int_0^x \cos\left(t^2\right) dt$

2. $\dfrac{d}{dx} \displaystyle\int_2^{x^2} \cos\left(e^t\right) dt$

3. $\dfrac{d}{dx} \displaystyle\int_{e^x}^{\pi} \sqrt{t^2 + 2}\, dt$

4. $\dfrac{d}{dx} \displaystyle\int_x^{4x} \dfrac{\sec t}{t^3}\, dt$

5. $\dfrac{d}{dv} \displaystyle\int_7^{\ln(v^2+5)} \sin\left(t^2\right) dt$