

$$\textcircled{2} \int_0^{\frac{\pi}{2}} g \frac{x^2}{2} dx = \frac{1}{2} \int_0^{\frac{\pi}{2}} \frac{1+g x}{2} dx = \frac{1}{2} x + \frac{g x^2}{2} \Big|_0^{\frac{\pi}{2}} = \frac{\pi}{4} + \frac{1}{2}$$