Please inform your TA if you find any errors in the quiz solutions.

1. (4 points)
   1. (2 points) Is $\int_{u}^{a^3} e^{x^3} \, dv$ a function? If so, of what variable?
      
      **Solution:** It is a function (of $u$).

   2. (2 points) True or false? $\int (\sin(x^2) + x^2 \cos(x^2)) \, dx = x \sin(x^2) + C$.
      
      **Solution:** False Taking the derivative of the right hand side (using the product rule and chain rule) we get
      $$
      \frac{d}{dx} x \sin(x^2) = \sin(x^2) + 2x^2 \cos(x^2)
      $$

2. (6 points)
   1. (3 points) Compute $\int \sin(3x) \cos(3x) \, dx$
      
      **Solution:** $-\frac{1}{12} \cos(6x) + C$. Using the double angle theorem
      $$
      \int \sin(3x) \cos(3x) \, dx = \int \frac{1}{2} \sin(6x) \, dx
      $$
      
      Letting $u = 6x$, the latter integral equals
      $$
      \frac{1}{12} \int \sin(u) \, du = -\frac{1}{12} \cos(u) + C = -\frac{1}{12} \cos(6x) + C
      $$

   2. (3 points) Compute $\int x \sin(\pi x) \, dx$
      
      **Solution:** Integration by parts gives
      $$
      \int x \sin(\pi x) \, dx = x \cdot -\frac{1}{\pi} \cos(\pi x) - \int -\frac{1}{\pi} \cos(\pi x) \, dx
      = -\frac{1}{\pi} x \cos(\pi x) + \frac{1}{\pi^2} \sin(\pi x) + C
      $$