Name: ____________________ Section: ____________________

Answer all questions and show your work. Unsupported answers may receive *no credit*. You may not use a calculator on this quiz. Allow 15 minutes for the quiz.

1. Find the following integrals

   (a) (3 points) $\int x\sin(2x)\,dx$

   Solution: Set $u = x$, $dv = \sin(2x)\,dx$ so $du = 1\,dx$ and $v = -\frac{1}{2}\cos(2x)$. Then

   $$\begin{aligned}\int x\sin(2x)\,dx &= -\frac{x}{2}\cos(2x) + \frac{1}{2}\int \cos(2x)\,1\,dx\\ &= -\frac{x}{2}\cos(2x) + \frac{1}{4}\sin(2x) + C\end{aligned}$$

   (1 point) for correct u, dv, (1 point) for correct integration by parts, (1 point) for answer, including $+C$.

   (b) (4 points) $\int_0^2 xe^{x^2+1}\,dx$

   Solution: Use the substitution $u = x^2 + 1$. Thus $\frac{1}{2}du = x\,dx$ and when $x = 0$, $u = 1$ and when $x = 2$, $u = 5$ to obtain

   $$\begin{aligned}\int_0^2 xe^{x^2+1}\,dx &= \frac{1}{2}\int_1^5 e^u\,du\\ &= e^u\big|_{u=1}^5\\ &= e^5 - e.\end{aligned}$$

   Defining u and du (1 point). Writing integral in terms of u (1 point). Changing limits (1 point). Answer (1 point).

   Do not accept numerical answers without supporting work.

   Allow other solution methods. If a student finds the anti-derivative in terms and x and then evaluates at 0 and 2, give two points for correct answer.

   (c) (3 points) $\int x^3\ln(x)\,dx$.

   HINT: Use integration by parts with $dv = x^3\,dx$ and $u = \ln(x)$.

   Solution: Following the hint, we have $u = \ln(x)$, $du = \frac{1}{x}dx$, $v = \frac{1}{4}x^4$ and $dv = x^3\,dx$.

Using integration by parts, we have

$$\begin{aligned}\int x^3 \ln(x)\,dx &= \frac{1}{4}x^4\ln(x) - \frac{1}{4}\int x^4 \frac{1}{x}\,dx \\ &= \frac{1}{4}x^4\ln(x) - \frac{1}{4}\int x^3\,dx \\ &= \frac{1}{4}x^4\ln(x) - \frac{1}{16}x^4 + C.\end{aligned}$$

Listing u, du, v, and dv (1 point). Integrating by parts correctly (1 point). Answer (1 point).

Deduct one point if $+C$ is missing, but only deduct once for this mistake.