Math 252 Homework 14 Written Part **Name:**_____

Write legibly. Show your work. Graph neatly. Use a ruler for all straight lines.

Integration by Parts:

(1) Show how to integrate by filling in the blanks:

$\int x \cdot e^x \, dx$

$= \int \underbrace{x}_{u} \cdot \underbrace{e^x \, dx}_{dv}$

$u =$ x	$dv =$ $e^x dx$
$du =$ dx	$v =$ e^x

$= \overbrace{x}^{u} \cdot \overbrace{e^x}^{v} - \int \overbrace{e^x}^{v} \cdot \overbrace{dx}^{du}$

$= x \cdot e^x - e^x + C$

(don't forget + C)

(2) Explain why we choose u = x, instead of u = e^x.

If we chose $u = e^x$, then $dv = x\,dx$.
Then $v = \frac{1}{2}x^2$, which got more complicated rather than simpler.

(3) Show how to check your answer from problem 1 by taking a derivative:

$\frac{d}{dx}\left(\underbrace{x \cdot e^x - e^x + C}_{\text{your answer from problem 1}} \right)$

$= x \cdot e^x + e^x \cdot 1 - e^x + 0$

$= x \cdot e^x + e^x - e^x$

$= x \cdot e^x$ ← Make sure it works out! ✓

(4) Show how to integrate:

$$\int x \cdot \sin(x)\, dx$$

$u = x$	$dv = \sin(x)\,dx$
$du = dx$	$v = -\cos(x)$

$$= \overbrace{x}^{u} \cdot \overbrace{-\cos(x)}^{v} - \int \overbrace{-\cos(x)}^{v} \cdot \overbrace{dx}^{du}$$

$$= -x \cdot \cos(x) + \sin(x) + C$$

(don't forget + C)

(5) Show how to integrate:

$$\int x \cdot \sin(x^2)\, dx$$

Let $u = x^2$
$du = 2x\,dx$
$\frac{1}{2}du = x\,dx$

$$= \int \frac{1}{2} \sin(u)\, du$$

$$= -\frac{1}{2}\cos(u) + C$$

$$= -\frac{1}{2}\cos(x^2) + C$$

(6) Explain how we know that we shouldn't do problem 5 using integration by parts.

Reason 1 If we can do a problem by substitution, that's easier.

Reason 2 Let's try parts:

$u = x$	$dv = \sin(x^2)\,dx$
$du = dx$	

Oops! We don't know how to integrate $\sin(x^2)$!

Stuck