MIDTERM 1 PROBLEM 2.
(graded out of 20 pts)

Find the integral

$$\int x^9 e^{x^5} dx.$$

SOLUTION I
Choose the correct substitution

$$u = x^5, \quad du = 5x^4 dx \qquad\qquad (8\ pts)$$

The resulting integral equals

$$\frac{1}{5}\int u e^u du \qquad\qquad (4\ pts)$$

and can be integrated by parts:

$$\frac{1}{5}\int u e^u du = \frac{1}{5} u e^u - \frac{1}{5}\int e^u du = \frac{1}{5} u e^u - \frac{1}{5} e^u + C \qquad\qquad (6\ pts)$$

back to the original variable x:

$$= \frac{1}{5} e^{x^5}(x^5 - 1) + C \qquad\qquad (2\ pts)$$

SOLUTION II
Rewrite the integral as

$$\frac{1}{5}\int x^5 [5x^4 e^{x^5}] dx$$

then integrate by parts with

$$u = x^5 \text{ and } dv = [5x^4 e^{x^5}]dx, \; v = e^{x^5} \qquad\qquad (12\ pts)$$

to get

$$\frac{1}{5} x^5 e^{x^5} - \frac{1}{5}\int 5x^4 e^{x^5} dx =$$

$$\frac{1}{5} x^5 e^{x^5} - \frac{1}{5} e^{x^5} + C \qquad\qquad (8\ pts)$$

REMARK ON GRADING: iterative integration by parts with u's and v's different from the above without mistakes earns you 12 points. Each computational mistake takes off -2 pts, each mistake in integration -4 pts.