Integration by Parts

We study the integration technique of integration by parts.

$$x^4 e^{2x}$$

- Make a table: one column for u and another for dv. In the first row, rewrite the functions that you will use for u and dv:

u	dv
x^4	e^{2x}

- Add new rows: differentiate items in the u column and integrate items in the dv column to determine what items go in the next row.

u	dv
x^4	e^{2x}
$4x^3$	$e^{2x}/2$
$12x^2$	$e^{2x}/4$
$24x$	$e^{2x}/8$
24	$e^{2x}/16$

Now you combine terms by matching items in the first column with items *one row down*. For the last item in the u column, match it with the last item in the dv column (which you'll end up using twice):

$$x^4 \cdot \frac{e^{2x}}{2} \qquad 4x^3 \cdot \frac{e^{2x}}{4} \qquad 12x^2 \cdot \frac{e^{2x}}{8} \qquad 24x \cdot \frac{e^{2x}}{16} \qquad 24 \cdot \frac{e^{2x}}{16}$$

- To finish, you alternate addition and subtraction. Give a $+$ to the first term, a $-$ to the second, and so on. Last but not least, put an integral on the last term as well:

$$+x^4 \cdot \frac{e^{2x}}{2} - 4x^3 \cdot \frac{e^{2x}}{4} + 12x^2 \cdot \frac{e^{2x}}{8} - 24x \cdot \frac{e^{2x}}{16} + \int 24 \cdot \frac{e^{2x}}{16} dx$$

Example 1.

Learning outcomes:
Author(s): Philip T. Gressman