Calculus 2 Unit 1 worksheet: Integration by parts

Name _____ Date _____ Period _____

1. Find each integral by parts. Name u and dv each time, and say where the answer holds.

(a) $\displaystyle\int \frac{\ln x}{\sqrt{x}}\,dx$

(b) $\displaystyle\int \arctan 3x\,dx$

2. Find $\displaystyle\int (6x+7)\sin 2x\,dx$. Check your answer by differentiating.

3. Evaluate each definite integral exactly, using the definite form of integration by parts.

(a) $\displaystyle\int_0^{\pi/2} x\cos 2x\,dx$

(b) $\displaystyle\int_1^3 \ln(2x-1)\,dx$

4. Use tabular integration to find $\displaystyle\int x^2(x-3)^6\,dx$. Keep $(x-3)^6$ as the factor you integrate; do not expand it.

5. Let $I = \displaystyle\int e^{-x}\sin 3x\,dx$.

(a) Integrate by parts twice, keeping $e^{-x}\,dx$ as dv both times, and solve the resulting equation for I.

(b) Use (a) to evaluate $\displaystyle\int_0^{\pi} e^{-x}\sin 3x\,dx$ exactly.

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6. This problem finds $\int x \ln(x+1)\,dx$ for $x > -1$ in two ways, with $u = \ln(x+1)$ and $dv = x\,dx$ both times.

(a) Use $v = \dfrac{x^2}{2}$. The new integral needs long division.

(b) Use $v = \dfrac{x^2 - 1}{2}$ instead. Explain why this v is allowed, and finish.

(c) Show that your two answers agree.

7. Arjun's astronomy club counts meteors during a shower. In a made-up model, meteors arrive at the rate $r(t) = 30t^2 e^{-t}$ meteors per hour, where t is the number of hours after midnight.

(a) Find a formula for $N(T)$, the number of meteors counted from midnight to T hours after midnight.

(b) Find the exact number counted in the first 4 hours. Then use a calculator and round to the nearest whole meteor.

(c) Leah joins the count at 1 a.m. and leaves at 3 a.m. Find the exact number of meteors in her window, then use a calculator and round to the nearest whole meteor.

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