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Math 125 Quiz 3 — 40 Minutes 12:40-1:20, Tuesday, Oct. 31, 2017

(3 questions, 40 points, no notes or calculator permitted)

In Problems 1 and 2, please show your work clearly, and be sure to include the constant of integration in your answer.

1. (10 points, no partial credit)

$$\int x \cos\left(\frac{\pi}{3}x\right) dx.$$

2. (15 points, no partial credit)

$$\int t(3t+5)^{3/2} dt.$$

3. (15 points, no partial credit) Let R be the region above the x-axis, below the curve $y = xe^x$, and to the left of the line $x = 2$. If R is revolved around the x-axis, the resulting integral can be evaluated by applying integration by parts twice. Set up the integral and do **just the first** integration by parts. That is, your answer should have the form $A - B\int$, where A and B are specific numbers (written in exact form with numbers such as π and e^4) and $\int$ is a definite integral that is simpler. Do **not** evaluate this simpler integral.

Answers

1. $\int x\cos\left(\frac{\pi}{3}x\right)dx = x(\frac{3}{\pi})\sin\left(\frac{\pi}{3}x\right) - \frac{3}{\pi}\int \sin\left(\frac{\pi}{3}x\right)dx = \frac{3x}{\pi}\sin\left(\frac{\pi}{3}x\right) + \frac{9}{\pi^2}\cos\left(\frac{\pi}{3}x\right) + C$

2. Setting $u = 3t + 5$, we get $\int t(3t+5)^{3/2}dt = \frac{1}{9}\int (u-5)u^{3/2}du = \frac{1}{9}\int (u^{5/2} - 5u^{3/2})du =$ $= \frac{1}{9}(\frac{2}{7}u^{7/2} - 2u^{5/2}) + C = \frac{2}{63}(3t+5)^{7/2} - \frac{2}{9}(3t+5)^{5/2} + C$. NOTE: It is also possible to evaluate this integral using integration by parts, in which case you get the equivalent answer $\frac{2t}{15}(3t+5)^{5/2} - \frac{4}{315}(3t+5)^{7/2} + C$.

3. $\pi\int_0^2 x^2e^{2x}dx = \frac{\pi}{2}x^2e^{2x}\Big|_0^2 - \pi\int_0^2 xe^{2x}dx = 2\pi e^4 - \pi\int_0^2 xe^{2x}dx$.