MATH 115 **Name:** ______________________________

In class work 13, Fall 2022 **Row and Seat:**______________________________

In class work 13 has questions 1 through 2 with a total of 9 points. Turn in your work at the end of class *on paper*. This assignment is due *Wednesday 16 November 13:15* PM.

1. Find a formula for each antiderivative.

$\boxed{1}$ (a) $\int (6x+3)(x+1)\,\mathrm{d}x =$

Solution:

$$\begin{aligned}\int (6x+3)(x+1)\,\mathrm{d}x &= \int 6x^2+9x+3\,\mathrm{d}x, && \text{(expand)}\\ &= 6\int x^2\,\mathrm{d}x + 9\int x\,\mathrm{d}x + 3\int 1\,\mathrm{d}x && \text{(linearity)}\\ &= 6\times\frac{1}{3}x^3 + 9\times\frac{1}{2}x^2 + x + C, && \text{(power rule)}\\ &= 2x^3+\frac{9}{2}x^2+x+C. && \text{(simplify)}\end{aligned}$$

The fact $\int 1\,\mathrm{d}x = x + C$ is a special case of the power rule. But it's such a commonly needed antiderivative, we should simply commit it to our long term memory.

$\boxed{1}$ (b) $\int (x-1)(x+2)\,\mathrm{d}x =$

Solution: The process for this problem is much the same as before; my answer is

$$\int (x-1)(x+2)\,\mathrm{d}x = \frac{x^3}{3}+\frac{x^2}{2}-2x+C$$

$\boxed{1}$ (c) $\int \frac{7}{x}+\frac{x}{7}\,\mathrm{d}x =$

Solution: For the interval $(-\infty, 0)$, we have

$$\begin{aligned}\int \frac{7}{x}+\frac{x}{7}\,\mathrm{d}x &= 7\int \frac{1}{x}\,\mathrm{d}x + \frac{1}{7}\int x\,\mathrm{d}x && \text{(linearity)}\\ &= 7\ln(-x)+\frac{x^2}{14}+C.\end{aligned}$$

For the interval $(0, \infty)$, we have

$$\int \frac{7}{x}+\frac{x}{7}\,\mathrm{d}x = 7\ln(x)+\frac{x^2}{14}+C.$$

And for either the interval $(-\infty, 0)$ or $(0, \infty)$, we have

$$\int \frac{7}{x} + \frac{x}{7}\,\mathrm{d}x = 7\ln(|x|) + \frac{x^2}{14} + C.$$

$\boxed{1}$ (d) $\int \frac{x+1}{\sqrt{x}}\,\mathrm{d}x =$

Solution:

1 (e) $\int \cos(23\pi x)\,\mathrm{d}x =$

Solution:

1 (f) $\int \cos(\pi x)^2 + \sin(\pi x)^2\,\mathrm{d}x =$

Solution:

1 (g) $\int 5\mathrm{d}x =$

Solution:

1 (h) $\int \mathrm{e}^{5x}\mathrm{d}x =$

Solution:

$\boxed{1}$ 2. Find numbers a and b such that $\int x\mathrm{e}^x\,\mathrm{d}x = (a+bx)\mathrm{e}^x + C$ is correct. Do this by requiring that $\frac{\mathrm{d}}{\mathrm{d}x}((a+bx)\mathrm{e}^x) = x\mathrm{e}^x$ be an identity.