MATH 202, Spring2024 **Name:** ______________________

In class work week 6 **Row and Seat**: ______________________

In class work **6** has questions **1** through **2** with a total of **6** points. Turn in your work at the end of class *on paper*. This assignment is due *Tuesday 13 Feb 13:20.*

1. For the DE $3y^3\frac{\mathrm{d}y}{\mathrm{d}x}+2x=0$, do the following:

$\boxed{2}$ (a) Find a GS to the DE. Remember that a GS has one arbitrary constant.

Solution: We need to match the given DE to $A'(y)\frac{\mathrm{d}y}{\mathrm{d}x}=B'(x)$. To make the match, we need to subtract $2x$ from the DE. That gives $3y^3\frac{\mathrm{d}y}{\mathrm{d}x}=-2x$. So $A'(y)=3y^3$ and $B'(x)=-2x$. Integrating, we find that $A(y)=y^4$ and $B(x)=-x^2+c$, where $c\in\mathbf{R}$. So a GS to the DE is

$$y^4=-x^2+c. \tag{1}$$

Another GS is

$$y^4=-x^2+\pi c. \tag{2}$$

And another is

$$y^4+14=-x^2+\pi c. \tag{3}$$

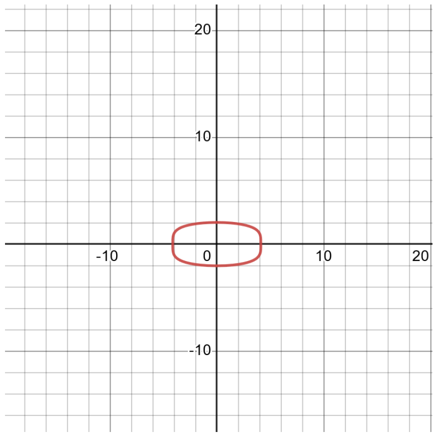
$\boxed{2}$ (b) Find a solution to the DE that satisfies $y=2$ when $x=1$.

Solution: We need to paste $y=2$ and $x=1$ into a GS. That gives

$$2^4=-1^2+c. \tag{4}$$

so $c=17$.

$\boxed{2}$ (c) Use Desmos to graph the solution you found in part 'b.'

Solution: 

2. Find the numerical value of the definite integral $\int_4^8 \frac{1}{5x+1}\,\mathrm{d}x$.

Solution: Let $z = 5x+1$. Then $\mathrm{d}z = 5\mathrm{d}x$. When $x = 4$, we have $z = 21$; and when $x = 8$, we have $z = 41$. So

$$\int_4^8 \frac{1}{5x+1}\,\mathrm{d}x = \int_{21}^{41} \frac{1}{5}\frac{1}{z}\,\mathrm{d}z = \frac{1}{5}\left(\ln(41) - \ln(21)\right). \tag{5}$$

Most folks would say that using the logarithm of a sum rule, a simpler answer is

$$\int_4^8 \frac{1}{5x+1}\,\mathrm{d}x = \frac{1}{5}\ln\left(\frac{41}{21}\right). \tag{6}$$

We could use the identity $y\ln(x) = \ln(x^y)$. That gives an answer

$$\ln\left(\sqrt[5]{\frac{41}{21}}\right), \tag{7}$$

but trading a division by 5 by a fifth root doesn't seem like a simplification.