Mathematics 1110H – Calculus I: Limits, Derivatives, and Integrals
Trent University, Summer 2025 (S62)

Assignment #0 – Plotting With SageMath
*Due on Friday, 20 June.**

Please take a peek at what is in the *SageMath* folder in the *Course Content* section of the course Blackboard site. At the very least, read the handout *Getting Started with* `sage.trentu.ca` that is attached to the link to Trent's SageMath server, and skim through the parts of Chapter 1 of *Sage for Undergraduates*, by Gregory Bard, that have to do with plotting graphs.

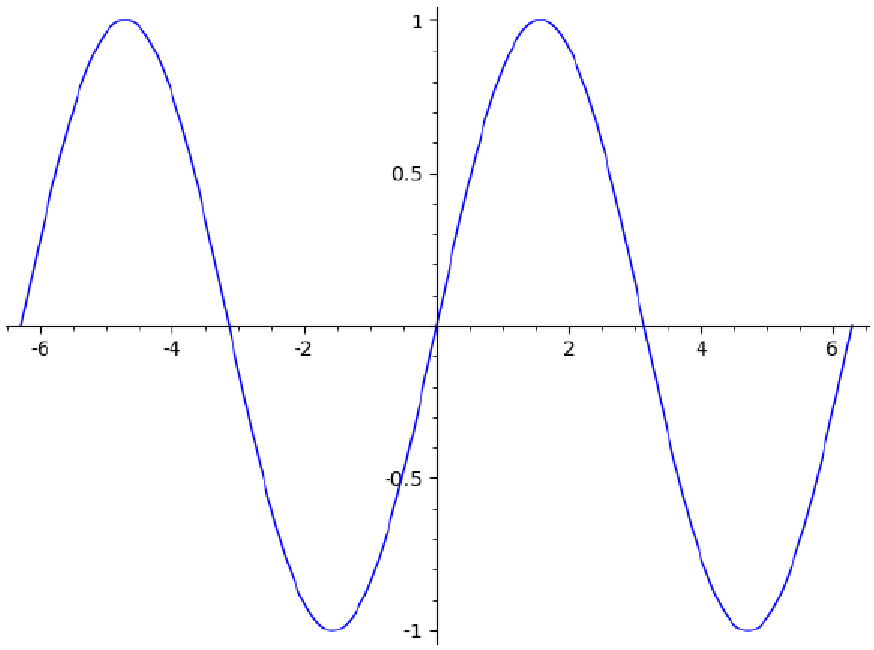
1. Use SageMath to plot each of the functions in **a**–**g** for $-2\pi \le x \le 2\pi$. *[7 = 7×1 each]*

a. $a(x) = \sin(x)$
b. $b(x) = x\sin(x)$
c. $c(x) = \sin\left(x^2\right)$
d. $d(x) = x^2\sin\left(x^2\right)$
e. $e(x) = \sin\left(\frac{1}{x}\right)$
f. $f(x) = x\sin\left(\frac{1}{x}\right)$
g. $g(x) = \frac{1}{x}\sin(x)$

Solutions. Here we go:

```
[2]: # 1a
     plot( sin(x), -2*pi, 2*pi )
```

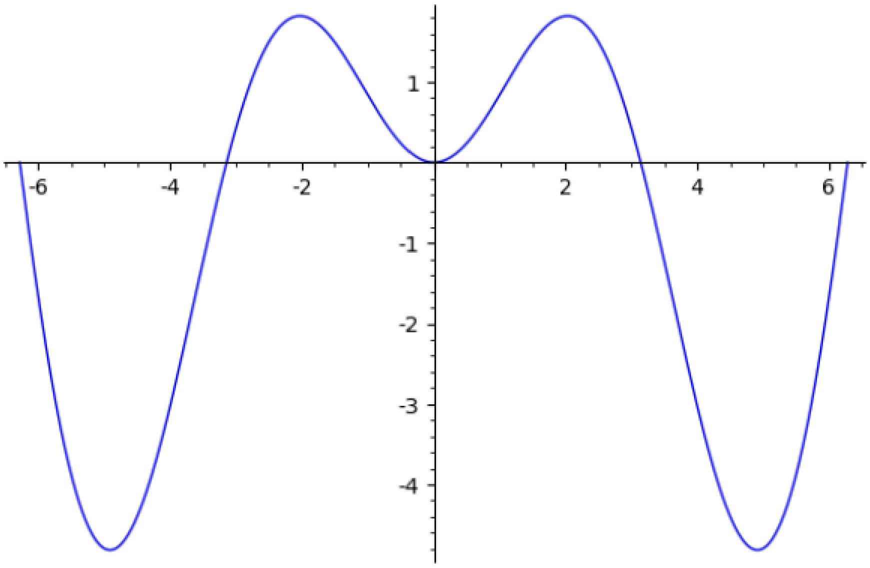
[2]:



* You should submit your solutions via Blackboard's Assignments module, preferably as a single pdf. If submission via Blackboard fails, please submit your work to your instructor by email or on paper. You may work together and look things up, so long as you write up your submission by yourself and give due credit to your collaborators and any sources you actually used.

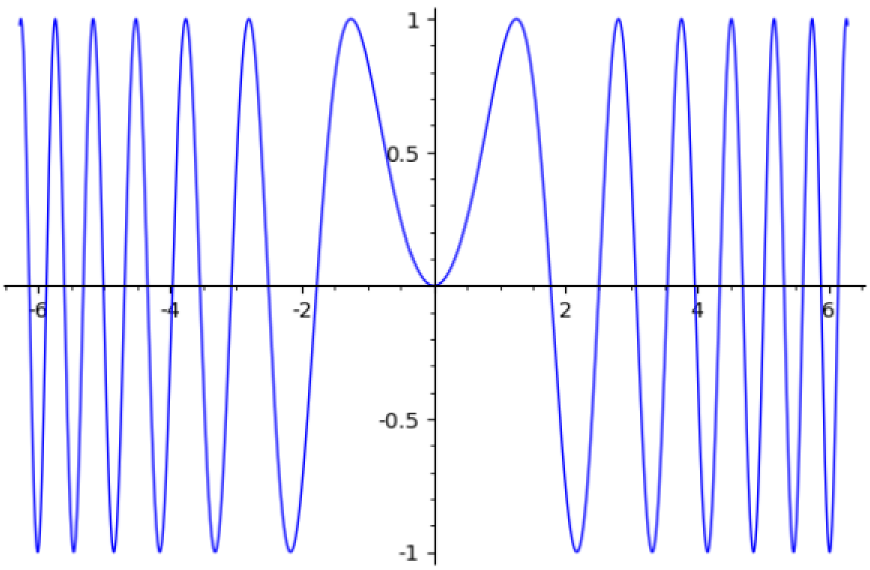
[3]:
```
# 1b
plot( x*sin(x), -2*pi, 2*pi )
```

[3]:



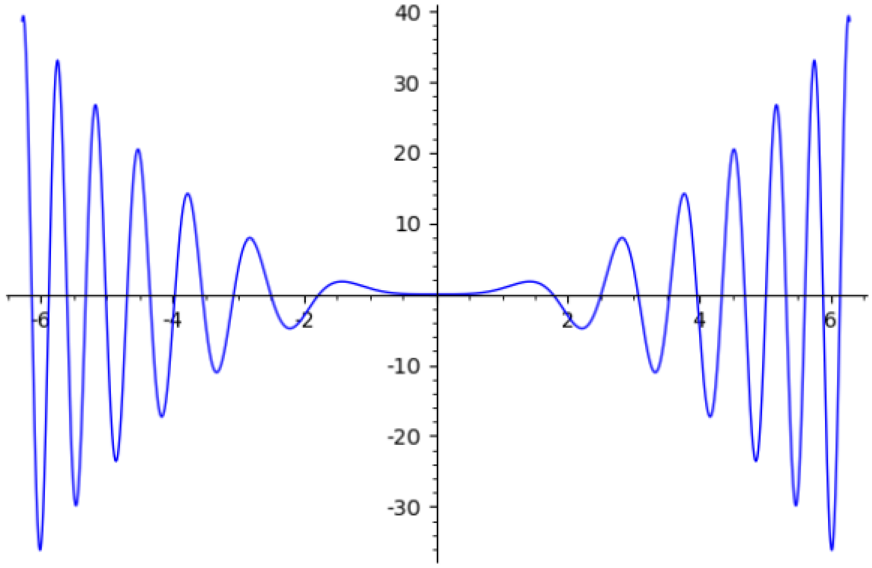
[4]:
```
# 1c
plot( sin(x^2), -2*pi, 2*pi )
```

[4]:



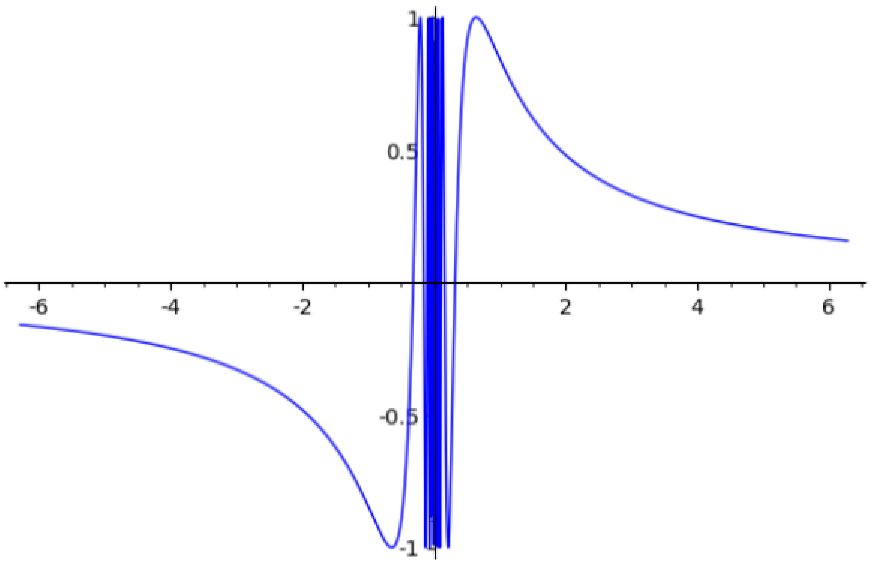
[5]:
```
# 1d
plot( x^2*sin(x^2), -2*pi, 2*pi )
```

[5]:



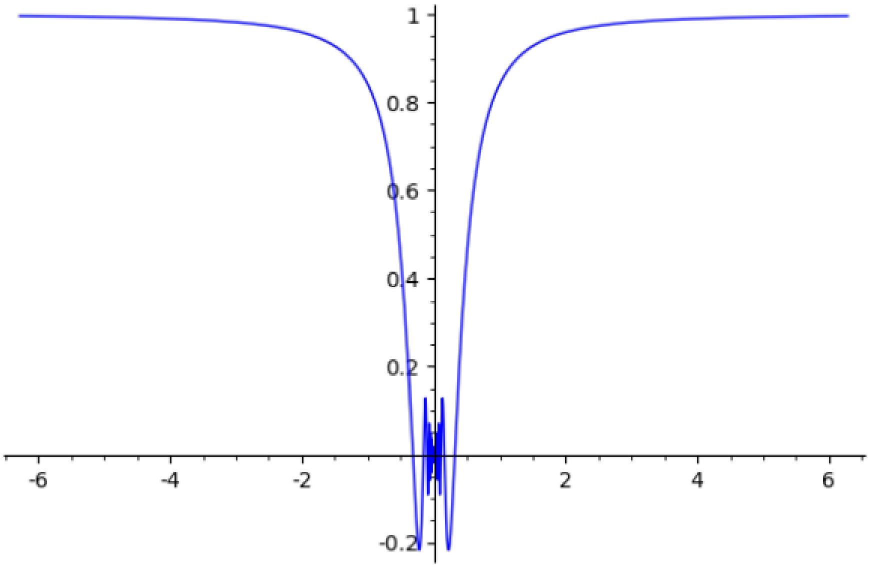
[6]:
```
# 1e
plot( sin(1/x), -2*pi, 2*pi )
```

[6]:



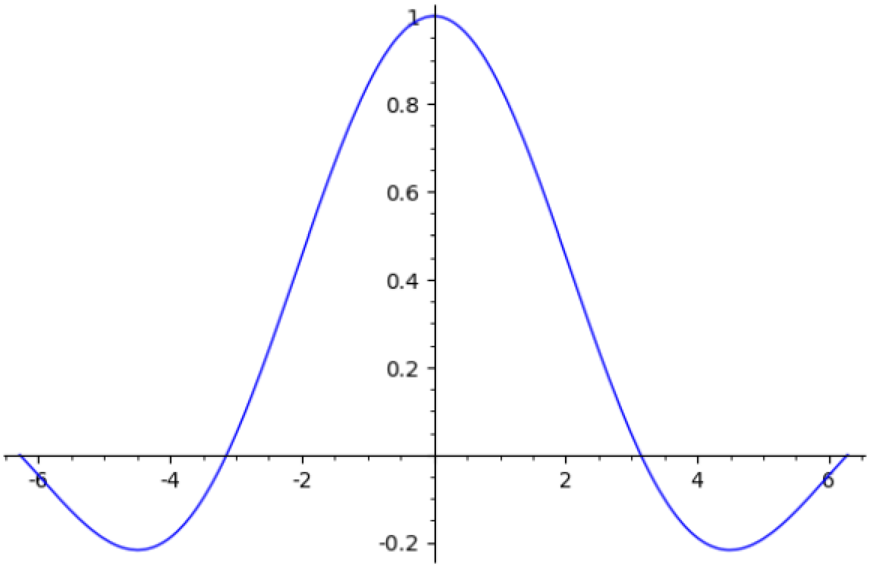
[7]:
```
# 1f
plot( x*sin(1/x), -2*pi, 2*pi )
```

[7]:



[8]:
```
# 1g
plot( sin(x)/x, -2*pi, 2*pi )
```

[8]:



□

2. Each of the functions in parts **e**–**g** of question **1** above is undefined at $x = 0$. For each of these three functions, explain what its value at $x = 0$ really ought to be if we could just give it one, or explain why there is no reasonable way to assign it a value at $x = 0$. *[3 = 3×1 each]*

Hint. Look at their graphs.

SOLUTIONS. **e.** There is no reasonable way to assign a value at $x = 0$ to $e(x) = \sin\left(\frac{1}{x}\right)$. If you look at the graph, the function oscillates ever faster between -1 and 1 as x gets closer and closer to 0. It approaches every point on the y-axis with $-1 \le y \le 1$ pretty much equally, so there is no particular value in this range that fits the function better than any other.

f. The nicest value one could assign to $f(x) = x \sin\left(\frac{1}{x}\right)$ at $x = 0$ would be 0. If you look at the graph, $f(x)$ oscillates infinitely often as x gets closer and closer 0, but the scale of the oscillations decreases down to 0 at the same time.

g. The nicest value one could assign to $g(x) = \frac{1}{x}\sin(x)$ at $x = 0$ would be 1. If you look at the graph, as x gets closer and closer to 0, $g(x)$ gets closer and closer to 1. ■