Week 1: Introduction to Mathematica

Due: Friday, 28 August, 11:59pm on D2L

To receive full credit, you must follow the formatting guidelines found on either the "Homework" tab of the course webpage, or at the end of this week's reading assignment.

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1. Each code segment below doesn't work properly. Match the code segment with the corresponding mistake.[1]

	Input	**Output**
1	`sin[1]`	`sin[1]`
2	`Sin(1)`	`Sin`
3	`Plot[Sin[x],(x,0,Pi)]`	
4	`f[x]=Cos[x]` `f[1]`	`Cos[x]` `f[1]`

	Mistake
(a)	to make a list, you need to use curly brackets, not parentheses
(b)	to evaluate a function, you need to use square brackets, not parentheses
(c)	you must capitalize the names of built in functions
(d)	you must put an underscore after the independent variables on the left side of a function definition

Note: you should use a text cell to answer this question. Your response might be formatted like this:

1	2	3	4
a	b	c	d

although we don't recommend that you use this exact pairing.

2. Consider the function

$$f(\theta) = \begin{cases} \frac{\sin\theta}{\theta} & \theta \neq 0 \\ 1 & \theta = 0. \end{cases}$$

   (a) Is the function continuous? What is the main point of concern? Why is this only point in question? Use *Mathematica* to prove that the function is continuous at this point.

   (b) Plot this function over the domain $-5\pi \leq \theta \leq 5\pi$. Make sure that the y-axis has appropriate limits (i.e. you can see the whole function) and label the axes. Also, modify the style of this plot in at least three ways (e.g. give the plot a title/label, make the function red and thick, and label the axes in a medium font (use the **Style** function)).

[1] Some output will vary with version number

3. Suppose that we have a wire of length 10. We will be cutting the wire, and using one piece to make a circle, and the other a square. The following steps will help us to determine the location at which we should cut the wire in order to maximize the total enclosed area.

   (a) If we cut the wire at some point $x \in [0, 10]$, what is the total enclosed area? Define this to be $f(x)$ (clear f using **Clear** function if you've already used it in your notebook).

   (b) What are the critical points of $f(x)$? The functions **Solve**, **NSolve**, or **FindRoot** might be helpful here.

   (c) Classify the critical point(s) found above.

   (d) Find the location of the global maximum of this function.

   (e) What is the maximum total area enclosed? How should we cut the wire to achieve this maximum area?