Math 300 Test 2   Name: _____

You have two hours. All paper notes are permitted, but no electronic devices of any kind may be used. In all Python questions you may assume that we have already entered `from pylab import *`.

1. (5 *pts*) In the context of computer networking, what does TCP stand for, and what does it do?

   ```
   TCP stands for Transmission Control Protocol.  It is the process that breaks messages
   send over a network into pieces for transmission, and reassembles them at the destination.
   It also maps network traffice to the applications to handle it.
   ```

2. (5 *pts*) Write LaTeX commands to display $$\int_0^N \cos\left(\frac{\pi x}{N}\right) dx.$$

   ```
   $$\int_0^N \cos\left(\frac{\pi x}{N}\right) dx.$$
   ```

3. (6 *pts*) Write Python commands to plot $\sin(x)$ on the interval $[-\pi, \pi]$. Use Pylab, not Sympy.

   ```
   h=.01
   x = arange(-pi,pi+h,h)
   plot(x,sin(x))
   show()
   ```

4. (9 *pts*) Write Matlab commands to evaluate $\sum_{n=1}^{N} \cos\left(\frac{n\pi}{N}\right)$ when $N = 233$.

   ```
   total = sum(cos([1:233]*pi/233))
   ```

5. (10 *pts*) Write Python commands to evaluate $\sum_{n=1}^{N} \cos\left(\frac{n\pi}{N}\right)$ when $N = 233$.

   ```
   total = sum(cos(arange(1,234)*pi/233))
   ```

6. (15 *pts*) Write a Matlab function that can be called as `somenorm(x,p)` that computes and returns $\sum_{k=1}^{n} \frac{|x_k|}{2^{pk}}$, where $x = (x_1, x_2, \ldots, x_n)^T$ and $p \geq 1$. You do not need to test p.

   ```
   function normval=somenorm(x,p)
   normval = sum(abs(x)./(2.^(1*[1:length(x)])))
   ```

   or

   ```
   function normval=somenorm(x,p)
   normval = 0;
   for k=1:length(x)
     normval = normval+abs(x(k)/2^(p*k));
   end
   ```

7. (6 *pts*) Assumimg we imported Sympy as sp, what Python command(s) would you use to find the solutions to $x^4 + 2x^2 + y^2 = 4, x^2 + y^2 = 1$?

```
sp.var('x,y')
solns = sp.solve([x**4+2*x**2+y**2-4,x**2+y**2-1],[x,y])
```

8. (5 *pts*) In the previous question, if we stored those solutions in a list called `solns`, then we can get the x coordinate of the second solution as `soln[1][0]`. How might we evaluate that to 51 decimal places?

```
solns[1][0].evalf(51)
```

9. (5 *pts*) Convert the decimal number 562 to hex.

```
562 = 2*256 + 3*16 + 2 = 232 (hex).
```

10. (9 *pts*) In Python suppose that `a=[1,2,3]`, `b=array(a)`. a) What are the results of the computations `2*a` and `2*b`? b) Supposing that v is the row vector $(1, 2, 3)$, how would you compute vv^T using the Python variables `a` or `b`?

```
a) 2*a = [1,2,3,1,2,3],  2*b = array([2,4,6])
b)dot(b,b) would evaluate that.  To use the list would require a for loop.
```

11. (4 *pts*) Write a CSS specification to cause all paragraphs of class `warning` to appear in red italics.

```
p.warning{color:red; font-style: italic}
```

12. (6 *pts*) Write LaTeX to make the table:

Deafheaven	7%
Trivium	46%
Between the Buried and Me	47%

```
\begin{tabular}{l|r}
\hline
Deafheaven & 7\%\\
Trivium & 46\%\\
Between the Buried and Me & 47\%\\
\hline
\end{tabular}
```

13. (15 *pts*) Write a Python function that can be called as `somenorm(x,p)` that computes and returns $\sum_{k=1}^{n} \frac{|x_k|}{2^{pk}}$, where $x = (x_1, x_2, \ldots, x_n)^T$ and $p \geq 1$.

```
def somenorm(x,p):
    return sum(abs(x)/(2**(k*arange(1,len(x)+1))))
```

or

```
def somenorm(x,p):
    normValue = 0
    for k in arange(0,len(x)):
        normValue += abs(x[k])/(2**(p*(k+1)))
    return normValue
```

Note that we were explicitly given that x was a vector, so we can assume array input - len(x) is ok.