AMAT 2120 — Fall 2005
Assignment 1 — Due Wednesday Sept.28, 2005

$\boxed{1}$ Write a C program to display some mathematical constants and interesting approximations.

For every number, your program should print the mathematical notation or formula and then its value, like this:

```
Pi = ...
22/7= ...
Pi-22/7= ...
  etc.
```

I ask you to compute (in C, not with a calculator!) and print the following values:
a) π (write as `Pi`),
b) 22/7 — approximation to π;
c) the difference of the two in (a) and (b);
d) e (the base of the natural log);
e) π^e (write: `Pi^e`);
f) e^π,
g) the Golden Section $\phi = (\sqrt{5}+1)/2$ (spell ϕ as `phi`),
h) a curious approximate relation of your own.

Hints:
a) Use the constant `M_PI` from library `math.h`;
b) Attention: need floating point division as opposed to integer division;
d) There is no predefined constant for e (unlike for π) in `math.h`, — use the function `exp` and the identity $e = e^1$;
e,g) Use the functions `pow` and `sqrt` respectively;
h) Suppose I found that $\frac{\pi+e}{2}$ is very close to $\sqrt{5} + \ln 2$, I would print the difference.

Arrange a variable for every value you define. Re-use previously computed values where appropriate; do not repeat the same calculation.

Your program must be properly documented: it should contain the required introductory comments (your name, course, assignment no, date, short description), as well as comments necessary to understand the code. Submit a printout of your source code (the "dot-c" file) and a printout of your script file showing how your program compiles and works. Do your best to check and ensure that the printed results are mathematically correct. Often a quick look can reveal a gross error!

$\boxed{2}$ Trace execution of the following fragment of code by hand and determine the final value of the variable w. Assume that all variables are declared as `int`. (Numbers on the left are line numbers. They are not part of the program.)

```
1       u=4;  /*initial value*/
2       v=u-7;
3       u++;
4       v*=3;
5       w=(x-y)/6;
```

Method: Fill in the table (each time one of the values is updated, fill in a new row in the table).

line#	u	v	w	comment
1	4	?	?	(initial assignment)
2				
3				
4				
5				

$\boxed{3}$ a) The variable of type `unsigned short int` occupies 2 bytes and represents a non-negative number. What is the length of such a variable in bits? Find the number of all possible binary sequences of that length and determine the largest value of the said type.

b) As you know, 3-bit long binary sequences can represent all integers from 0 to 7. Alternatively, one can represent positive and negative values in the range $[-4, 3]$; the first bit is used to store sign. Like this: $0 = [000], 1 = [001], 2 = [010], 3 = [011], -4 = [100], -3 = [101], -2 = [110], -1 = [111]$. Using this analogy and the result of (a), find the range of values representable by the 2-byte type `short int`.