MATLAB Practical I: Solutions

1. The first "9" in e^3 appears in the | 7th | position after the decimal point.

   Typing `exp(3)` gives the result `20.0855`. Type `format long` to see more digits. Then `exp(3)` gives the result `20.08553692318767`.

2. The determinant of $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 8 & 7 & 2 \\ 5 & 4 & 0 & 1 \end{pmatrix}$ is | 48 |

   Input the matrix by typing `A=[1 2 3 4; 5 6 7 8; 9 8 7 2; 5 4 0 1]` and find its determinant by typing `det(A)`.

3. The integral of $\Gamma(x)$ from 1 to 3 is approximately | 2.30802733... |

   $\Gamma(x)$ is the Gamma function (use `help gamma` to get a definition). You can use a quadrature rule to approximate its integral, for example `quad('gamma',1,3)` gives an answer `2.3080`. For a more accurate result, adjust the tolerance and use `format long`, e.g. try `quad('gamma',1,3,1e-8)` to get `2.30802733300912`. (Note that the default tolerance is `1e-6`.)

4. The iteration $x := \cos(x)$ converges to | 0.73908513... |

   Here you need to specify a starting value of x, e.g. `x=0;`. You then want to repeatedly overwrite x with $\cos x$ until x and $\cos x$ are the same — well almost the same so you could stop when $|x - \cos x| < 10^{-6}$ say. So you could do the following: `while abs(x-cos(x)) > 1e-6, x=cos(x); end` (Note the use of the semi-colon to suppress all the values of x.) You can find the value of x by typing `x` and compare it with `cos(x)`.

5. The 200th prime in the sequence 2,3,5,7,11,... is | 1223 | Here we can use the `isprime` command where `isprime(n)=1` if n is a prime number and `isprime(n)=0` if n is not a prime number. Thus the number of primes between 1 and n is given by $\sum_{i=1}^{n}$ `isprime(i)`. If we let `nprimes` = $\sum_{i=1}^{n}$ `isprime(i)` then initially we set `nprimes =0` and we want to have `nprimes =200` which can be done by

```
nprimes=0;
n=0;
while nprimes < 200 % keep looping until nprimes=200
  n=n+1; % increase n by one
  nprimes=nprimes+isprime(n); % increases nprimes by one if n is prime
end
n % display answer
```