Problem #1

The no of terms are 1000,000

In this problem it is required that the truncation error should be less than $10^{-6}$ Which can be thought as the true error as it is the difference of the true value and the value calculated from n terms.

\[ F(x) = (\text{sum of n terms of Taylor series}) + \text{truncation error} \]

Where the \( n \)th term is calculated as \( \frac{(-1)^{n-1} x^n}{n} \)

The program below will solve the no. of terms required to reduce the truncation error to $10^{-6}$

```matlab
% PROGRAM TO CALCULATE THE log(2)
clear
x = 1;
no_of_terms = 2;
desired_error = 1.0E-06;
true_error = 1.0E06;
exact_val = log(x+1);
max_no_terms = 50000
while(true_error > desired_error)
    sum = 0.0;
    for n = 1:no_of_terms
        term = (-1)^(n+1)*(x^n)/n;
        sum = sum + term;
    end
    approx_val = sum;
    true_error = abs(exact_val - approx_val);
    no_of_terms = no_of_terms + 1
    if(no_of_terms > max_no_terms)
        stop
    end
end
approx_val
exact_val
true_error
no_of_terms
```

In order to solve \( \ln(10) \) we can write it as

\[ \ln(10) = \ln(2x2x2x1.25) \]
\[ \ln(10) = \ln(2x2x2x1.25) \]
\[ \ln(10) = \ln(2^3) + \ln(1.25) \]

Thus we already have \( \ln(2) \) and \( \ln(1.25) = \ln(1+0.25) \)

Problem #2

% PROBLEM #II (A) - TRAPEZOIDAL RULE FOR EXP(-X^2) IN [0:pi]
clear all
a=0;
b=pi;
n=40;
h=(b-a)/n
y=1;
y0=exp(-(pi)^2)
y0=1;
I=1;
for i=1:n
    y=exp(-(i*h)^2)
    I=I+y
end
I_trap=h*(I-(y0+yn)/2.0)
ea_20=(0.88621840001355-0.88621652520082)/0.88621840001355
\[ e_{40} = (0.88621889268915 - 0.886218840001355)/0.88621889268915 \]

Following are the values of the Function after the intervals:

\[ n=10 \quad I_{\text{trap}} = 0.88621652520082 \quad \text{Approx. rel. error} = - \]
\[ n=20 \quad I_{\text{trap}} = 0.88621840001355 \quad \text{Approx. rel. error} = 2.115519977958109e-006 \]
\[ n=30 \quad I_{\text{trap}} = 0.88621889268915 \quad \text{Approx. rel. error} = 5.559299221081497e-007 \]