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Assignment – 1

1. **Value of polynomial sum:** Given the value of x and the coefficients a_n supplied, calculate the value of the polynomial sum $p(x) = a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \cdots + a_n x^n$.

ANSWER:

```
function result = polyFunc(c,x)
n = length(c);
p = c(n);
i = n;
for i = n:-1:2
p = c(i-1) + p*x;
i = i-1;
end
result = p;
end
```

RESULT – for the coefficient array c = [7 2 0 -3 1 -4 8 11 5 -1 2 3], it will give the value of the polynomial = 7.6834

2. **Evaluation of *Sin(x)* within a given error limit by adding up the series:** Use power series expansion in order to evaluate *Sin(x)* for a given *x*. Truncate the series when the value reaches within the accuracy of allowed error *e* (User defined error limit) set by you.

ANSWER:

```
function result = Sine(x,e)
x=pi/2;
p=0;
t=x;
i=0;
while t>e
    p=p+(-1)^i*t;
```

```
        i=i+1;
        t=t*x^(2)/((2*i+1)*2*i);
    end
    disp(p);

    RESULT -
    Input: pi/2, 1e-5
    Output: 1
```

3. **Machine epsilon:** Determine machine epsilon for the computer you are using. Do this for both single precision and double precision floating point numbers.

ANSWER:

```
function result = Epsilon()
clear all;
e=double(1); %% or single(1)
while (1+e)~=1
    e=e/2;
end
result=e*2;
end

   RESULT -
   Single: 1.1921e-07
   Double: 2.2204e-16
```

4. **Computer arithmetic 1:** Evaluate the expression $y = \sqrt{x^2 + 1.0} - 1.0$ in two ways

(a) $y = \sqrt{x^2 + 1.0} - 1.0$

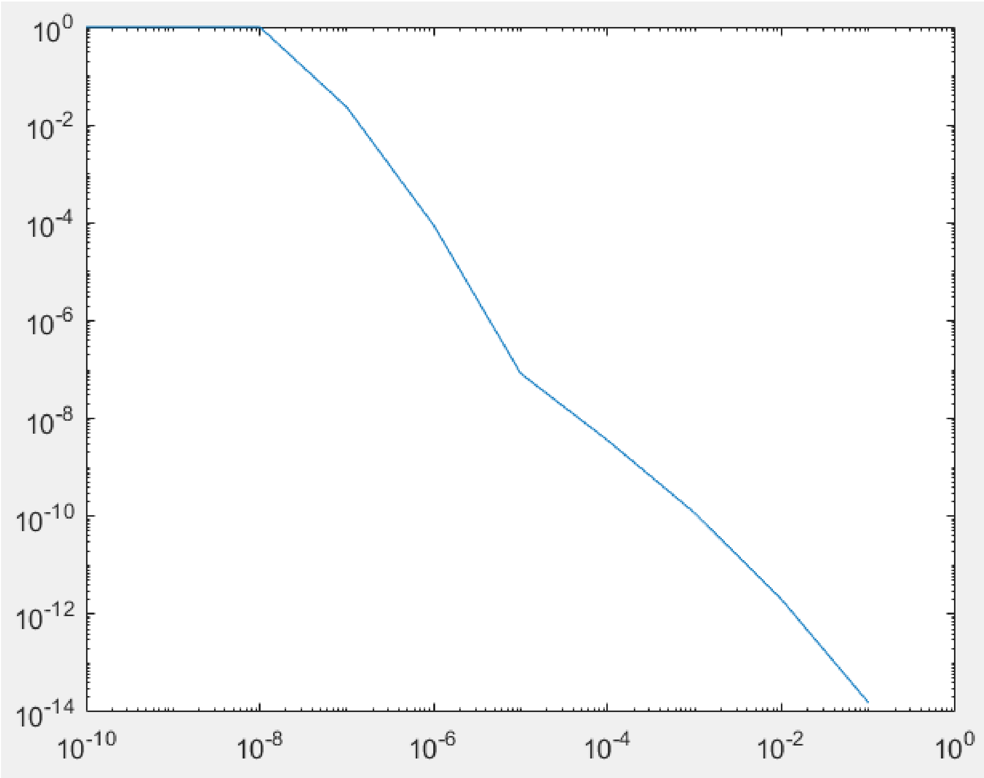
(b) $y = \frac{x^2}{(\sqrt{x^2+1.0}+1.0)}$

for small values of *x*, *x*=[0.1, 0.01, 0.001,0.0001, ..., and so on]. Determine the relative error in both the methods of performing the subtraction. Make a plot of *x* vs. Error in logarithmic scale. Which method is superior, and why?

ANSWER:

```
x=10.^(-1:-1:-30);
y1=sqrt(x.^2+1)-1;
```

```
y2=(x.^2)./(sqrt(x.^2+1)+1);
loglog(x,double(y1))
figure
loglog(x,abs(y2-y1)./y2)
```



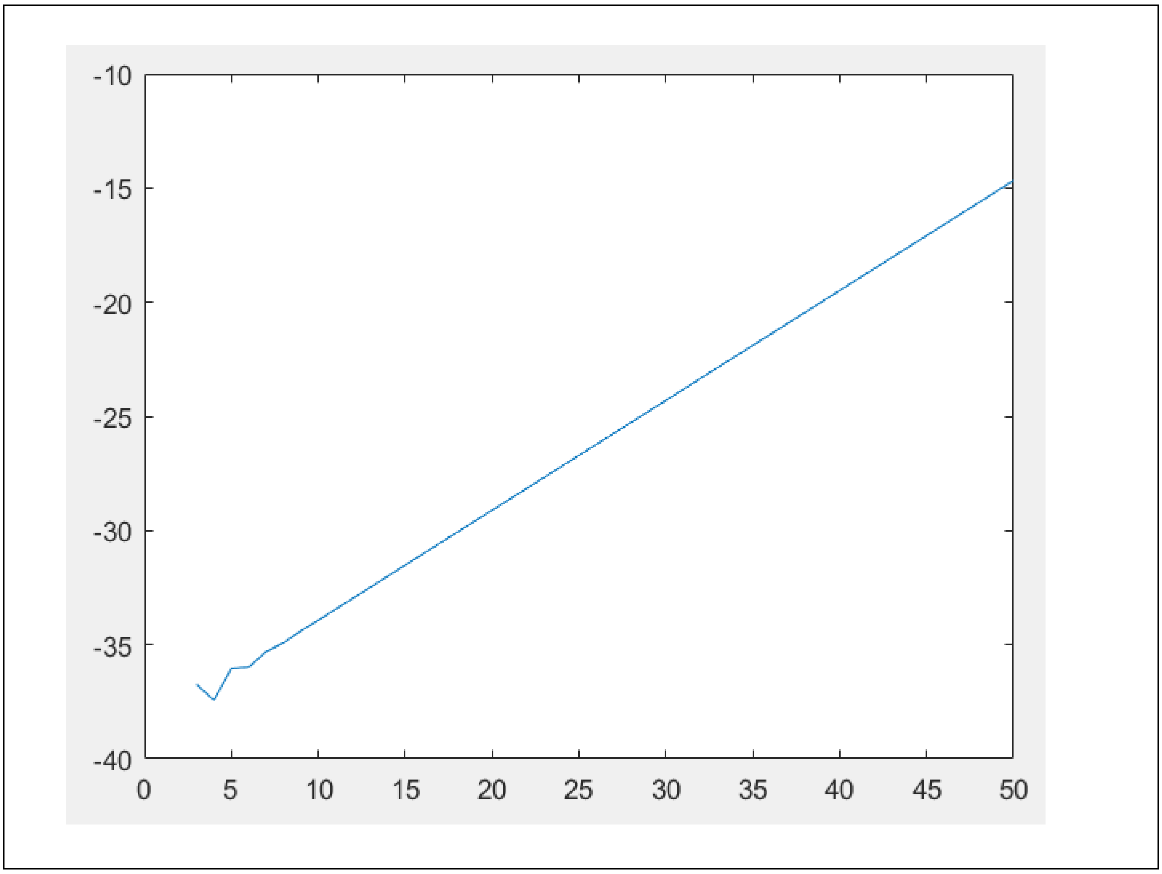
5. **Computer arithmetic 2:** It is desired to calculate all integral powers of the number $x = (\sqrt{5} - 1)/2$.
It turns out that the integral powers of *x* satisfy a recursive relation:

$$x^{n+1} = x^{n-1} - x^n$$

Show that the above recurrence relation is unstable by calculating x^{14}, x^{30}, x^{40} and x^{50} from the recurrence relation and comparing with the actual values obtained by using inbuilt function e.g., (a^b) in matlab.

ANSWER:

```
x=(5^0.5-1)/2;
p=zeros(1,50);
p(1)=1;
p(2)=x;
for i=3:50
    p(i)=p(i-2)-p(i-1);
end
plot(log(abs(p-x.^(0:49))));
```



-10
-15
-20
-25
-30
-35
-40
0
5
10
15
20
25
30
35
40
45
50