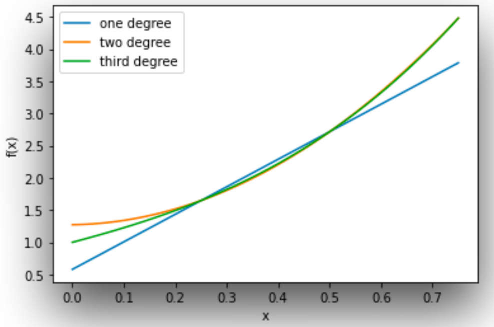
Scientific Computing Lab 03

180123035 - Rahul Krishna

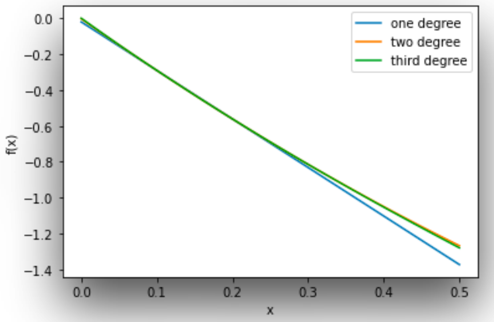
Problem 1:

Output:

```
part (i) :
one Degree approximation f(0.43) = 2.4188032
two Degree approximation f(0.43) = 2.3488631200000003
three Degree approximation f(0.43) = 2.3606047340800003
```

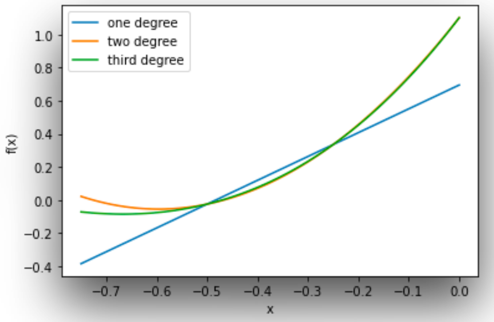



```
part (ii) :
one Degree approximation f(0.18) = -0.506647844
two Degree approximation f(0.18) = -0.508049852
three Degree approximation f(0.18) = -0.5081430744
```

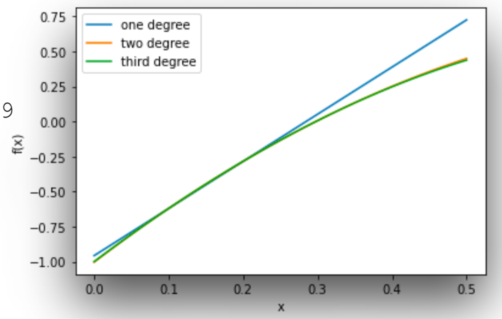


Problem 2:

```
part (i) :
one Degree approximation f(-1/3) = 0.2150416666666667
two Degree approximation f(-1/3) = 0.16988888888888887
three Degree approximation f(-1/3) = 0.1745185185185185
```



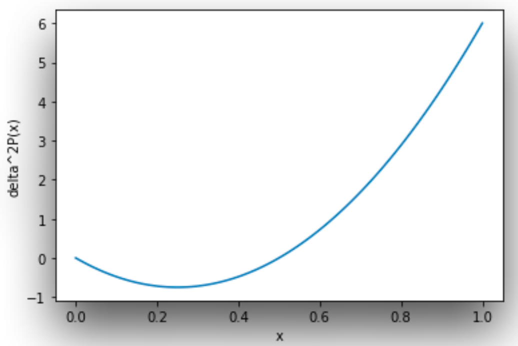

```
part (ii) :
one Degree approximation f(0.25) = -0.11573022999999999
two Degree approximation f(0.25) = -0.13295220624999998
three Degree approximation f(0.25) = -0.13277477437499999
```



Problem 3:

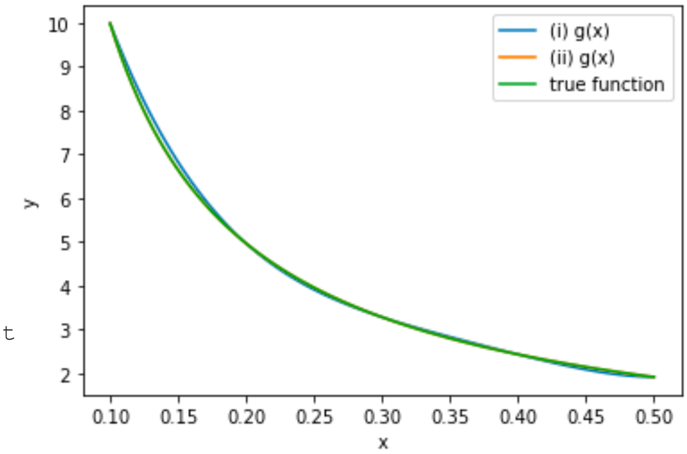
$\Delta^2 P(10) = 1140$

$\Delta^2 P(x) \;=\; 12x^2 - 6x$



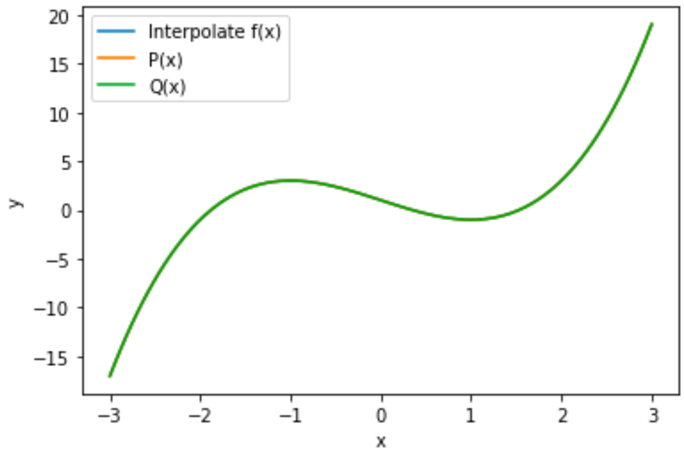
Problem 4:

```
part (i) Approximation g(0.25) =
3.9115984374999995
part (ii) Approximation g(0.25) =
3.9584781250000005
Actual g(0.25) = 3.958463348072367
```



Second approximation is far better than first one. Thus $xg(x)$ gives better approximation.

Problem 5:



(ii) Because one can compare the coefficients of both the polynomial

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Problem 6:

$$P(x) = P(0) + \sum_{k=1}^{n} \frac{x(x-1)\dots(x-k+1)}{k!} \Delta^k P(0)$$

Since, all fourth order difference is 1;

This means $\Delta^4 P(x) = 1 \implies \Delta^5 P(x) = 0 \implies P(x)$ has degree 4

So, for determining coefficient of x^3 we need to look determine

$$\Delta^3 P(0) = \Delta^2(P(1) - P(0)) = \Delta^1(P(2) - 2P(1) + P(0)) = P(3) - 3P(2) + 3P(1) - P(0) = -4$$

And $\Delta^4 P(0) = 1$

$$coeff(x^3) = \frac{-4}{3!} + \frac{-6}{4!} = \frac{-11}{12}$$

Problem 7:

The Interpolating Polynomial takes actual value of the function when the same x-value is given as input.

Thus $f(0.75) = P(0.75) = 6$