



$$P$$

$$f$$

$$s$$

$$s + p/f$$

$$\sin(x, 7) \rightarrow x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!}$$

$$\sin(x, 5) + p/f \rightarrow 7!$$

$$\sin(x, 3) + p/f$$

$$-x^3(-1)x^2 = x^5$$

$$3! \times 4 \times 5 = 5!$$

$$x - \frac{x^3}{3!} + \frac{x^5}{5!}$$

$$\sin(x, 1) + p/f$$

$$(-1)(x)(x^2) = -x^3$$

$$1 * n * (n-1) = 1 * 3 * 2 = 3!$$

$$p = (-1) * p * x = -1(-1) = x$$

return

$$x - \frac{x^3}{3!}$$

Note :- We are giving  $(x)$  in degree  
it should be converted to radian

$$\therefore 180^\circ = \pi$$

$$1^\circ = \pi/180$$

$$x^\circ = (x * \pi)/180$$

Optimized

$$x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!}$$

$$x \left[ 1 - \frac{x^2}{3!} + \frac{x^4}{5!} - \frac{x^6}{7!} + \frac{x^8}{9!} \right]$$

$$x \left( 1 - \frac{x^2}{3!} \left( 1 - \frac{x^2}{5 \times 4} + \frac{x^4}{7 \times 6 \times 5 \times 4} - \frac{x^6}{9 \times 8 \times 7 \times 6 \times 5 \times 4} \right) \right)$$

$$x \left( 1 - \frac{x^2}{3!} \left( 1 - \frac{y^2}{5 \times 4} \left( 1 - \frac{x^2}{7 \times 6} + \frac{y^4}{9 \times 8 \times 7 \times 6} \right) \right) \right)$$

$$x \left( 1 - \frac{x^2}{3!} \left( 1 - \frac{x^2}{5 \times 4} \left( 1 - \frac{x^2}{7 \times 6} \left( 1 - \frac{x^2}{9 \times 8} \right) \right) \right) \right)$$

first evaluation then calling here we do tail recursion (not exactly but last is call then returning

$$y = 1$$

$$y = y * (-1) \left( \frac{y^2}{n(n-1)} \right) + 1$$

(Static)

calling

long double sine(long double x, int n)

```
{
    static long double result = 1;
    if (n == 1)
    {
        return x;
    }

    result = result * (-1) * x^2 / (n(n-1)) + 1

    sine(x, n-2)

    return result;
}
```

result

sine(x, 7)

$$y = \cancel{1} * (-1) * \frac{y^2}{n \times (n-1)} + 1$$

$$= - \frac{1^2}{7 \times 6}$$