Homework I in IAG0581

Calculating function $y = f(x)$

According to the last number of your birthdate choose function argument (x) finding method and according to your birthdate choose the function $y = f(x)$.

Come up with an algorithm to solve the task and implement code in C that corresponds to the algorithm. The homework should include both, the algorithm and the code.

All of the input data should be inserted from keyboard and it can any real number.

Results will be outputted on the display as a table with arguments in the first column and corresponding function values in the second column. For example:

Argument	**Function**
x_1	y_1
x_2	y_2
…	…
x_n	y_n

NB! Function value should be displayed only if it exists i.e. it is final and real number. Else if function value is not defined (it is infinite) or it is complex number, program should display ‘not available’ or ‘complex number’. For complex number you can also display the value in the form of $a + bi$, where a is the real part and b is the imaginary part.

To verify the results, graph the results with any software of your liking, e.g. MS Excel or OpenOffice and add it to your report.

Methods for finding the argument

Chosen by the last number of you birthdate

0. User inputs a starting value A, stopping value B, step H and step’s coefficient C. The conditions $B > A$ and $H, C > 0$ have to be true. The function will be calculated in the following points until $x_N \leq B$ and $N \leq 15$ (N – number of total steps):

$$\boldsymbol{x_1 = A}$$
$$\boldsymbol{x_2 = A + H}$$
$$\boldsymbol{x_3 = A + H + C \cdot H}$$
$$\boldsymbol{x_4 = A + H + C^2 \cdot H}$$
…

1. User inputs a starting value A, stopping value B and step H. The conditions $B > A$ and $H, C > 0$ have to be true. The function will be calculated in the following points until $x_N \leq B$ and $N \leq 15$ (N – number of total steps):

$$\boldsymbol{x_1 = A}$$
$$\boldsymbol{x_2 = A + H}$$
$$\boldsymbol{x_3 = A + 2 \cdot H}$$
$$\boldsymbol{x_4 = A + 3 \cdot H}$$
…

2. User inputs a starting value A, stopping value B and number of steps N, where $H = (B - A)/N$. The function will be calculated in the following points while $N \leq 15$:

$$\boldsymbol{x_1 = A}$$
$$\boldsymbol{x_2 = A + H}$$

$x_3 = A + 2 \cdot H$

...

$x_N = B$

3. **User inputs a starting value A, step value H and number of steps N. The function will be calculated in the following points until $N \leq 15$:**

$x_1 = A$
$x_2 = A + H$
$x_3 = A + 2 \cdot H$

...

$x_N = A + N \cdot H$

4. **User inputs a starting value A, stopping value B, step initial value H and step coefficient C. The function will be calculated in the following points until $x_N \leq B$ and $N \leq 15$:**

$x_1 = A$
$x_2 = A + H$
$x_3 = A + H + C \cdot H$
$x_4 = A + H + C \cdot H + C^2 \cdot H$

...

5. **User inputs a starting value A, number of steps N, initial step value H and step coefficient C. The function will be calculated in N points, however $N \leq 15$:**

$x_1 = A$
$x_2 = A + H$
$x_3 = A + H + C \cdot H$
$x_4 = A + H + C^2 \cdot H$

...

$x_n = A + H + C \cdot H + \ . \ . \ . + C^N \cdot H$

6. **User inputs a starting value A, function upper limit (maximum value) YM and step H. The function will be calculated in points:**

$x_1 = A$
$x_2 = A + H$
$x_3 = A + 2 \cdot H$
$x_4 = A + 3 \cdot H$

...

Until function value does not exceed YM and $N \leq 15$.

7. **User inputs a starting value A, function lower limit (minimal value) YM and step H. The function will be calculated in points:**

$x_1 = A$
$x_2 = A + H$
$x_3 = A + 2 \cdot H$
$x_4 = A + 3 \cdot H$

...

Until function value exceeds YM and $N \leq 15$.

8. **User inputs a starting value A, function upper limit (maximal value) YM, step's initial value H and coefficient C. The function will be calculated in points:**

$x_1 = A$
$x_2 = A + H$

$\boldsymbol{x_3 = A + H + C \cdot H}$
$\boldsymbol{x_4 = A + H + C^2 \cdot H}$
…
Until function value does not exceed YM and $\boldsymbol{N \leq 15}$.

9. **User inputs a starting value A, function lower limit (minimal value) YM, step's initial value H and coefficient C. The function will be calculated in points:**
   $\boldsymbol{x_1 = A}$
   $\boldsymbol{x_2 = A + H}$
   $\boldsymbol{x_3 = A + H + C \cdot H}$
   $\boldsymbol{x_4 = A + H + C^2 \cdot H}$
   …
   Until function value exceeds YM and $\boldsymbol{N \leq 15}$.

<u>Functions</u>

Chosen by your birthdate

1) $y = 2^{-x} + \left(x + x^{\frac{1}{4}}\right)^{\frac{1}{2}}$

2) $y = \left(e^{x - \frac{1}{\sin(x)}}\right)^{\frac{1}{4}}$

3) $y = \frac{x + \left(\frac{1}{x^2+4}\right)}{(1+x^3)}$

4) $y = x + \frac{x}{x + \frac{x^2}{x + \frac{x^3}{5}}}$

5) $y = \frac{1}{x} * \ln\left(\sqrt{e^{x-1}}\right)$

6) $y = \frac{\sqrt{8+|x-1|^2+1}}{x^2+x+2}$

7) $y = (2 + x) \cdot \frac{x + \frac{1}{x}}{x^2 + \frac{1}{1+x^2}}$

8) $y = \frac{\frac{1}{\cos(x)}}{\sqrt{1+\sin(x^2)}}$

9) $y = \frac{\sqrt{x^3+1}}{3-x^2}$

10) $y = \frac{1}{\sqrt{x^2 - \frac{1}{x}}} - \frac{2}{3\sqrt{5-x^5}}$

11) $y = \frac{\sqrt{x} \cdot \sin\frac{1}{x}}{x + e^x}$

12) $y = \frac{1}{x^2} + \frac{x}{(4+x)^{\frac{1}{2}}}$

13) $y = \frac{\ln(x+5)}{\sqrt{7+5x+x^2}}$

14) $y = \frac{\sin^2\left(\frac{1}{x}+5\right) + \cos x}{x + e^{x+3}}$

15) $y = 2 - \left(\frac{1+\sqrt{4-x^2}}{1+5x}\right)^{\frac{1}{2}}$

16) $y = \frac{3+e^{x-1}}{1+x^2(3-\tan x)}$

17) $y = \frac{x + \frac{2}{x^2-3}}{e^{x-2} + \frac{1}{(3-x^2)}}$

18) $y = \frac{2x+1}{\sqrt{(2x^2+3x+4)^3 - 7}}$

19) $y = \frac{6x^2 - \left(\frac{1+x^2}{4-x^2}\right)^{\frac{1}{2}}}{8-x^3}$

20) $y = x^2 + \frac{x}{2} - \sqrt{\frac{1}{2x}}$

21) $y = \frac{2x^{\frac{3}{4}}}{\sqrt{1+x}}$

22) $y = \frac{(4x^3+3x^2+2x-4)}{2+\frac{1}{x}}$

23) $y = \frac{\sqrt{x^3}+4x^2}{4-x^2}$

24) $y = \frac{x^3+x^5+7}{x^2-5x+15} \cdot \frac{\sqrt{4.5+x^{\frac{1}{2}}}}{1-(1+x)^{\frac{1}{2}}} \cdot (4x^2 + x + 2)$

25) $y = \frac{x+4}{(x^2-x)^{\frac{1}{2}}} - x^2\sqrt{4 - x^3}$

26) $y = \frac{8x^2-1.5x+4}{8-x^2}$

27) $y = \frac{\left(4+\sqrt{x^2-4}\right)}{5x^2}$

28) $y = \left(\frac{\left(1+2x^2+x\right)}{x^3+x-21}\right)^{\frac{1}{2}}$

29) $y = \frac{1+\sqrt{x^2-4}}{x-8}$

30) $y = \frac{\sqrt{x^2+x-20}}{x^2+x-10}$

31) $y = 1 - \frac{1-\sqrt{4-x^2}}{40x^2+x^{\frac{1}{2}}}$