Print a .pdf file (with outputs/graphs) for each of the following questions for submission. Round your answer to 6 decimal places unless otherwise specified.

1. There are two parts for this problem: (a) and (b).

   (a) Graph the function $y = \dfrac{7x^2}{80} - \dfrac{\sqrt{x+4}}{2}$. Follow the directions below.

   i. Start with the x-interval $[3, 8]$, and divide it into 300 equal parts.

   ii. Label the axes, and provide the plot with the title: "Lab Practical 1 2D graph".

   (b) Graph the following "discrete data" and the "sine function" on the same set of axes. *Follow the graphing standards.*

t	0	1	2	3	4	5	6	7
C	0.2	1	0.5	-0.25	-0.3	-1	0.2	1

$$y(t) = \frac{1}{2}\, e^{0.2t} \sin(t), \quad t \in [0, 8]$$

2. (a) Write a script using **for loop** to find the sum.

$$\frac{1}{3^2} + \frac{1}{5^2} + \cdots\cdots + \frac{1}{21^2} + \frac{1}{10^3} + \frac{1}{20^3} + \cdots\cdots + \frac{1}{50^3}$$

   (b) Write a script to find the first 12 terms of the following sequence, and display them (all 12).

$$a_1 = 2;$$
$$a_n = 1 + 2a_{n-1}, \quad n \geq 2$$

   That is, the next term is 1 more than double the previous term.

3. Consider the following equation for the following two questions.

$$x^2 - e^x + 2 = 0, \qquad x_0 = 2$$

(a) Use the Newton's Method to perform 10 iterations (that is, find x_{10}) to approximate the solution of the following equation. Round your answer to eight decimal places.

(b) Create a **Python function** for the Newton's method and use it with the specified initial approximation x_0 to find x_{10}. Round your answer to eight decimal places. **Your function must take exactly three arguments: $f(x), f'(x)$ and x_0, the initial value.**

4. (a) Write a Python **function** that takes as inputs `a`, `b`, and `c` of a quadratic equation

$$ax^2 + bx + c = 0,$$

and returns the roots of the equation, `r1` and `r2`.

Now use your function to find the roots of (i) $2x^2 - x - 6 = 0$ and (ii) $3x^2 + 2x - 8 = 0$

Provide the function which should take arguments (or inputs): a, b, c; and answers of (i) and (ii) calculated by your function.

Note that the quadratic formula is given by $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

(b) Use a for loop to find the exponential smoothed data with $\alpha = 0.25$.

$$\{50, 45, 32, 56, 83, 58, 34, 48, 33, 66, 49\}$$

5. (a) Note that the Volume and Surface area of a cone are given by

$$V = \frac{1}{3}\pi r^2 h, \quad \text{and} \quad S = \pi r\left(r + \sqrt{h^2 + r^2}\right),$$

respectively. Write **a Python function** that computes the volume and the surface area. Use the function to compute the V and S for the cone where $r = 2, h = 10$.

(b) Write a **for loop** to find thee 18th term, and display as shown below.

$$\{1, 7, 17, \ldots, 2n^2 - 1, \ldots\}.$$

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The 18th term of the sequence is xx.
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