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## Differential Equation Python Quiz 6

**1 (Series Solutions)** Consider the equation below

$$y'' + y = 0 \quad (1)$$

$$y(x) = a_0 \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n)!} x^{2n} + a_1 \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} x^{2n+1} \quad (2)$$

You can rewrite the above equation as follows:

$$y(x) = a_0 y_1(x) + a_1 y_2(x) \quad (3)$$

Your task is to approximate the solution to the above equation by 11 terms. Meaning  $n = 0, 1, \dots, 10$

Given  $a_0 = 1$ ,  $a_1 = 1$

**a)** Plot  $y_1(x)$  in figure 1 (40 points)

**b)** Plot  $y_2(x)$  in figure 2 (40 points)

**c)** Plot  $y_3(x) = \cos x$  in figure 1 and  $y_4(x) = \sin x$  in figure 2 (20 points)

**Bonus** Solve the task without using loops. (20 points) *Hint:* look up `repmat` function in `numpy`

To help you get started with the code:

```
n = 10
```

```
m = 100
```

```
range = 9.5
```

```
x = np.linspace(0, range, m)
```

Upload your Python script as "StudentID\_python\_quiz6.py" to new E3 before Monday 12:00 AM.

No late submissions will be possible.