M104 Quiz 4 (Group work) November 3, 2016 Grade:

Student 1: ____________________ Student 2: ____________________

Student No 1: ____________________ Student No 2: ____________________

1. Suppose that the population (in thousands) of a certain kind of insect after t months is given by the following formula.

$$F(t) = \pi/8t + \cos(\pi/4t) + 10$$

Determine the absolute minimum and maximum population in the first month. You may need to know that $\sqrt{2} \simeq 1.4$ and $\sqrt{3} \simeq 1.7$.

Solution: We want to find absolute minimum and absolute maximum of $F(t)$. Since $F(t)$ is a *nice* function, it is continuous everywhere, so we can use method of closed interval. The interval of interest in this problem is $[0, 1]$.

- evaluate end points

$$F(0) = 0 + \cos(0) + 10 = 11$$

$$F(1) = \pi/8 + \cos(\pi/4) + 10 = \pi/8 + \sqrt{2}/2 + 10 \simeq \frac{3.14}{8} + \frac{1.4}{2} + 10 = \frac{3.14 + 5.6}{8} + 10 = \frac{8.56}{8} + 10 = 11.07$$

- Find the critical points. Note that derivative exists everywhere.

$$F'(t) = \pi/8 - \pi/4 \sin(\pi/4t)$$

$$F'(t) = 0 \Rightarrow \pi/8 - \pi/4 \sin(\pi/4t) = 0$$

$$\Rightarrow \pi/4 \sin(\pi/4t) = \pi/8 \Rightarrow \sin(\pi/4t) = \frac{1}{2} \Rightarrow \pi/4t = \pi/6 \Rightarrow t = \frac{4}{6} = \frac{2}{3}.$$

- evaluate the critical point

$$f(2/3) = \pi/12 + \cos(\pi/6) + 10 = \pi/12 + \frac{\sqrt{3}}{2} + 10 \simeq \frac{3.14}{12} + \frac{1.7}{2} + 10 = \frac{3.14 + 10.2}{12} + 10 = \frac{13.24}{12} + 10 \simeq 11.10$$

- therefore absolute max is $\pi/12 + \frac{\sqrt{3}}{2} + 10$ and absolute min is 11.