Ex 2.3.1 應用迴圈來寫一個程式計算 $sin(x)$, 其中 x 為一個徑度。30 度等於 $30 * PI/180$ 徑度, 例如 $sin(30') = sin(pi/6) = sin(3.14159/6)$ 約等於 0.5。使用 debug 的工具來協助你撰寫此程式。$sin(x)$ 的公式如下, 迴圈跑的越多次值會越精準, 請設定迴圈內的執行次數為 10，並印出結果。(請透過 Math.sin() 來檢驗你的答案是否正確)

$$sin(x) = x - (x^3/3!) + (x^5/5!) - (x^7/7!) + ...$$

```
package lab;
import java.util.Scanner;

public class Main {

	public static void main(String[] args) {
		Scanner keyboard = new Scanner(System.in);
		double angle = keyboard.nextDouble();
		keyboard.close();
		double radian = angleToRadian(angle);
		System.out.println("Java sin:");
		System.out.println(Math.sin(radian));
		System.out.println("My sin:");
		System.out.println(sin(radian));

	}

	public static double angleToRadian(double angle) {
		double pi = 3.14159;
		double radian = angle * pi / 180;
		return radian;
	}

	public static double sin(double x) {
		double vlaue = 0;
		int sign = 1;
		int factorial = 1;
		double java_sin = Math.sin(x);
		for (; Math.abs(vlaue - java_sin) > 0.0000000001; factorial
+= 2) {
			vlaue += sign * power(x, factorial) / fact(factorial);
			sign *= -1;
		}
		return vlaue;
	}

	public static int fact(int n) {
		if (n == 1) {
			return 1;
		}
		return n * fact(n - 1);
	}

	public static double power(double num, int n) {
```

```
            if (n == 1) {
                  return num;
            }
            return num * power(num, n - 1);
      }
}
```

```
30
Java sin:
0.4999996169872557
My sin:
0.4999996170075354
```

心得：

使用 debuger 去找出可疑的地方，理解為何出錯。