

Formal Report Template

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CONTENTS

I. QUESTION 1

A. Part (a)

```
1
2 function RELATIVE_ERROR(VALUE, REFERENCE) {
3     output absolute_value(VALUE - REFERENCE) /
4         REFERENCE
5 }
6 function STD_METHOD_1(X_LIST) {
7     LEN_X = length of X_LIST
8     SUM_X = sum of X_LIST
9     MEAN_X = SUM_X / LEN_X
10
11     STD = 0
12
13     for i=0 to LEN_X - 1 {
14         STD = STD + power((X_LIST[i] - MEAN_X)
15             ,2)
16     }
17
18     STD = power(((1/(LEN_X - 1)) * STD), 0.5)
19
20     output STD
21 }
22
23 function STD_METHOD_2(X_LIST) {
24     LEN_X = length of X_LIST
```

```
25     SUM_X = sum of X_LIST
26     MEAN_X = SUM_X / LEN_X
27
28     STD = 0
29
30     for i=0 to LEN_X - 1 {
31         STD = STD + power(X_LIST[i], 2) - LEN_X*
32             power(MEAN_X, 2)
33     }
34
35     STD = power(((1/(LEN_X - 1)) * STD), 0.5)
36
37     output STD
38
39     X_DATA = some list of elements
40     STD_1 = STD_METHOD_1(X_DATA)
41     STD_2 = STD_METHOD_2(X_DATA)
42     TRUE_STD = numpy(X_DATA, ddof=1)
43
44     output "Method 1" : RELATIVE_ERROR(STD_1,
45         TRUE_STD)
46
47     output "Method 2" : RELATIVE_ERROR(STD_1,
48         TRUE_STD)
```

* Location: MP257

B. Part (b)

C. Part (c)

D. Part (d)

II. QUESTION 2

A. Part (a)

B. Part (b)

C. Part (c)

D. Part (d)

III. QUESTION 3

A. Part (a)

$$\begin{aligned}
 \int_0^1 \frac{4}{1+x^2} dx &= 4 \int_0^1 \frac{1}{1+x^2} dx \\
 &= 4 \arctan(x) \Big|_0^1 \\
 &= 4 \left(\frac{\pi}{4} - 0 \right) \\
 &= \pi
 \end{aligned}$$

B. Part (b)

```

1 Simpson Method: 3.14156862745098
2 Trapezoidal Method: 3.1311764705882354
3 True Value: 3.141592653589793
4 Simpson Relative: 7.647757511045905e-06
5 Trapezoidal Relative 0.003315574025695356

```

C. Part (c)

```

1 Optimized Simpson with 16 Slices :
  3.141592651224822
2 Optimized Trapezoidal with 8192 Slices :
  3.1415926511062726

```

D. Part (d)

1 ppiwn

```

2 1 Error 2: 0.00016276037786200348

```