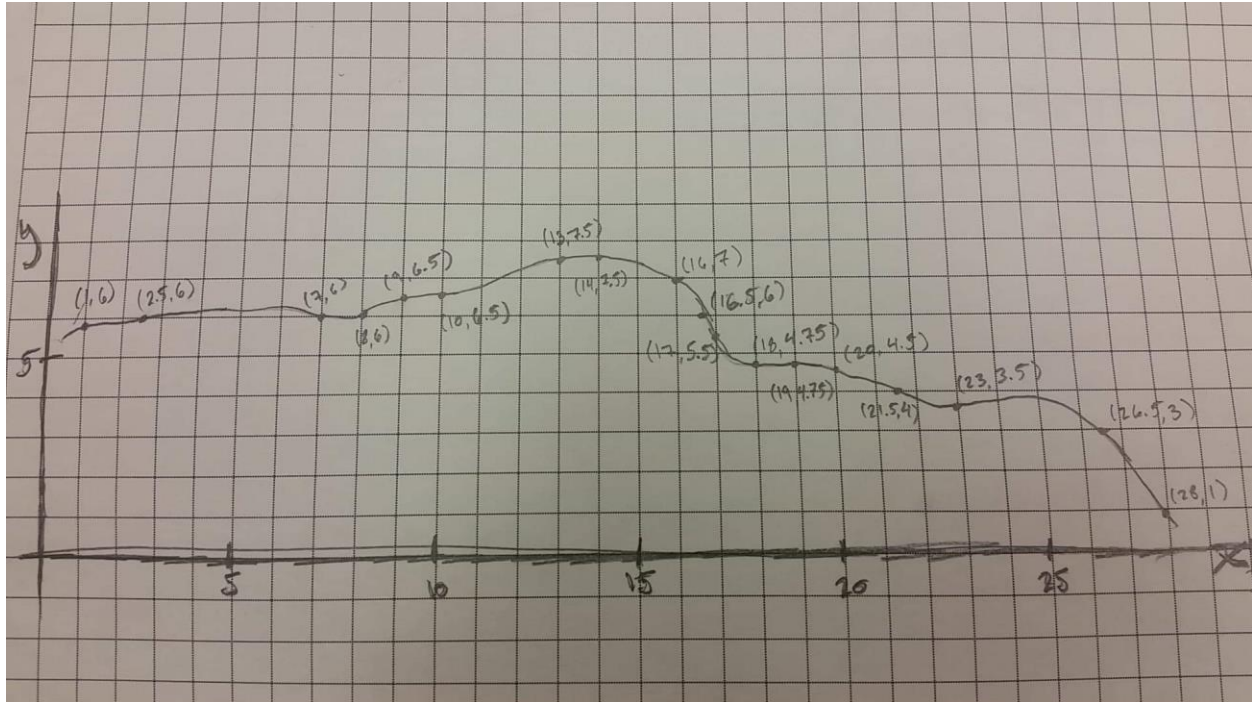


# MATH 366 Methods of Applied Mathematics II

Clayton Johnson

## Project 2: Ch19.5 Area Under Face Curve

### Original Data



### Python

### Spyder Program

```
Editor - K:\MATH366\001-41964\Students\cpjohnson\project2.py
Project 1.py  avg.py  newtoninterp.py  project2.py  fcdpt_2.py  hml.py

1 # -*- coding: utf-8 -*-
2 """
3 Created on Mon Feb 10 08:21:16 2020
4
5 @author: cpjohnson
6 """
7
8 import numpy as np
9
10 # Data collected from my face
11 xdata = np.array([1, 2.5, 7, 8, 9, 10, 13, 14, 16, 16.5, 17, 18, 19, 20, 21.5, 23, 26.5, 28])
12 ydata = np.array([6, 6, 6, 6.5, 6.5, 7.5, 7.5, 7, 6, 5.5, 4.75, 4.75, 4.5, 4, 3.5, 3, 1])
13
14 # Note that the following code could break if len(xdata) < len(ydata)
15
16 # Use rectangle rule to find area under my face
17 rect = 0
18
19 # Use trapezoid rule to find area under my face
20 trap = 0
21
22 for i in range(len(ydata) - 1):
23     # left-hand rule
24     rect += ydata[i] * (xdata[i+1] - xdata[i])
25
26     # Trapezoid rule (How do you catch a zero?)
27     trap += (ydata[i] + ydata[i+1]) * (xdata[i+1] - xdata[i]) / 2.0
28
29 print('Rectangle rule: {}'.format(rect))
30 print('Trapezoid rule: {}'.format(trap))
```

Name	Type	Size	Value
N	int	1	18
h	float64	1	1.5
i	int	1	16
k	int	1	16
n	int	1	17
p	float64	1	142.5
rect	float64	1	147.5
trap	float64	1	144.75
xdata	float64	(18,)	[ 1.  2.5  7.  ... 23. 26.5 28.]

```
Python console
Console 2/A

In [52]: runfile('K:/MATH366/001-41964/Students/cpjohnson/project2.py', wdir='K:/MATH366/001-41964/Students/cpjohnson')
Rectangle rule: {} 147.5
Trapezoid rule: {} 144.75

In [53]:
```

## Python Code

```
Editor - K:\MATH366\001-41964\Students\cpjohnson\project2.py
Project 1.py x avg.py x newtoninterp.py x project2.py x fxdpt_2.py x hw3.py x

1 # -*- coding: utf-8 -*-
2 """
3 Created on Mon Feb 10 08:21:16 2020
4
5 @author: cpjohnson
6 """
7
8 import numpy as np
9
10 # Data collected from my face
11 xdata = np.array([1, 2.5, 7, 8, 9, 10, 13, 14, 16, 16.5, 17, 18, 19, 20, 21.5, 23, 26.5, 28])
12 ydata = np.array([6, 6, 6, 6, 6.5, 6.5, 7.5, 7.5, 7, 6, 5.5, 4.75, 4.75, 4.5, 4, 3.5, 3, 1])
13
14 # Note that the following code could break if len(xdata) < len(ydata)
15
16 # Use rectangle rule to find area under my face
17 rect = 0
18
19 # Use trapezoid rule to find area under my face
20 trap = 0
21
22 for i in range(len(ydata) - 1):
23     # Left-Rectangle rule
24     rect += ydata[i]*(xdata[i+1] - xdata[i])
25
26     # Trapezoid rule (How do you catch a zoid?)
27     trap += (ydata[i] + ydata[i+1]) * (xdata[i+1] - xdata[i]) / 2.0
28
29 print('Rectangle rule: {}'.format(rect))
30 print('Trapezoid rule: {}'.format(trap))
```

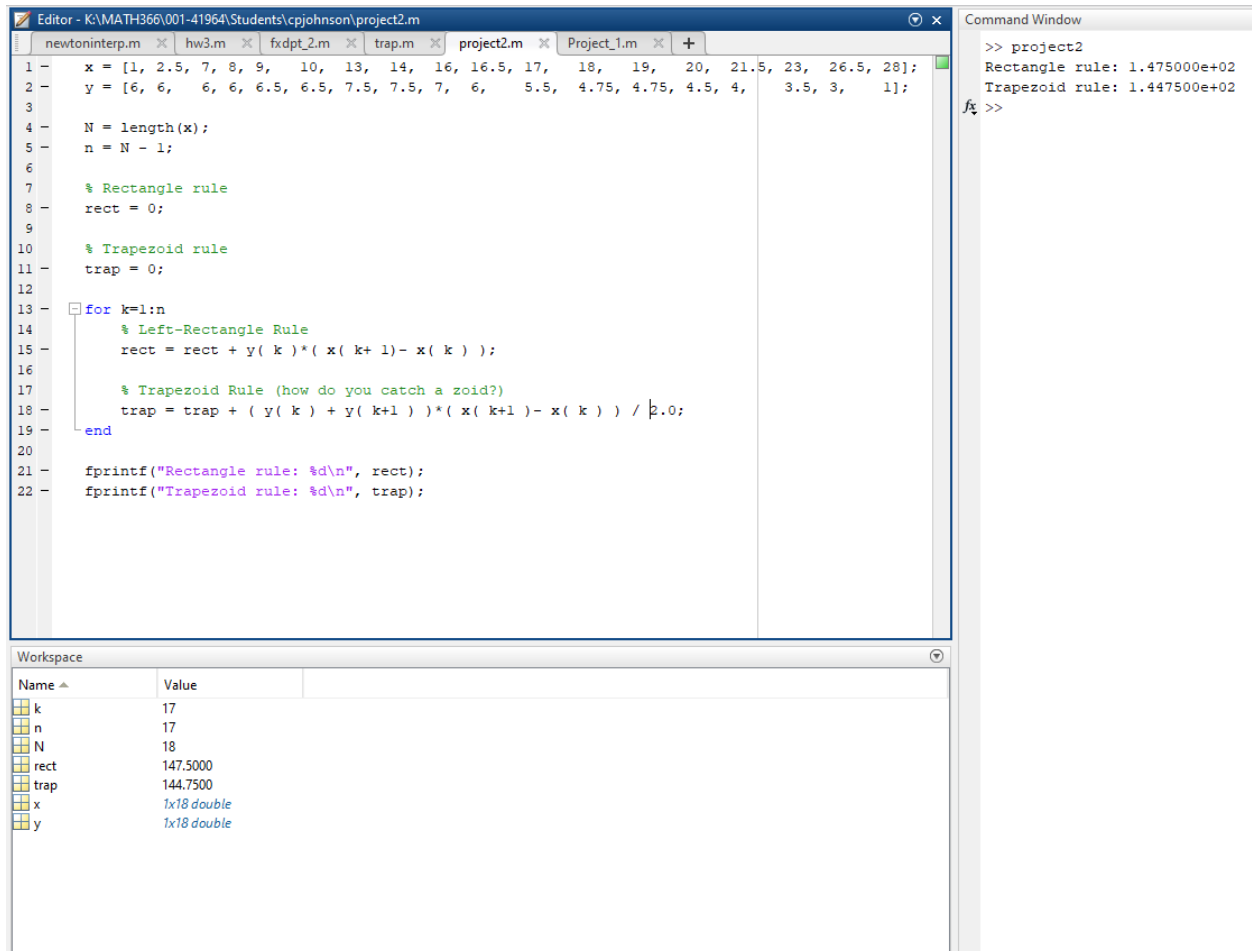
## Python Output

```
In [52]: runfile('K:/MATH366/001-41964/Students/cpjohnson/project2.py', wdir='K:/MATH366/001-41964/Students/cpjohnson')
Rectangle rule: {} 147.5
Trapezoid rule: {} 144.75
```

```
In [53]:
```

## MATLAB

### MATLAB Full



The image shows a MATLAB environment with the Editor, Command Window, and Workspace.

**Editor:** The script `project2.m` is open. It defines two vectors `x` and `y`, calculates the number of points `N`, and implements the Rectangle and Trapezoid rules for numerical integration. The Trapezoid rule calculation includes a comment: `% Trapezoid Rule (how do you catch a zoid?)`.

```
1 x = [1, 2.5, 7, 8, 9, 10, 13, 14, 16, 16.5, 17, 18, 19, 20, 21.5, 23, 26.5, 28];
2 y = [6, 6, 6, 6, 6.5, 6.5, 7.5, 7.5, 7, 6, 5.5, 4.75, 4.75, 4.5, 4, 3.5, 3, 1];
3
4 N = length(x);
5 n = N - 1;
6
7 % Rectangle rule
8 rect = 0;
9
10 % Trapezoid rule
11 trap = 0;
12
13 for k=1:n
14     % Left-Rectangle Rule
15     rect = rect + y(k) * ( x(k+1) - x(k) );
16
17     % Trapezoid Rule (how do you catch a zoid?)
18     trap = trap + ( y(k) + y(k+1) ) * ( x(k+1) - x(k) ) / 2.0;
19 end
20
21 fprintf("Rectangle rule: %d\n", rect);
22 fprintf("Trapezoid rule: %d\n", trap);
```

**Command Window:** The command `>> project2` has been executed, resulting in the following output:

```
>> project2
Rectangle rule: 1.475000e+02
Trapezoid rule: 1.447500e+02
fx >>
```

**Workspace:** The workspace contains the following variables:

Name	Value
k	17
n	17
N	18
rect	147.5000
trap	144.7500
x	1x18 double
y	1x18 double

## MATLAB Code

```
Editor - K:\MATH366\001-41964\Students\cpjohnson\project2.py
Project 1.py x avg.py x newtoninterp.py x project2.py x fxdpt_2.py x hw3.py x

1 # -*- coding: utf-8 -*-
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23     # Left-Rectangle rule
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27     trap += (ydata[i] + ydata[i+1]) * (xdata[i+1] - xdata[i]) / 2.0
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## MATLAB Output

```
In [52]: runfile('K:/MATH366/001-41964/Students/cpjohnson/project2.py', wdir='K:/MATH366/001-41964/Students/
cpjohnson')
Rectangle rule: {} 147.5
Trapezoid rule: {} 144.75
```

```
In [53]:
```