

Riemann Sums I ¹

1. In the command window type:

```
dx = .1  
x = 0:dx:2  
y = 3*x.^2
```

Describe dx, x and y.

2. Next type:

```
format long  
yl = y(1:20)  
L = dx*sum(yl)  
yr = y(2:21)  
R = dx*sum(yr)
```

What are yl and yr? What are L and R? How do they compare with the true value of the integral (what is the percentage errors)?

3. Repeat the above commands, but begin with:

```
dx = .001
```

You will need to adjust the index numbers in the commands for yl and yr. What are the percentage errors of these approximations.

4. To obtain a midpoint Riemann sum type:

```
dx = .1  
x = dx/2:dx:2-dx/2  
y = 3*x.^2  
M = dx*sum(y)
```

Explain why this is a midpoint sum. For $dx = .1$ and $dx = .001$ compute the percentage errors. Make a table of percentage errors in all the above calculations.

5. Repeat all the above commands for the function $f(x) = \sqrt{1 + .5 \sin^2 x}$ (input as `y = sqrt(1 + .5*sin(x).^2)`) and record the answers. The value of this integral correct to 15 significant digits is: 2.27220510258726. Make a table of percentage errors as above.

6. Using complete sentences and standard mathematical notation, prepare a brief (< 1 page) written report answering all the questions. Do **not** get a printout.

The user compares different Riemann sums and considers their accuracy.

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