Plotting graphs and Pylab

August 2017

1. Plot the following ordered pairs and show the graph: (1, 2), (2, 3), (3, 5), (4, -1), (5, 0).

```
from pylab import *
from rmdplot import figsize,savefig
plot([1, 2, 3, 4, 5], [2, 3, 5,-1, 0])
savefig("figure/graphing1.pdf",caption="question 1")
```

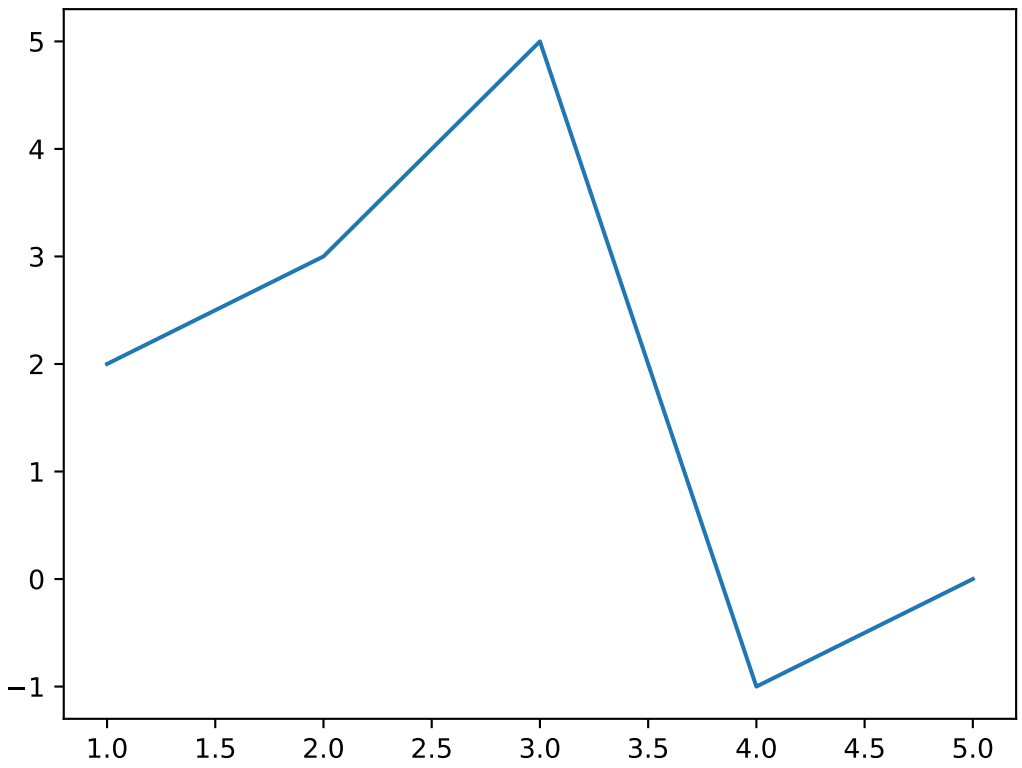

Figure 1: question 1

2. Plot a vertical line extending from (1, 2) to (1, 8) and a horizontal line extending from (4, 4) to (-1, 4).

```
from pylab import *
from rmdplot import figsize,savefig
plot([1, 1],[2, 8])
plot([4, -1],[4, 4])
savefig("figure/graphing2.pdf",caption="question 2")
```

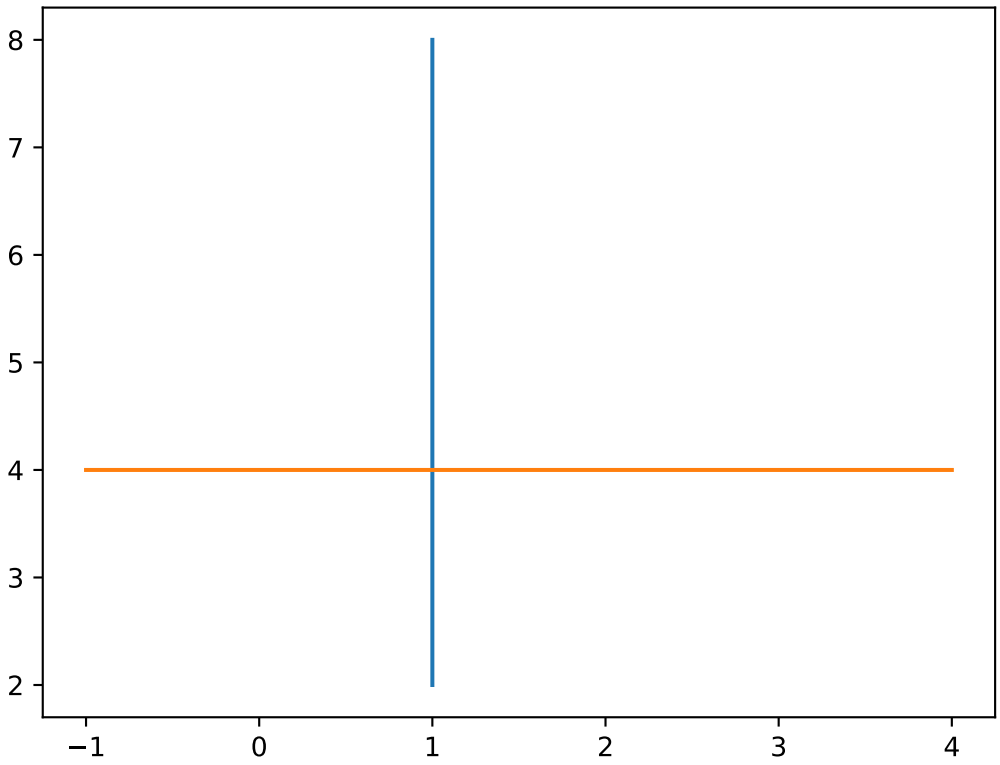

Figure 2: question 2

3. Plot the parabola with domain [-1, 1]. Take the step between points along the x-axis to be 0.1. Have the individual points be shaped as green triangles and the connecting line be dashed.

```
from pylab import *
from rmdplot import figsize,savefig
x_values = arange(-1, 1.1, 0.1)
y_values = x_values**2
plot(x_values, y_values, 'g>--')
savefig("figure/graphing3.pdf",caption="question 3")
```

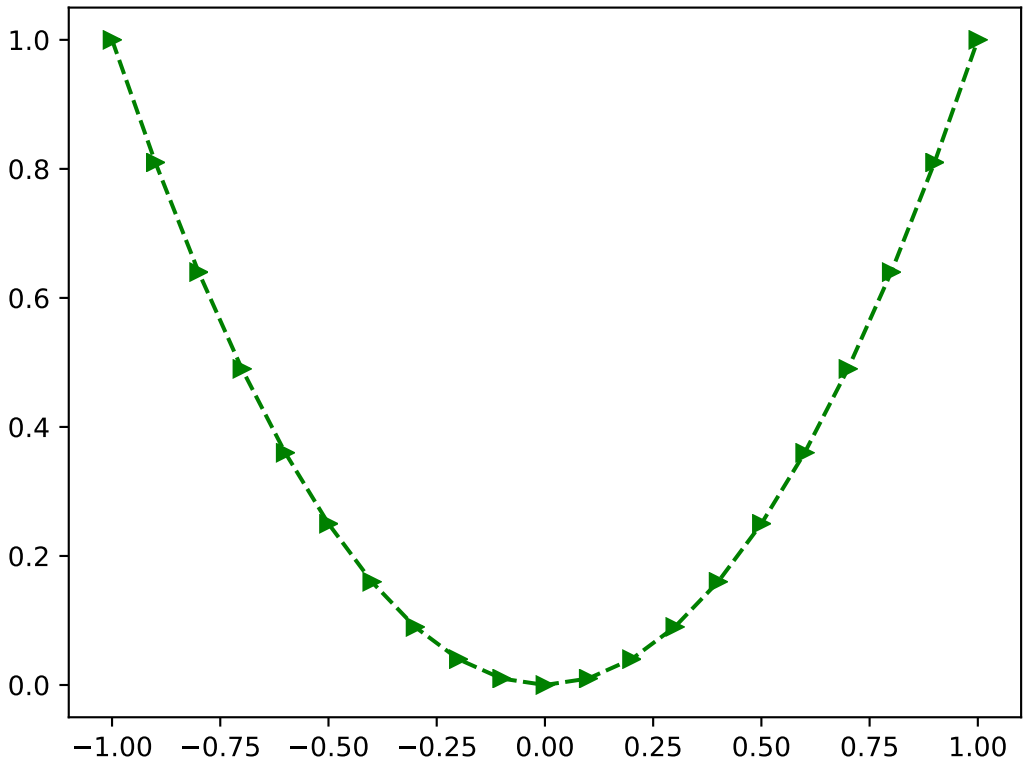

Figure 3: question 3

4. A projectile is launched from an inital height 0 with a speed 4.0 m/s at 45 degrees to the horizontal. Plot the trajectory of the projectile in its plane of motion (letting the x-axis be parallel to the horizontal, and the origin be the initial position of the projectile) from the point of launch to the point where it lands on the ground (assume the ground is level). Make sure to label the axes and add a title to the graph.

```
from pylab import *
from rmdplot import figsize,savefig
x_values = arange(0, 1.64, 0.01)
y_values = x_values * (1 -x_values * 9.8 / 16)
plot(x_values, y_values)
xlabel('Horizontal displacement (m)')
ylabel('Vertical displacement (m)')
title('Projectile Trajectory')
savefig("figure/graphing4.pdf",caption="question 4")
```

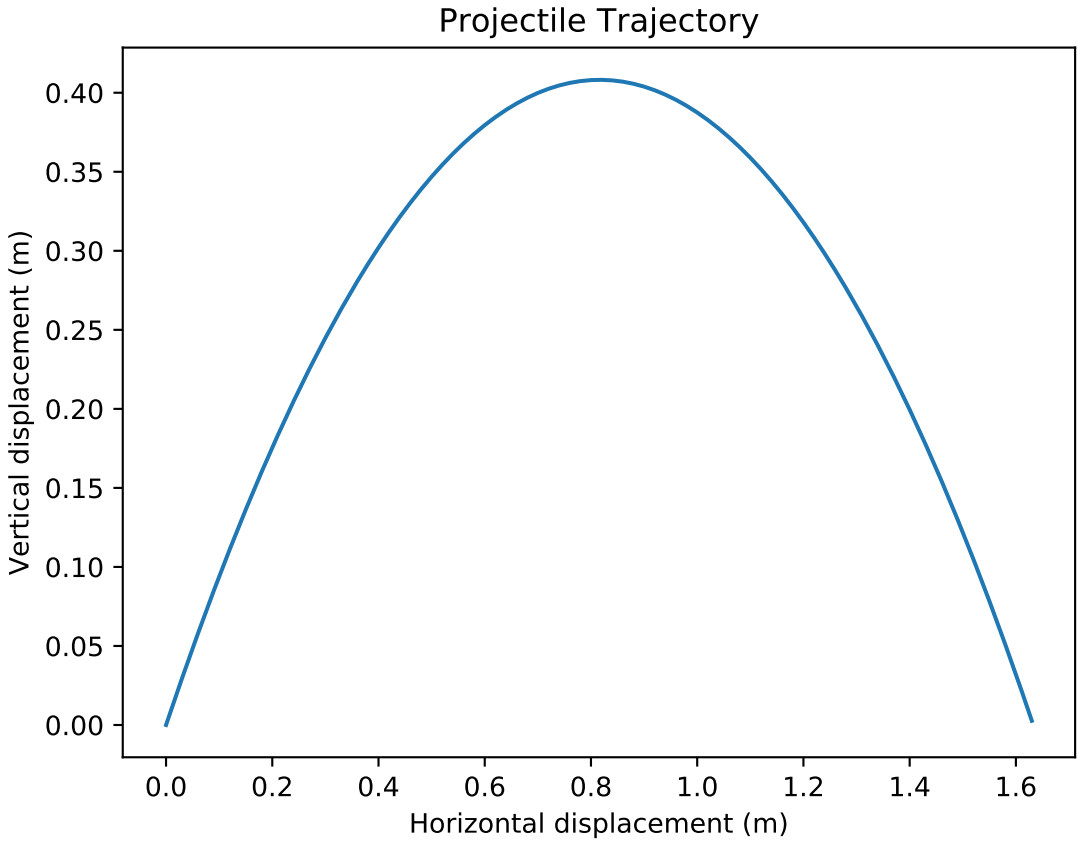

Figure 4: question 4

5. Let $f(x) = \exp(x^2/2)$. Find $f'(x)$ and $f''(x)$, i.e. the first and second derivatives of f. Plot f, f' and f'' in the domain [-1, 1] with step 0.01 along the x-axis. Display all three plots in the same window.

```
from pylab import *
from rmdplot import figsize,savefig
x_values = arange(-1, 1.001, 0.01)
f = []
f_prime = []
f_prime_prime = []
for value in x_values:
    f.append(exp(value**2/2))
    f_prime.append(value * exp(value**2/2))
    f_prime_prime.append((value**2 + 1) * exp(value**2/2))

subplot(3,1,1)
plot(x_values, f)
subplot(3,1,2)
plot(x_values, f_prime)
subplot(3,1,3)
plot(x_values, f_prime_prime)
savefig("figure/graphing5.pdf",caption="question 5")
```

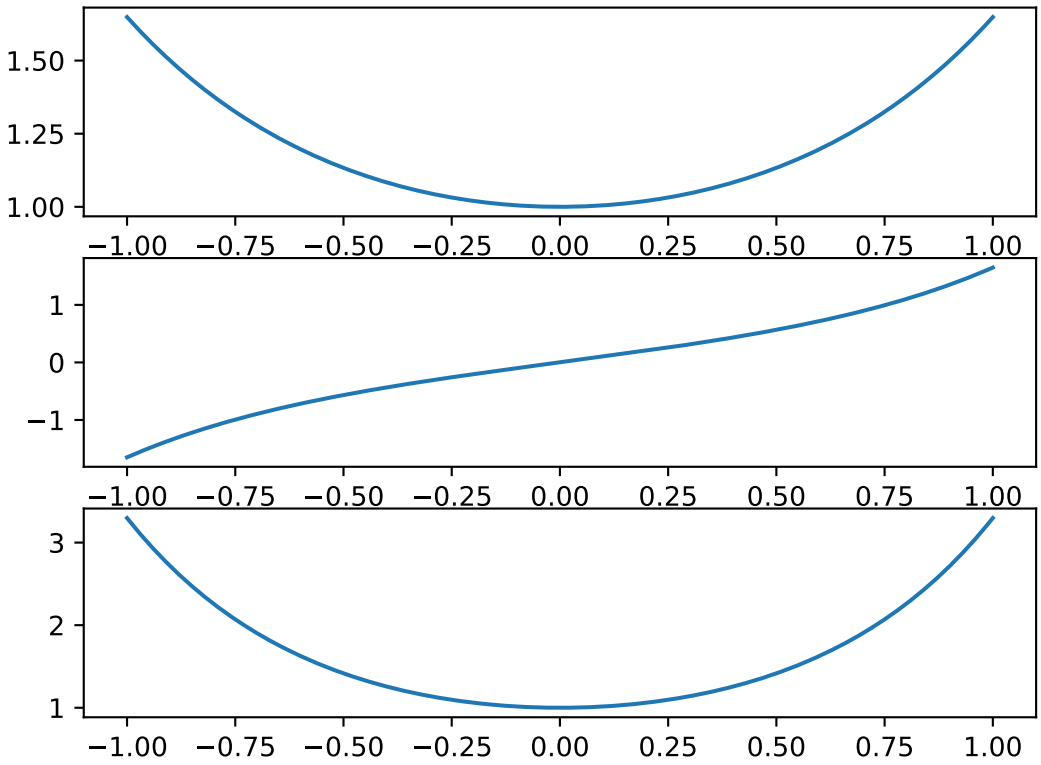

Figure 5: question 5

6. Using the arange function, produce a list of numbers between -10 and 10 at intervals of 0.01. Use this list to plot graphs of:

   i. $y = x$

```
from pylab import *
from rmdplot import figsize,savefig
x_values = arange(-10, 10.001, 0.01)
y_values = x_values
plot(x_values, y_values)
xlabel('x')
ylabel('y')
title("$y=x$")
savefig("figure/graphing6i.pdf",caption="question 6i")
```

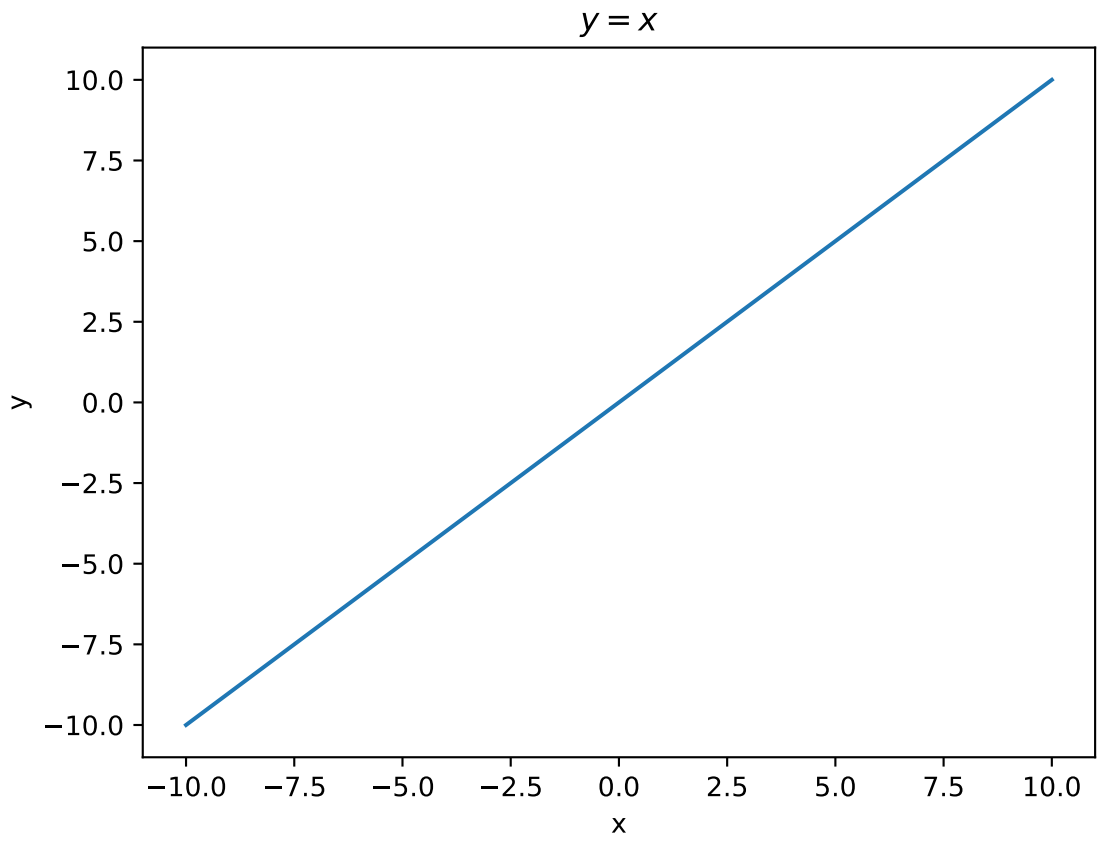

Figure 6: question 6i

ii. $y = x^2$

```
from pylab import *
from rmdplot import figsize,savefig
x_values = arange(-10, 10.001, 0.01)
y_values = x_values**2
plot(x_values, y_values)
xlabel('x')
ylabel('y')
title("$y=x^2$")
savefig("figure/graphing6ii.pdf",caption="question 6ii")
```

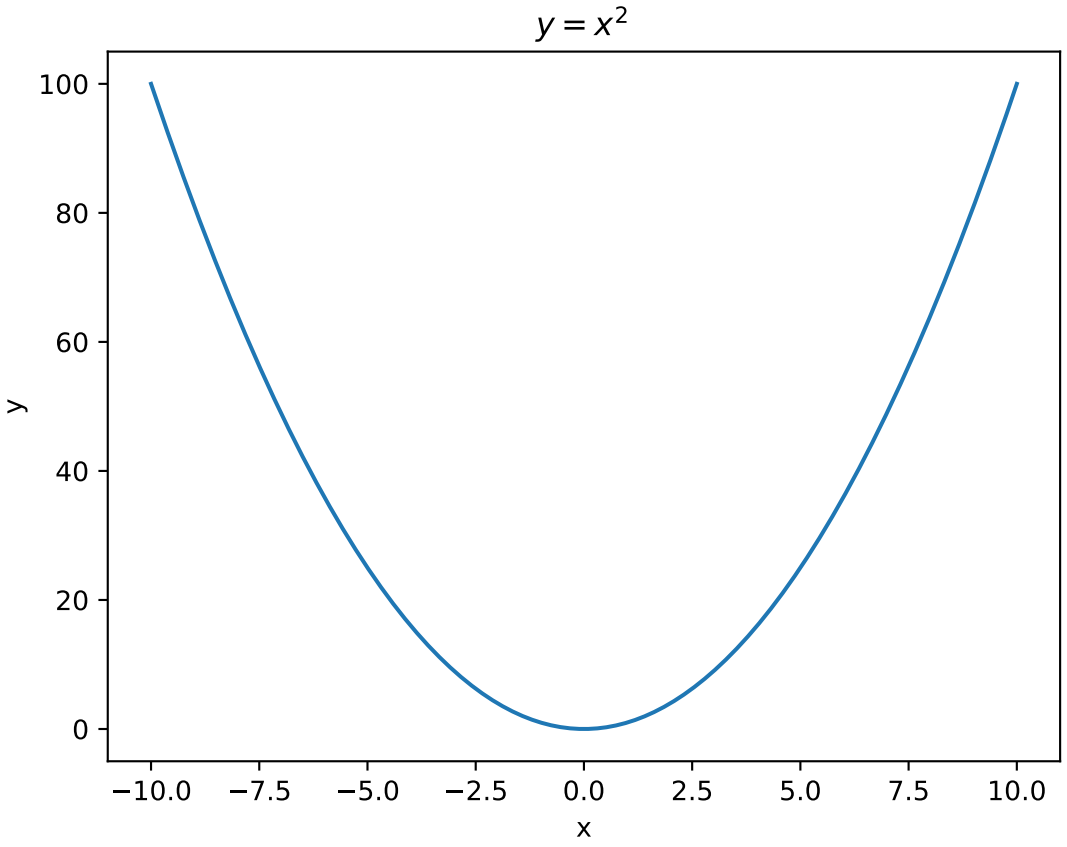

Figure 7: question 6ii

iii. $y = \exp(x)$

```
from pylab import *
from rmdplot import figsize,savefig
x_values = arange(-10, 10.001, 0.01)
y_values = exp(x_values)
plot(x_values, y_values)
xlabel('x')
ylabel('y')
title("$y=\exp(x)$")
savefig("figure/graphing6iii.pdf",caption="question 6iii")
```

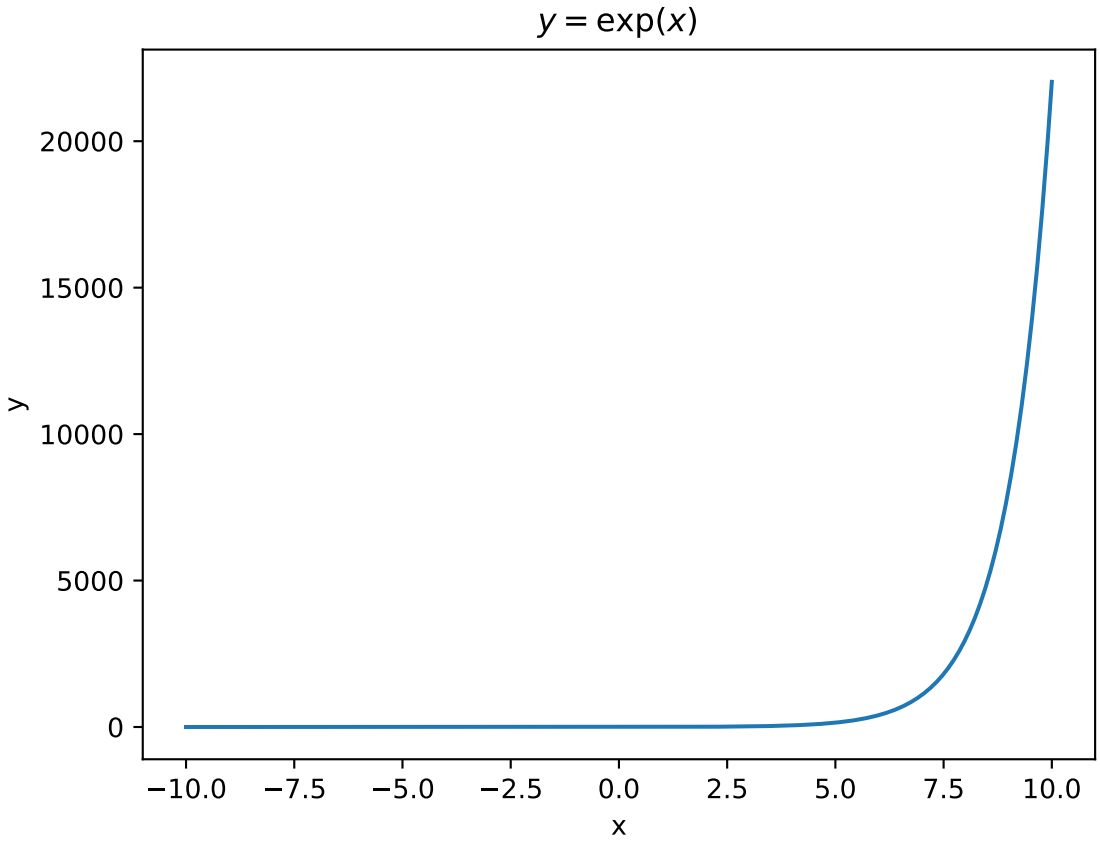

Figure 8: question 6iii

iv. $y = \arctan(x)$

```
from pylab import *
from rmdplot import figsize,savefig
x_values = arange(-10, 10.001, 0.01)
y_values = arctan(x)
plot(x_values, y_values)
xlabel('x')
ylabel('y')
title("$y=arctan(x)$")
savefig("figure/graphing6iv.pdf",caption="question 6iv")
```

Traceback (most recent call last): File “”, line 4, in NameError: name ‘x’ is not defined

Make sure to label your axes and graphs.

7. Plot graphs of the following functions in the domain (0, 1]:

i. $y = \log(x)$

```
from pylab import *
from rmdplot import figsize,savefig
x_values = arange(0.01, 1.001, 0.01)
y_values = log(x_values)
plot(x_values, y_values)
```

```
xlabel('x')
ylabel('y')
title("$y=\log(x)$")
savefig("figure/graphing7i.pdf",caption="question 7i")
```

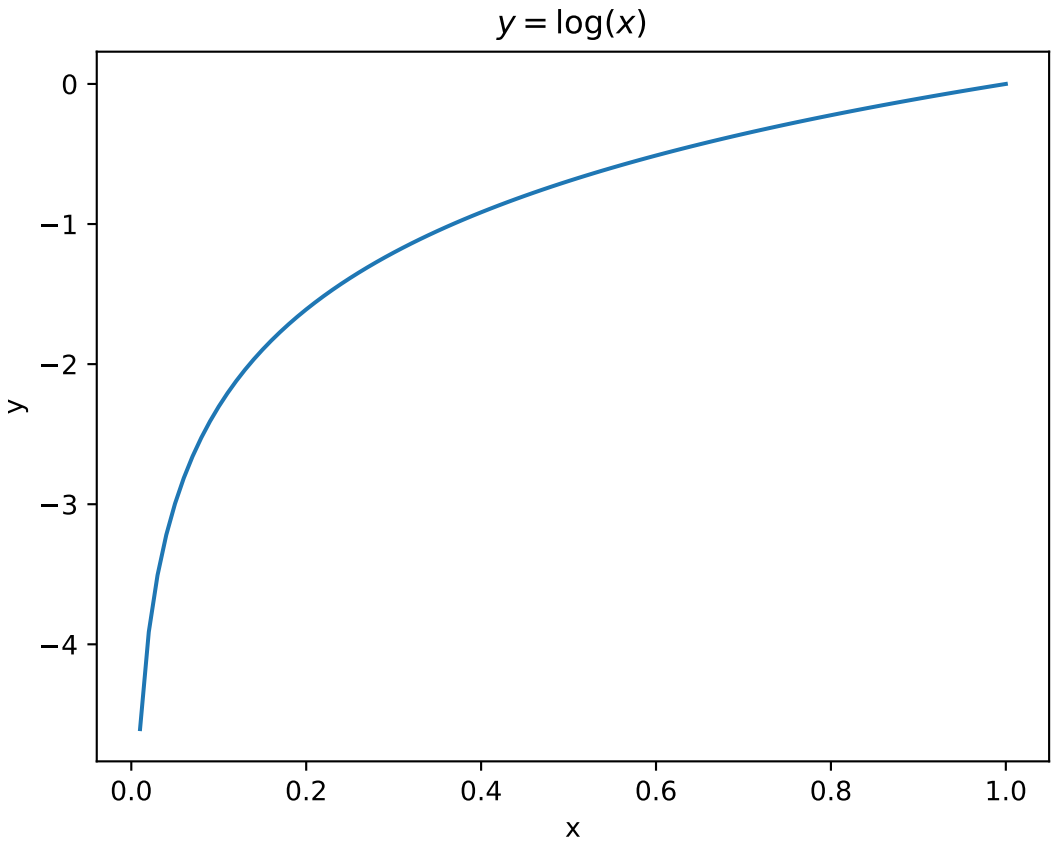

Figure 9: question 7i

ii. $y = x^x$

```
from pylab import *
from rmdplot import figsize,savefig
x_values = arange(0.01, 1.001, 0.01)
y_values = x_values**x_values
plot(x_values, y_values)
xlabel('x')
ylabel('y')
title("$y=x^x$")
savefig("figure/graphing7ii.pdf",caption="question 7ii")
```

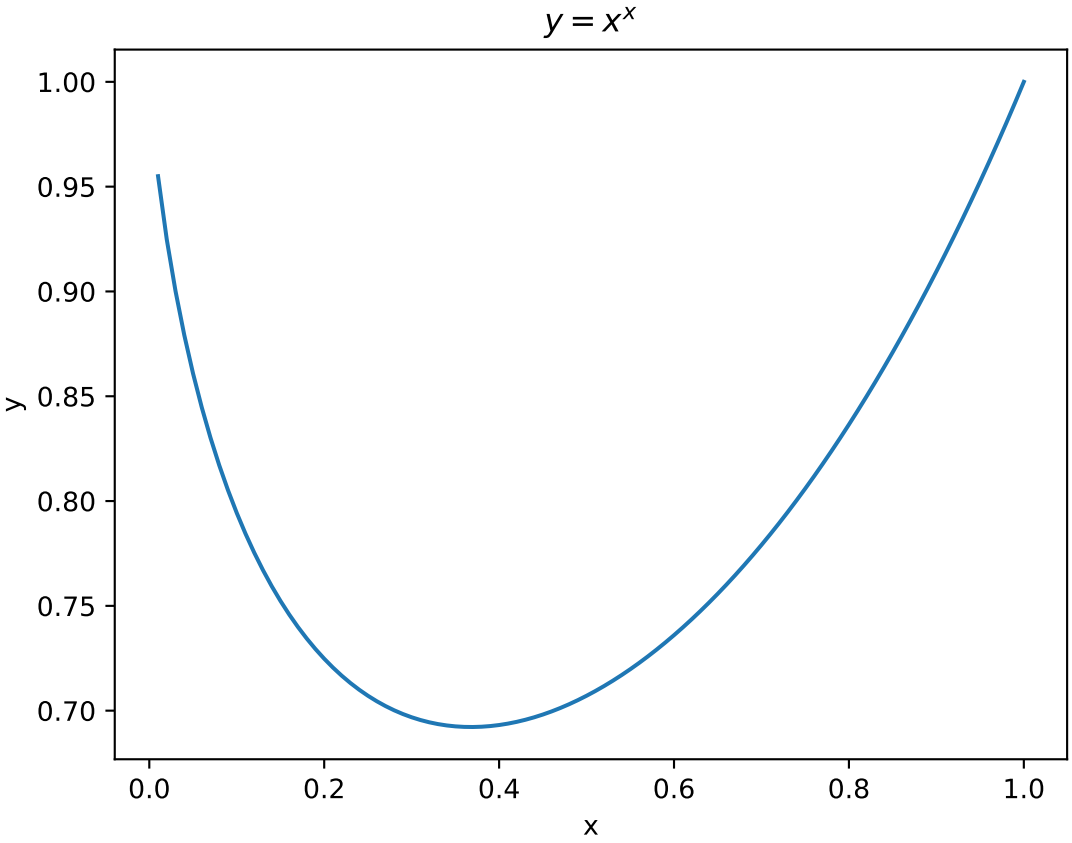

Figure 10: question 7ii

iii. $y = x^{(x^x)}$

```
from pylab import *
from rmdplot import figsize,savefig
x_values = arange(0.01, 1.001, 0.01)
y_values = x_values**(x_values**x_values)
plot(x_values, y_values)
xlabel('x')
ylabel('y')
title("$y=x^{(x^x)}$")
savefig("figure/graphing7iii.pdf",caption="question 7iii")
```

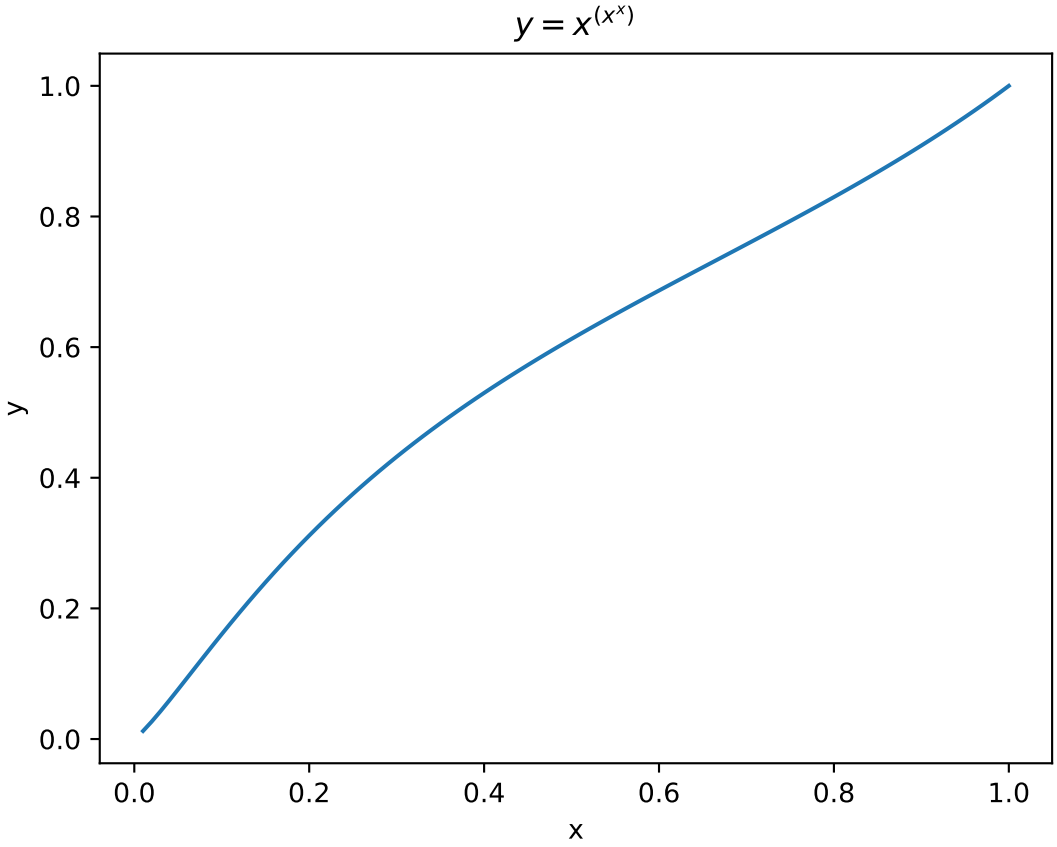

Figure 11: question 7iii

Make sure to label your axes and graphs.