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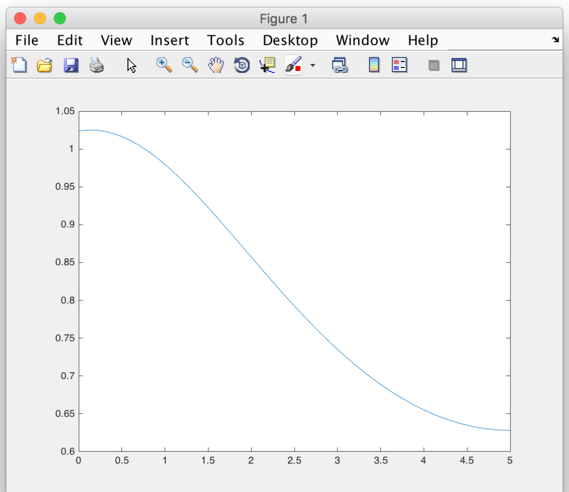
Career Discovery
ETCS 105-M01
MatLab Project IV
12/9/15

Two 150 Watt Bulbs II

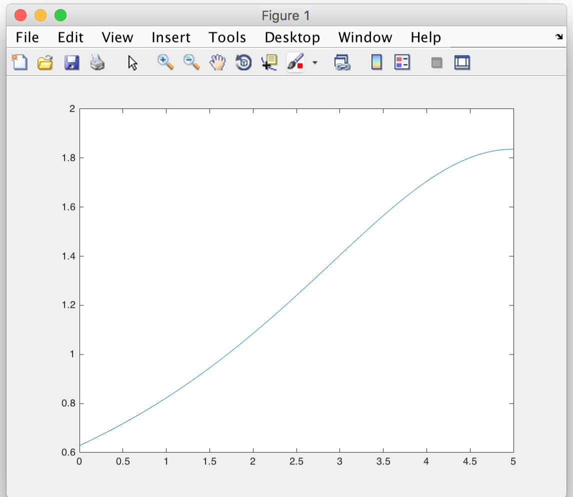
By symmetry, the intensity will be the same at all four corners, so let's graph the intensity at one of the corners (0, 0) as a function of d

```
d = 0:0.1:5; plot(d, two_lights(0, 0, d) + two_lights(0, 0, 10 - d))
```



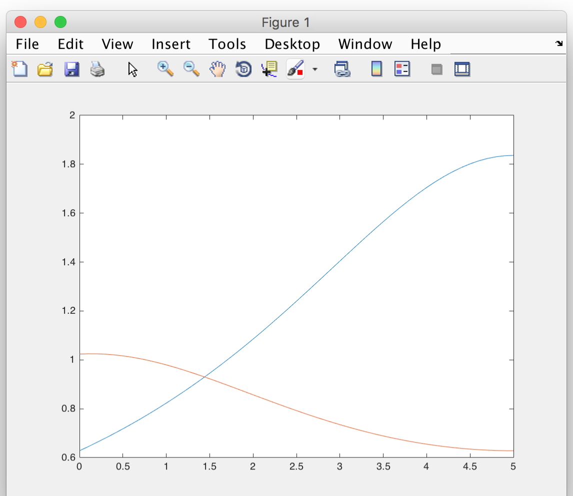
In contrast, the graph for the intensity at the midpoint (5, 0) of a long wall (again by symmetry it does not matter which of the two long walls we choose) should grow as d increases toward 5.

```
d = 0:0.1:5; plot(d, two_lights(5, 0, d) + two_lights(5, 0, 10 - d))
```



We are after the value of d for which the lower of the two numbers on the above graphs (corresponding to the darkest spot in the room) is as high as possible. We can find this value by showing both curves on one graph.

```
hold on; plot(d, two_lights(0, 0, d) + two_lights(0, 0, 10 - d));
hold off
```



To get the optimum value of d, we find exactly where the two curves intersect.

```
syms d; eqn = inline(char(two_lights(0, 0, d) + two_lights(0, 0, 10 -
d) - two_lights(5, 0, d) - two_lights(5, 0, 10 - d)))
```

```
eqn =
     Inline function:
     eqn(d) =
75/2/pi/(d^2+13)+75/2/pi/((-10+d)^2+13)-75/2/pi/((5-d)^2+13)-75/2/pi/
((-5+d)^2+13)

fzero(eqn, [0 5])

ans =
    1.4410
```

For this configuration, the approximate intensity at the darkest spots on the floor is as follows.

```
two_lights(0, 0, 1.441) + two_lights(0, 0, 10 - 1.441)

ans =
    0.9301
```

The darkest spots in the room have intensity around 0.93, as opposed to 0.63 for a single bulb. This represents an improvement of about 50%.