Data 605 - DB13

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Import Libraries

```
library(pracma)
```

4.3 Question 8

A rancher has 1000 feet of fending in which to construct adjacent, equally sized recatngular pens. What dimensions should these pens have to maximize the enclosed area?

Our fencing contraint yields: 3l + 2w = 1000

The cost function to optimize is: area = l * w

Using substitution: area = l * (1000 - 3l)/2

Calculate the derivative:

```
area = expression(-3/2 * l^2 + 500*l)
deriv <- D(area, "l")
deriv
```

```
## -3/2 * (2 * l) + 500
```

Using bisection to find the root for where deriv = 0

```
root <- bisect(function(l) -3/2 * (2 * l) + 500, 0, 1000)
root
```

```
## $root
## [1] 166.6667
##
## $f.root
## [1] 1.136868e-13
##
## $iter
## [1] 56
##
## $estim.prec
## [1] 2.842171e-14
```

The optimal length is equal to:

```
l <- root$root
l
```

```
## [1] 166.6667
```

The resulting maximized area is:

```
fence_area <- function(l) {
  return(-3/2 * l^2 + 500*l)
}
fence_area(l)
```

```
## [1] 41666.67
```

The optimal width is equal to:

```
w <- fence_area(l)/l
w
```

```
## [1] 250
```