# STAT 527 HW 1

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23 January 2023

1
(a)Evaluate the following expressions.

```
a <- (93^2 - 164) / (46^3 + 189)
b <- 376 - (23^2) / 4
c <- (59 + 48^2) / ((-9) + 22^2)
d <- (-16 + 55^2) / (13 + 29^2)
e <- 18^4 - 16^3 + 14^2 - 12
c(a, b, c, d, e)
```

```
## [1] 8.700333e-02 2.437500e+02 4.974737e+00 3.523419e+00 1.010640e+05
```

1
(b)Evaluate 3^x for x = 1, 2, . . . , 20 and store the values in a vector. Print the vector with the function print(). Report the length of the vector with the function length().

```
x <- 1:20
print(3^x)
```

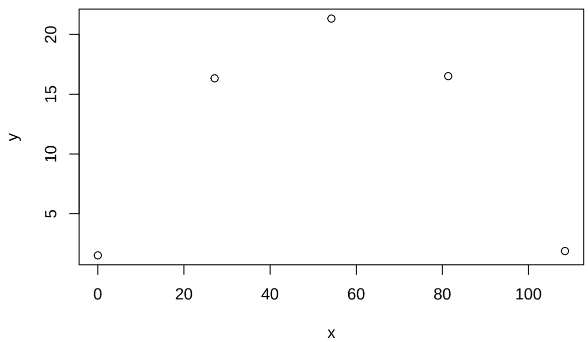
```
##  [1]          3          9         27         81        243        729
##  [7]       2187       6561      19683      59049     177147     531441
## [13]    1594323    4782969   14348907   43046721  129140163  387420489
## [19] 1162261467 3486784401
```

```
length(3^x)
```

```
## [1] 20
```

2
(10 points) If you throw a baseball at an angle of 45 ∘ , at an initial velocity of 75 mph, while standing on a level field, the ball's horizontal distance x traveled after t seconds is described (neglecting air resistance) by the following equation from Newtonian physics: x = 27.12t Furthermore, the height above the ground after t seconds, assuming the ball was initially released at a height of 5 ft, is described by y = 1.524 + 19.71t - 4.905t^2. The equations have been calibrated to give the distance x and height y in meters. The ball will hit the ground after about 4.09 seconds. Calculate a vector (say, x) of baseball distances for a range of values of t from 0 to 4.09. Calculate a vector of baseball heights (say, y) for the same collection of times. Make a plot of x (horizontal axis) and y (vertical axis). Read from the graph of the ball's trajectory how high and how far, approximately, the ball will travel.

```r
t <- 0:4.09
x <- 27.12 * t
y <- 1.524 + 19.71 * t - 4.905 * t^2
plot(x, y)
```

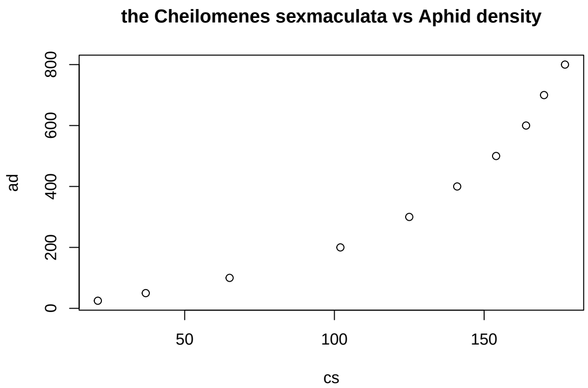



```r
# From the plot, the ball goes up to a maximum of 21 ft and flies far up to 130 ft.
```

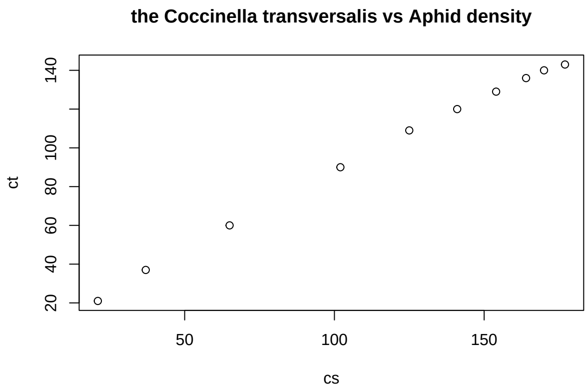
3

(10 points) To decrease the use of insecticides in agriculture, predator insects are often released to combat insect pests. Coccinellids (lady beetles), in particular, have a voracious appetite for aphids. In a recent study (Pervez and Omkar 2005), entomologists looked at the suitability of using coccinellids to control a particular aphid, Myzus persicae (common name is the "green peach aphid"), a serious pest of many fruit and vegetable crops. In the study, the entomologists experimentally ascertained aphid kill rates for three different species of coccinellids: Enter the data columns above into vectors, giving them descriptive names. For each type of coccinellid, use R to construct a scatterplot (type = "p") of the feeding rate of the coccinellid versus aphid density.

```r
# vectors data
cs <- c(21, 37, 65, 102, 125, 141, 154, 164, 170, 177)
ct <- c(21, 37, 60, 90, 109, 120, 129, 136, 140, 143)
pd <- c(15, 26, 42, 59, 69, 74, 79, 83, 85, 82)
# plot for each type of coccinellid
## vector data of aphid density
ad <- c(25, 50, 100, 200, 300, 400, 500, 600, 700, 800)
## plot
plot(cs, ad, type = "p", main = "the Cheilomenes sexmaculata vs Aphid density")
```




```
plot(cs, ct, type = "p", main = "the Coccinella transversalis vs Aphid density")
```




```
plot(cs, pd, type = "p", main = "the Propylea dissecta vs Aphid density")
```