605-Wk15-HW

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R Markdown

1. Find the equation of the regression line for the given points. Round any final values to the nearest hundredth, if necessary. (5.6,8.8), (6.3,12.4), (7,14.8), (7.7,18.2), (8.4,20.8)

```
x.data <- c(5.6,6.3,7,7.7,8.4)
y.data <- c(8.8,12.4,14.8, 18.2, 20.8)
my.data <- data.frame( y.data, x.data)
```

```
linear.fit <- lm(my.data)
summary(linear.fit)
```

```
##
## Call:
## lm(formula = my.data)
##
## Residuals:
##     1     2     3     4     5
## -0.24  0.38 -0.20  0.22 -0.16
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -14.8000     1.0365  -14.28 0.000744 ***
## x.data        4.2571     0.1466   29.04 8.97e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3246 on 3 degrees of freedom
## Multiple R-squared:  0.9965, Adjusted R-squared:  0.9953
## F-statistic: 843.1 on 1 and 3 DF,  p-value: 8.971e-05
```

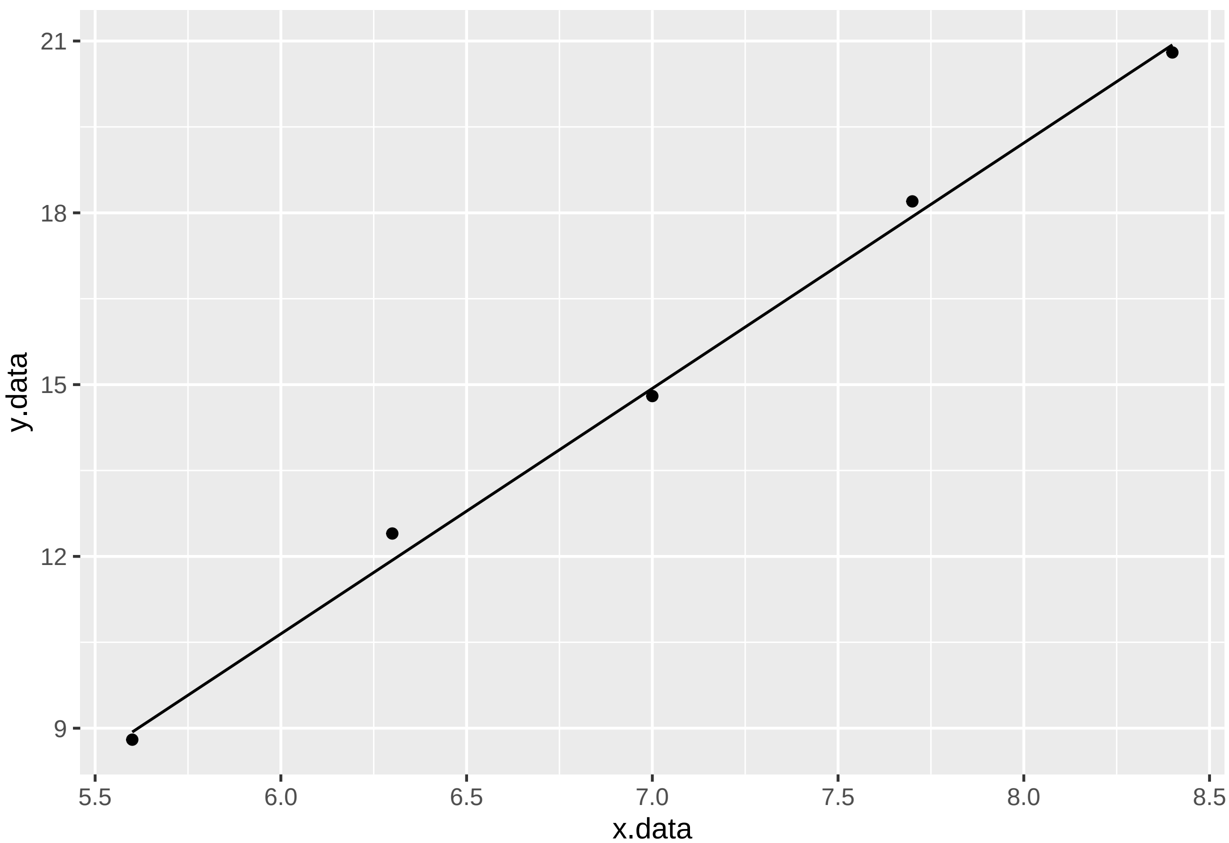
The equation of the regresion line is: y = -15.0667 + 4.2857*x

Below we see a Scatter Plot of the 3 sets of datapoints with a Fit line created using the parameters from the linear regression.

```
p <- ggplot(my.data, aes(x.data, y.data)) + geom_point()


fun.1 <- function(x) -15.0667 + 4.2857*x


p + stat_function(fun = fun.1)
```


21
18
15
12
9
y.data
5.5
6.0
6.5
7.0
7.5
8.0
8.5
x.data

2. Find all local maxima, local minima, and saddle points for the function given below. Write your answer(s) in the form (x, y, z). Separate multiple points with a comma.

$$f(x,y) = 24x - 6xy^2 - 8y^3$$

```
print("Given the variables:")
```

```
## [1] "Given the variables:"
```

```
sympy("var('x')")
```

```
## [1] "x"
```

```
sympy("var('y')")
```

```
## [1] "y"
```

```
print("fx:")
```

```
## [1] "fx:"
```

```
fx <- sympy("latex(diff(24*x - 6*x*y**2 - 8*y**3, x))")

print("fy:")
```

```
## [1] "fy:"
```

```
fy <-sympy("latex(diff(24*x - 6*x*y**2 - 8*y**3, y))")
```

The partials derivatives are:

fx $= 24 - 6y^2$

fy $= -12xy - 24y^2$

$$y = \sqrt{\tfrac{24}{6}} = \pm 2$$
$$x = -2y = \mp 4$$

The critical points are: (-4,+2) ; (+4,-2)

3. A grocery store sells two brands of a product, the "house" brand and a "name" brand. The manager estimates that if she sells the "house" brand for x dollars and the "name" brand for y dollars, she will be able to sell $81 - 21x + 17y$ units of the "house" brand and $40 + 11x - 23y$ units of the "name" brand. Step 1. Find the revenue function R (x, y).

R(House Brand) = x*(81-21*x+17*y) R(Name Brande) = y*(40+11*x-23*y) R(Total) = x*(81-21*x+17*y) + y*(40+11*x-23*y)

Step 2. What is the revenue if she sells the "house" brand for $2.30 and the "name" brand for $4.10?

Solve R(total) when x = 2.30 and y = 4.10

R(total) = 116.62

4. A company has a plant in Los Angeles and a plant in Denver. The firm is committed to produce a total of 96 units of a product each week. The total weekly cost is given by $C(x, y) = \frac{1}{6}x^2 + \frac{1}{6}y^2 + 7x + 25y + 700$, where x is the number of units produced in Los Angeles and y is the number of units produced in Denver. How many units should be produced in each plant to minimize the total weekly cost?

   Since the total number of produced units is 96, we can express x in terms of y:

   x = 96 - y

$$\frac{\partial}{\partial x}\left(\frac{1}{6}x^2 + \frac{1}{6}(96 - x)^2 + 7x + 25(96 - x) + 700\right)$$

And we can find the first derivative to find the minimum of this equation:

$$2 \times \frac{x}{6} + \frac{1}{6}(-2 \times 96) + 2 \times \frac{x}{6} + 7 - 25$$

Gathering terms:

$$\frac{2x}{3} - 50$$

with a root of x = 75 and a y value of y = 21

To minimize production cost, the company should produce 75 units in Los Angeles and 21 in Denver.

5. Evaluate the double integral on the given region.

$$\iint_R \left(e^{8x+3y}\right) dA; R : 2 \leq x \leq 4 \text{ and } 2 \leq y \leq 4$$

```
sympy("var('x')")
```

```
## [1] "x"
```

```
sympy("var('y')")
```

```
## [1] "y"
```

```
Sol.5 <- sympy("latex(integrate(exp(8*x+3*y), (x, 2, 4), (y, 2, 4)))")
```

Write your answer in exact form without decimals: $\frac{1}{24}e^{22} - \frac{1}{24}e^{28} - \frac{1}{24}e^{38} + \frac{1}{24}e^{44}$