Class time and place: Thursday, Oct. 6, 2pm-3:15pm, Lafayette 102

Math 19 Exam 2 Name

1. Suppose the data for the cost-output relationship in a hosiery mill is given in the following table:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| x | 16 | 31 | 48 | 57 | 63 | 103 | 110 | 114 | 117 | 126 |
| y | 30 | 60 | 100 | 130 | 135 | 230 | 230 | 235 | 250 | 260 |

Here x is the output in thousands of dozens, and y is the total cost in thousands of dollars.

(a) Determine the best-fitting line using least squares

(b) What does this model predict the total cost will be when the output is 100,000 dozen?

(c) What does this model predict the output will be if the total cost is $125,000?

(a) $y = 2.12247x - 0.61436$

(b) $y = 2.12247 \times 100 - 0.61436$

$= \$211,633$

(c) $125 = 2.12247x - 0.61436$

$x = 59.185$ dozens

2. Elliott studied the temperature effects on the alder fly. In 1967, he collected the data shown in the following table relating the temperature in degrees Celsius to the number of pupae successfully completing pupation.

| | | | | | | |
|---|---|---|---|---|---|---|
| t | 8 | 10 | 12 | 16 | 19 | 22 |
| y | 18 | 27 | 43 | 44 | 38 | 6 |

Here t is the temperature in degrees Celsius, and y is the number of pupae successfully completing pupation.

a. Use quadratic regression to find y as a function of t
b. Determine the temperature at which this model predicts the maximum number of successful pupations.
c. Determine the two temperatures at which this model predicts there will be no successful pupation.

(a) $y = -0.7201x^2 + 21.1076x - 107.6271$

(b) $y_{max} = 47.0496$ at $T = 14.656$

(c) $T = 6.5729°$ and $22.7391°$

3. The following table gives the population in millions of the northeastern part of the United States for some selected early years.

| Year | 1790 | 1810 | 1830 | 1850 | 1870 | 1890 |
|---|---|---|---|---|---|---|
| Population | 2 | 3.5 | 5.5 | 8.5 | 12.2 | 17.3 |

a. On the basis of the above data, find the best-fitting exponential function.
b. Using this exponential model, estimate the population in 1990
c. Now find the best-fitting logistic curve.
d. Using this logistic model, estimate the population in 1990.

(a) $y = 2.1988 \times 1.0216^{x}$, where $x$ : years since 1790

(b) $1990 - 1790 = 200$

$y = 2.1988 \times 1.0216^{200} =$ ~~[illegible]~~ 158.35 million

(c) $y = \dfrac{42.8548}{1 + 18.9930\, e^{-0.02544x}}$

(d) $y = 38.40$ million