College - math problem example

<u>Science</u>



College

Math Problem a) I constructed the first linear function based on the municipal solid waste data for 1970 and 1997 and the second linear function based on the data for 1980 and 1997. A dependent variable is the annual production of municipal solid waste in million tons. An independent variable is the number of years after 1960.

Based on the municipal solid waste data from the graph, I received such numbers for independent and dependent variables for the models.

Model 1

Model 2

Dependent Variable

Independent Variable

Dependent Variable

Independent Variable

121

10

152

20

217

37

217

37

Model 1:

121 = a + b*10

217 = a + b*37

The solution is a = 85. 4, b = 3. 56. Therefore, the first linear function is: Annual MSW = 85. 4+3. 56*(Number of years after 1960)

Model 2:

152 = a + b*20

217 = a + b*37

The solution is a = 75. 6, b = 3. 82. Therefore, the first linear function is: Annual MSW = 75. 6+3. 82*(Number of years after 1960)

b) Model 1 predicts MSW in 2005 to be on the level of 245. 6 mil tons (85.

4+3. 56*45= 245. 6).

Model 2 predicts MSW in 2005 to be on the level of 247. 5 mil tons (75. 6+3. 82*45= 247. 5).

c) Both models have rather close predictions. In order to validate their predictive power it is necessary to check the predicted values vs. the actual values. For this purpose I used the actual MSW data for 2003 provided by the United States Environmental Protection Agency (EPA)1. The actual MSW in 2003 was 236. 2 mil tons.

The predicted results are 238. 48 mil tons for Model 1 and 239. 86 mil tons for Model 2. So Model 1 seems to be slightly better than Model 2 in predicting the actual level of MSW in the USA.

2. In order to find the maximum profit and the number of tonnage which must be processed to yield the maximum profit, I took the first derivative of the profit function and found its solution when it equals to 0.

a) R(x) = 5x; C(x) = 0.0001x2 + 1.2x + 60.

Profit function is P(x) = 5x - 0.0001x2 - 1.2x - 60.

The derivative is P(x) = 5 - 0.0002x - 1.2 = 0.

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The maximum profit is 36, 040 and the number of tonnage needed to be processed is 19, 000.

b) R(x) = 50x - 0. 5x2; C(x) = 10x + 3.

Profit function is P(x) = 50x - 0.5x2 - 10x - 3

The derivative is P(x) = 50 - x - 10 = 0.

The maximum profit is 797 and the number of tonnage needed to be processed is 40.

c) R(x) = 20x - 0. 1x2; C(x) = 4x + 2.

Profit function is $P(x) = 20x - 0.1x^2 - 4x - 2$.

The derivative is P(x) = 20 - 0.2x - 4 = 0.

X= 80; P= 638

The maximum profit is 638 and the number of tonnage needed to be processed is 80.

References

United States Environmental Protection Agency (EPA). Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures

for 2003. Retrieved November 17, 2005, from http://www.epa.

gov/epaoswer/non-hw/muncpl/pubs/msw05rpt.pdf