Math Final

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05-19-2019

7.11

(a)

$$\frac{\partial}{\partial \beta_1} = \alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i2}^2 + \beta_4 x_{i2}^3 + \beta_5 x_{i3} + \beta_6 x_{i4} + \beta_7 x_{i3} x_{i4},$$

Derivative of a constant is zero, so drop α:

$$= \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i2}^2 + \beta_4 x_{i2}^3 + \beta_5 x_{i3} + \beta_6 x_{i4} + \beta_7 x_{i3} x_{i4},$$

Break up across addition and subtration, then again across multiplication:

$$= \frac{\partial}{\partial \beta_1}\beta_1 x_{i1} + \frac{\partial}{\partial \beta_1}\beta_2 \frac{\partial}{\partial \beta_1} x_{i2} + \frac{\partial}{\partial \beta_1}\beta_3 \frac{\partial}{\partial \beta_1} x_{i2}^2 + \frac{\partial}{\partial \beta_1}\beta_4 \frac{\partial}{\partial \beta_1} x_{i2}^3 + \frac{\partial}{\partial \beta_1}\beta_5 \frac{\partial}{\partial \beta_1} x_{i3} + \frac{\partial}{\partial \beta_1}\beta_6 \frac{\partial}{\partial \beta_1} x_{i4} + \frac{\partial}{\partial \beta_1}\beta_7 \frac{\partial}{\partial \beta_1} x_{i3} \frac{\partial}{\partial \beta_1} x_{i4},$$

All other independent variables are treated as constants:

$$= \frac{\partial}{\partial \beta_1}\beta_1 x_{i1} + 0(0) + 0(0) + 0(0) + 0(0) + 0(0) + 0(0)(0),$$

Bring the constant out:

$$= \beta_1 \frac{\partial}{\partial \beta_1} x_{i1} = \beta_1(1) = \beta_1.$$

9.10

10.9