ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2015
William M. Boal

EXAMINATION #1 ANSWER KEY
"Mathematical Tools"

Version A

I. Multiple choice

(1)d. (2)c. (3)a. (4)a. (5)c. (6)d. (7)f. (8)c. (9)b. (10)b.

II. Short answer

(1) a. increase b. 20 units, using derivative since change is given in units.
(2) a. increase b. 5 %, using elasticities since changes are given in percent.
(3) a. decrease b. 2 %, using approximation rule for products.
(4) a. increase b. 3 %, using approximation rule for ratios.
(5) a. increase b. 12 units c. decrease d. 6 units.
(6) a. down b. -1.75.

III. Problems

(1) a. dy/dx = -2x+10. b. x* = 5.
c. Slopes up for x<5 because dy/dx is positive.
Slopes down for x>5 because dy/dx is negative.
d. y* = f(x*) = f(5) = 10.

(2) a. $\varepsilon_1 = 2.$ b. $\varepsilon_2 = \frac{4x_2}{x_2 - 3}$

(3) a. $\frac{\partial y}{\partial x_1} = 7\, x_1^{-2}$ b. $\frac{\partial y}{\partial x_2} = 5\, x_2^{-2}$ c. $MRS = \frac{\partial y/\partial x_2}{\partial y/\partial x_1} = \frac{5x_1^2}{7x_2^2}$.

(4) a. $\frac{\partial y}{\partial x_1} = 2(x_1 - 5)(x_2 - 4)^3$ b. $\frac{\partial y}{\partial x_2} = (x_1 - 5)^2 3(x_2 - 4)^2$
c. $MRS = \frac{\partial y/\partial x_2}{\partial y/\partial x_1} = \frac{3(x_1 - 5)}{2(x_2 - 4)}$.

IV. Critical thinking

Using the total derivative in elasticity form,

% chg in y $= \varepsilon_1$ (% chg x_1) + ε_2 (% chg x_2)
$= \varepsilon_1$ (3%) + ε_2 (3%)
$= (\varepsilon_1 + \varepsilon_2)$ (3%)
= (1) (3%) = 3%.

So y *increases* by about 3%.

Version B

I. Multiple choice

(1)f. (2)d. (3)c. (4)b. (5)d. (6)f. (7)b. (8)a. (9)b. (10)a.

II. Short answer

(1) a. increase b. 1.5 %, using elasticity since change is given in percent.
(2) a. decrease b. 14 units, using derivative since changes are given in units.
(3) a. increase b. 3 %, using approximation rule for products.
(4) a. increase b. 4 %, using approximation rule for ratios.
(5) a. increase b. 20 units c. decrease d. 10 units.
(6) a. down b. -3.

III. Problems

(1) a. dy/dx = 2x-20. b. x* = 10.
c. Slopes up for x>10 because dy/dx is positive.
Slopes down for x<10 because dy/dx is negative.
d. y* = f(x*) = f(10) = -75.

(2) a. $\varepsilon_2 = \frac{2x_1}{x_1+3}$. b. $\varepsilon_1 = 3$

(3) a. $\frac{\partial y}{\partial x_1} = 3\,x_1^{-3/2}$ b. $\frac{\partial y}{\partial x_2} = x_2^{-3/2}$ c. $MRS = \frac{\partial y/\partial x_2}{\partial y/\partial x_1} = \frac{1}{3}\left(\frac{x_1}{x_2}\right)^{3/2}$.

(4) a. $\frac{\partial y}{\partial x_1} = 3(x_1+2)^3(x_2+1)^4$ b. $\frac{\partial y}{\partial x_2} = (x_1+2)^3 4(x_2+1)^3$
c. $MRS = \frac{\partial y/\partial x_2}{\partial y/\partial x_1} = \frac{4(x_1+2)}{3(x_2+1)}$.

IV. Critical thinking

Using the total derivative in elasticity form,

% chg in y $= \varepsilon_1$ (% chg x_1) + ε_2 (% chg x_2)
$= \varepsilon_1$ (5%) + ε_2 (5%)
$= (\varepsilon_1 + \varepsilon_2)$ (5%)
= (0) (5%) = 0%.

So y *remains constant* (no increase or decrease).

Version C

I. Multiple choice

(1)b. (2)a. (3)e. (4)a. (5)d. (6)b. (7)d. (8)d. (9)d. (10)d.

II. Short answer

(1) a. increase b. 15 units, using derivative since change is given in units.
(2) a. increase b. 0.8 %, using elasticities since changes are given in percent.
(3) a. decrease b. 2 %, using approximation rule for products.
(4) a. decrease b. 3 %, using approximation rule for ratios.
(5) a. increase b. 18 units c. decrease d. 9 units.
(6) a. down b. -5/3 .

III. Problems

(1) a. dy/dx = -20x+60. b. x* = 3.
c. Slopes up for x<3 because dy/dx is positive.
Slopes down for x>3 because dy/dx is negative.
d. y* = f(x*) = f(3) = 80.

(2) a. $\varepsilon_1 = 3$. b. $\varepsilon_2 = \frac{2x_2}{x_2+4}$

(3) a. $\frac{\partial y}{\partial x_1} = x_1^{-1/2}$ b. $\frac{\partial y}{\partial x_2} = 2\,x_2^{-1/2}$ c. $MRS = \frac{\partial y/\partial x_2}{\partial y/\partial x_1} = 2\left(\frac{x_1}{x_2}\right)^{1/2}$.

(4) a. $\frac{\partial y}{\partial x_1} = 5(x_1-3)^4(x_2-6)^2$ b. $\frac{\partial y}{\partial x_2} = (x_1-3)^5\,2\,(x_2-6)$
c. $MRS = \frac{\partial y/\partial x_2}{\partial y/\partial x_1} = \frac{2(x_1-3)}{5(x_2-6)}$.

IV. Critical thinking

Using the total derivative in elasticity form,
% chg in y $= \varepsilon_1$ (% chg x_1) + ε_2 (% chg x_2)
$= \varepsilon_1$ (2%) + ε_2 (2%)
$= (\varepsilon_1 + \varepsilon_2)$ (2%)
= (-1) (2%) = - 2%.
So y *decreases* by about 2%.

[end of answer key]