
**SCHOOL OF PUBLIC POLICY
UNIVERSITY OF MARYLAND**

**PUAF Mathematics Immersion Course
Summer 2011**

Problem Set 2

Question 1: Graph the following

On a single graph, draw the following equations with y on the vertical axis and x on the horizontal axis. Also mention the range of x for which you think the function is valid (ie. exists in the real space).

- (a) $y = 3x$
- (b) $y = 3/x$
- (c) $y = x^3$
- (d) $y = 3^x$

Question 2: Graph the following equations

- (a) $y = 4x - 3$
- (b) $y = -3x + 4$
- (c) $y = 4 - 3x$
- (d) $y = 5/x + 2$
- (e) $y = x^2 - 3x + 2 = 0$
- (f) $y = 4x^2 - 9$

Question 3: Graph and solve algebraically

- (a) What is the shape of the equation $x/a + y/b = 1$ (where a and b are positive constants, and x and y are the horizontal and vertical axes)?
- (b) If you think this is a linear equation, can this be transformed into the generic form of a straight line equation: $y = mx + c$?

Question 4: Graphically solve the following systems of equations

- (a) $y = 4x + 3$ and $y = 3 - 2x$
- (b) $y = 3x^2 - 11x + 8$ and $y = -4/x$
- (c) $y = 2x - x/3$ and $2y = 4$
- (d) $y = 2x^2 - x/3$ and $y = -2$
- (e) $y = 3 - x$ and $3y = 9 - 3x$
- (f) $y = 2x - 3z + 4$ and $y = x + 2z$

Question 5: From PUAF 640 (Microeconomics)

Almost the entire world's supply of soccer balls (irrespective of their brand names) come from Asia – notably Pakistan, India and China. We are given that the US demand for soccer balls every year is represented by the equation: $Q_D = 150 - 3P$ and that the supply of imported soccer balls into US markets is represented by the function: $Q_S = 3P - 30$. In both functions, Price is measured in US \$ per soccer ball, and soccer balls are counted in thousands.

- (a) Represent the supply and demand functions graphically. Make sure you label the graph completely – including the axes, the slopes and the intercepts. You will have to calculate some of them.
- (b) Calculate the equilibrium Price and Quantity (P_0 and Q_0) of soccer balls that are traded in the US market. Also mark them on the diagram above.
- (c) If Price were artificially set at \$20, how much would be the quantity supplied and quantity demanded of soccer balls at that price? Is this a case of shortage or surplus, and if so by how much?

Question 6: Wandering around the nation's capital

Last summer taxicabs in Washington DC finally began (were forced to) to charge passengers based on the actual mileage (and not some archaic zonal system that only the cab drivers knew about). Let the following be components of the cost of a cab ride: (1) a fixed cost or base fare of \$5.00 and (2) a variable cost of \$0.80 per mile traveled.

- (a) Denote this information as a cost function, where Cost in \$ (C) is the dependent or explained variable, and Miles (M) is the independent or explanatory variable.
- (b) Is the relationship between C and M linear in form? How do we know?
- (c) How much will a 6-mile ride cost (excluding tips of course)?
- (d) How far can you travel if you had \$20 bill (excluding tips)?
- (e) What will be the cost function if 15% tips were to be included in the computation?
- (f) How much will a 6-mile ride cost (including tips)?
- (g) How far can you travel if you had \$20 bill (including tips)?