Monmouth COLLEGE

- Name: __________
- Date: __________
- Section: __________

ECON 300: Intermediate Price Theory

Problem Set #0: Suggested Solutions

Fall 2024

INSTRUCTIONS:

- It is strongly recommended that students try out the problem set on their own before consulting the suggested solutions.

Problem 1. System of Linear Equations

Find the value(s) of x and y:

1.A. $x + 2y = 5$
$x + y = 3$

Take the difference between the two equations to get $y = 2$. Insert $y = 2$ to either the first or second equation to get $x = 1$.

$$x = 1, y = 2$$

1.B. $4x + y = 9$
$2x + 3y = 7$

Multiply the first equation by 3, then take the difference between the two equations and you will have $10x = 20$, so $x = 2$. Insert $x = 2$ to either the first or second equation to get $y = 1$.

$$x = 2, y = 1$$

1.C. $2x - y = 1$
$x + 2y = 18$

Multiply the second equation by 2, then take the difference between the two equations and you will have $-5y = -35$, so $y = 7$. Insert $y = 7$ to either the first or second equation to get $x = 4$.

$$x = 4, y = 7$$

1.D. $2x + 3y = 18$
$3x + 2y = 22$

Multiply the second equation by 3 and the second equation by 2. Then take the difference between the two equations and you will have $5y = 10$, so $y = 2$. Insert $y = 2$ to either the first or second equation to get $x = 6$.

$$x = 6, y = 2$$

1.E. $x + 3y = 8$
$-x + 2y = 2$

Add the two equations, and you will have $5y = 10$, so $y = 2$. Insert $y = 2$ to either the first or second equation to get $x = 2$.

$$x = 2, y = 2$$

Problem 2. Exponents

Solve the following.

2.A. $x \times x \times x$

By definition, $x \times x \times x$ is x^3.

$$x^3$$

2.B. $x^3 \times x^2$

Expanding the expressions for x^3 and x^2, we have:

$$x^3 \times x^2 = \underbrace{(x \times x \times x)}_{\text{3 times}} \times \underbrace{(x \times x)}_{\text{2 times}} = \underbrace{x \times x \times x \times x \times x}_{\text{5 times}} = x^5$$

2.C. $x^2 \times y \times x$

$x \times y$ is the same as $y \times x$, and x's are multiplied together, and y's are multiplied together.

$$x^2 \times y \times x = x^2 \times x \times y = (x \times x) \times x \times y = x^3 y$$

2.D. $\dfrac{x^3}{x}$

By dividing 3 x's by 1 x, this is what happens:

$$\frac{x^3}{x} = \frac{x \times x \times x}{x} = \frac{x \times x \times \cancel{x}}{\cancel{x}} = x^2$$

2.E. $\dfrac{x^5 \times y}{x^2 \times y^2}$

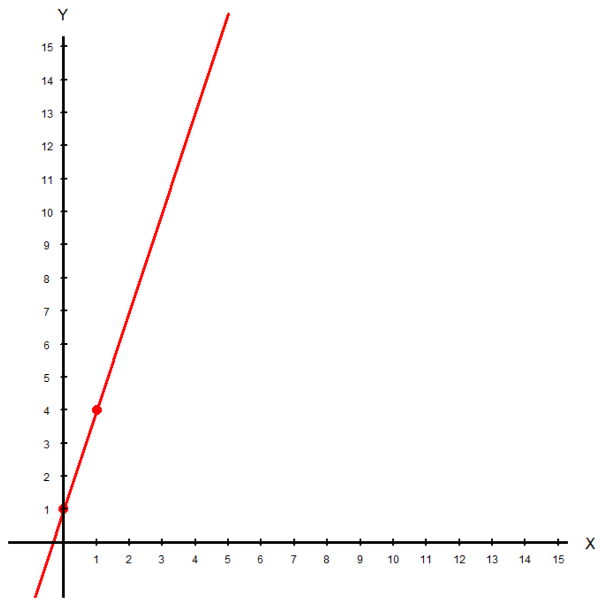
Same division as 2.D., but keep the x's and y's separate:

$$\frac{x^5 \times y}{x^2 \times y^2} = \frac{(x \times x \times x \times x \times x) \times y}{(x \times x) \times (y \times y)} = \frac{x \times x \times x \times \cancel{x} \times \cancel{x} \times \cancel{y}}{\cancel{x} \times \cancel{x} \times y \times \cancel{y}} = \frac{x^3}{y}$$

Problem 3. Slopes

Plot the following equations on the empty chart, and calculate their respective slopes.

3.A. $y = 3x + 1$



To plot a simple linear function, find two points that belongs on the line, and draw a straight line that passes through both.

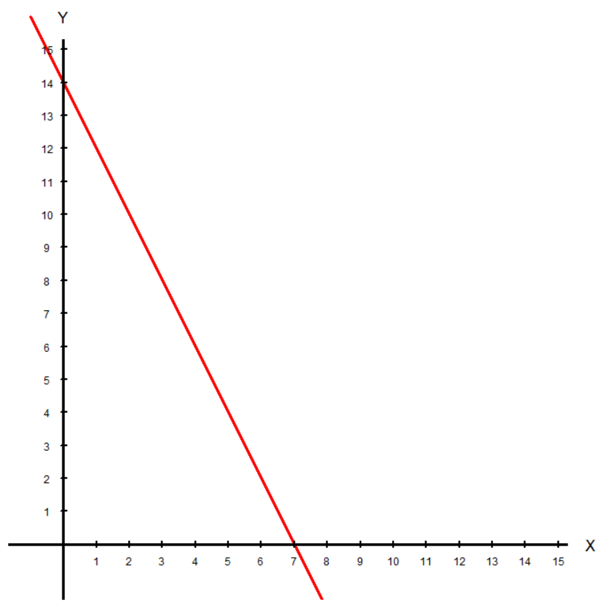
For instance, when $x = 0$, $y = 1$.

Then choose another point, when $x = 1$, $y = 4$.

Using these two points, we can calculate the slope by using the formula:

$$\texttt{Slope} = \frac{\texttt{Rise}}{\texttt{Run}} = \frac{4-1}{1-0} = 3$$

3.B. $y = 14 - 2x$



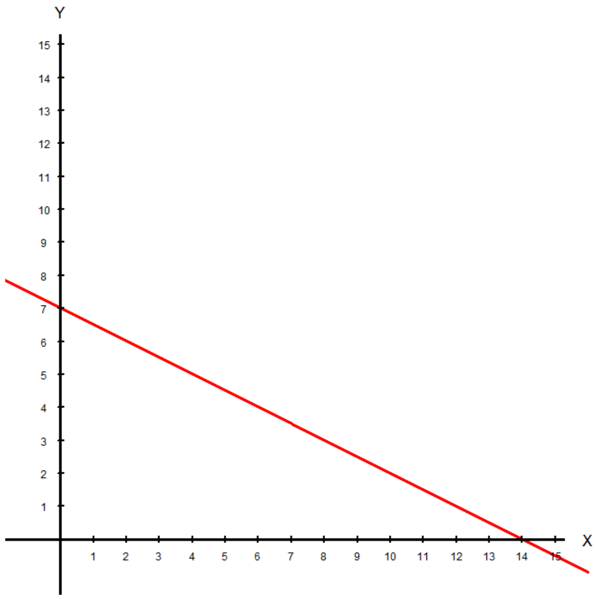
The two points that is easy to point out are going to be the x and y intercepts; the points where the line "passes through" the axes.

Here, the two points are $(0, 14)$ and $(7, 0)$.

$$\texttt{Slope} = \frac{\texttt{Rise}}{\texttt{Run}} = \frac{14-0}{0-7} = -2$$

Problem 3. Slopes (Continued)

3.C. $y = 7 - \dfrac{1}{2}x$

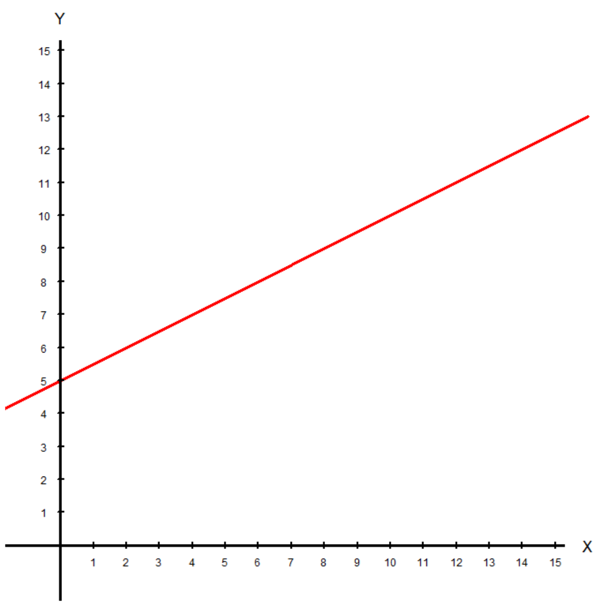


We will be using the x and y intercepts again.

Here, the two points are $(7, 0)$ and $(0, 14)$.

$$\texttt{Slope} = \frac{\texttt{Rise}}{\texttt{Run}} = \frac{7-0}{0-14} = -\frac{1}{2}$$

3.D. $y = 5 + \dfrac{1}{2}x$



Here, we use the y intercept of $(0, 5)$. But the next point will be $(2, 6)$.

$$\texttt{Slope} = \frac{\texttt{Rise}}{\texttt{Run}} = \frac{6-5}{2-0} = \frac{1}{2}$$

Problem 4. Derivatives

Solve.

4.A. $\dfrac{d}{dx}2x$

Apply the basic power rule:

$$2$$

4.B. $\dfrac{d}{dx}x^2$

Apply the basic power rule:

$$2x$$

4.C. $\dfrac{d}{dx}(2x^5 + x^2)$

Apply the basic power rule to each term separately:

$$10x^4 + 2x$$

4.D. $\dfrac{\partial}{\partial x}xy^2$

We care about the rate of change of x, not y, so treat y as a constant number:

$$y^2$$

4.E. $\dfrac{\partial}{\partial y}xy^2$

We care about the rate of change of y, not x, so treat x as a constant number:

$$x(2y) = 2xy$$