



- Name: \_\_\_\_\_
  - Date: \_\_\_\_\_
  - Section: \_\_\_\_\_
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## **ECON 300: Intermediate Price Theory**

### **Problem Set #0: Suggested Solutions**

#### **Math Review**

#### **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:

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

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.  $\frac{x^3}{x}$

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.  $\frac{x^5 \times y}{x^2 \times y^2}$

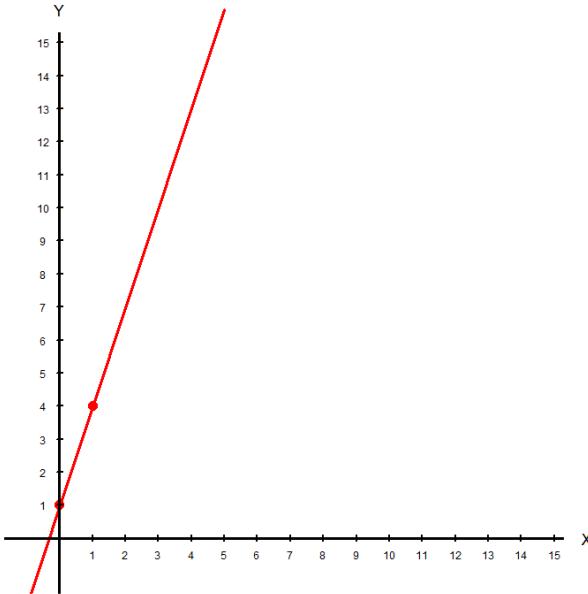
Same division as 2.D., but keep the  $x$ 's and  $y$ 's separate:

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

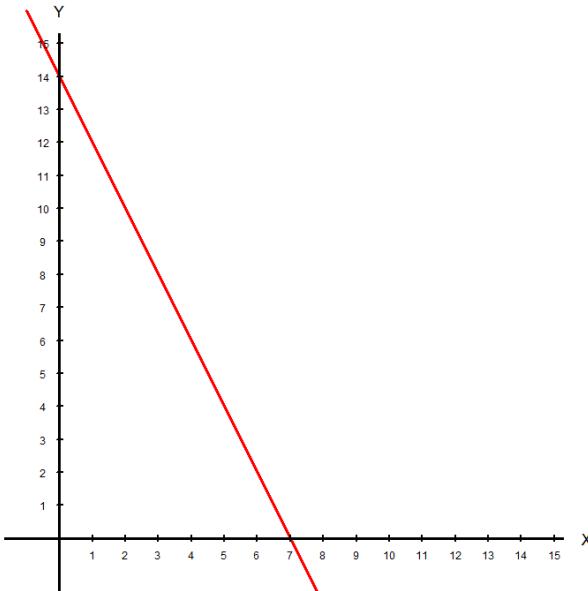
**Problem 3. Slopes**

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

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



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



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:

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

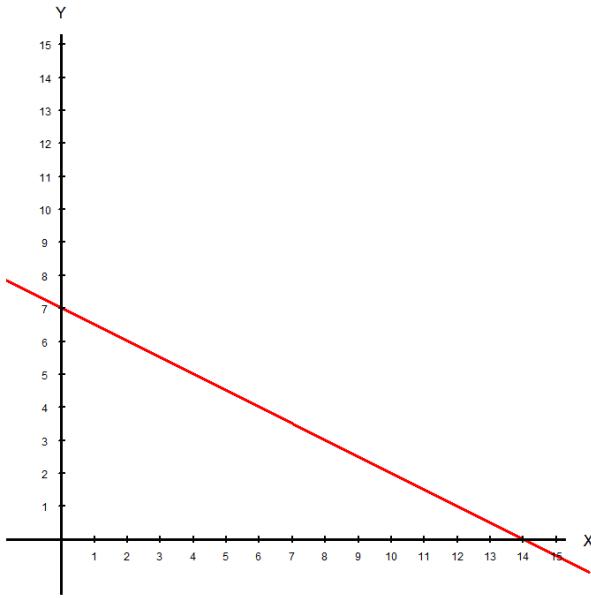
The two points that is easy to point out are going to be the  $x$  and  $y$  intercepts; the points where the line “passes through” the axes.

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

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

**Problem 3. Slopes (Continued)**

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

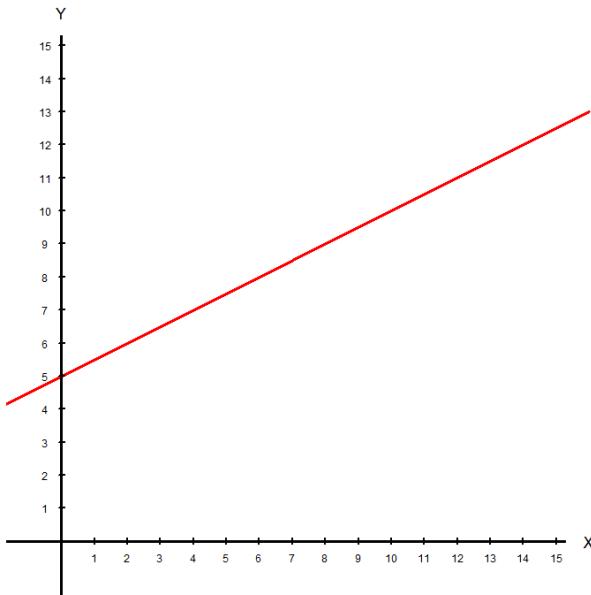


We will be using the  $x$  and  $y$  intercepts again.

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

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

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



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

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

**Problem 4. Derivatives**

Solve.

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

Apply the basic power rule:

$$2$$

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

Apply the basic power rule:

$$2x$$

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

Apply the basic power rule to each term separately:

$$10x^4 + 2x$$

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

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

$$y^2$$

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

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

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