Finite Math Section 1_4
Solutions and Hints

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for the book:
<u>Finite Mathematics, 7th Edition</u>
by S. T. Tan.

DO NOT PRINT THIS OUT AND TURN IT IN !!!!!!!!
This is designed to assist you in the event you get stuck.
If you do not do the work you will NOT pass the tests.

Section 1.4:

Problem 1 to 6:
For these problems get both equations into the form y = stuff (so y is all by itself with a 1 for a coefficient). The set the equations equal to each other (i.e. stuff of equation 1 = stuff of equation 2). For example consider problem 2:

Problem 2:
$y = -4x - 7$
$-y = 5x + 10$ ← divide both side of this equation by –1 to get $y = -5x - 10$

Set $-4x - 7 = -5x - 10$ and solve for x
$x - 7 = -10$
$x = -3$

Put –3 in for x into
$y = -4x - 7$
$y = -4*(-3) - 7$
$y = 12 - 7$
$y = 5$

So the answer is x = -3 and y = 5.

Problem 8:

Find the break-even point for the firm whose cost function is C and revenue function R are given as:
$C(x) = 15x + 12000; \quad R(x) = 21x$

To "break-even" means that the amount you spent on it = the amount you sold it for.

So set $C(x) = R(x)$ and solve for x.

$15x + 12000 = 21x$
$12000 = 7x$
$(12000 / 7) = x$

$x \approx 1714.285714$ units

Often in these problems the units will NOT be allowed to be fractional. So you would say x = 1714 units. Watch out for this. Most of the professors are nice and will make the problems come out to integer solutions – but not all.

Problem 20:
Find the equilibrium quantity and equilibrium price for the supply-and-demand equation pair given. Where x = quantity demanded in units of 1000 and p is the unit price in dollars.

Notice that demand equations almost always have a negative slope and supply equations almost always have a positive slope.

$p = -0.3x + 6$ and $p = 0.15x + 1.5$

You could set the equations equal (i.e. $-0.3x + 6 = 0.15x + 1.5$) and solve for x.
But let's try something different and subtract the second equation from the first:

$p = -0.3x + 6$
$-(p = 0.15x + 1.5)$

$0 = -0.45x + 4.5$ ← now solve for x

$-4.5 = -0.45x$
$10 = x$

Now put 10 in for x into $p = 0.15x + 1.5$
$p = 0.15*10 + 1.5$
$p = \$3.00$

So the answer is:

Equilibrium quantity = 10 units
Equilibrium price = $3.00

<u>Problem 22</u>:
The demand equation for the Drake GPS Navigator is x + 4p – 800 = 0, where x is the quantity demanded per week and p is the wholesale unit price in dollars. The supply equation is x – 20p + 1000 = 0, where x is the quantity the supplier will make available in the market when the wholesale price is p dollars. Find the equilibrium quantity and the equilibrium price for the GPS Navigators.

You will likely be given a program for the calculators to solve this type of problem. What follows is how to work it out by hand:

Solve the system of equations:
Eq. 1: $x + 4p - 800 = 0$
Eq. 2: $x - 20p + 1000 = 0$

Solve equation 1 in terms of x:
$x + 4p - 800 = 0 \rightarrow x = 800 - 4p$

Substitute 800 – 4p in for x in equation 2:
$x - 20p + 1000 = 0 \rightarrow (800 - 4p) - 20p + 1000 = 0$

Solve for p:
$(800 - 4p) - 20p + 1000 = 0 \rightarrow$

$$800 - 4p - 20p + 1000 = 0$$
$$-24p + 1800 = 0$$
$$-24p = -1800$$
$$p = -1800 / -24$$
$$p = 75$$

Now put p = 75 into equation 1 and solve for x:
$x + 4p - 800 = 0 \rightarrow$

$$x + 4*75 - 800 = 0$$
$$x + 300 - 800 = 0$$
$$x - 500 = 0$$
$$x = 500$$

So the answer is x = 500 and p = 75

You may wish to put these values into equation 2 to make sure there are no errors (i.e. make sure the left side ends up equaling zero):
$x - 20p + 1000 = 500 - 20*75 + 1000 = 500 - 1500 + 1000 = 0$

Problem 24:

The quantity demanded each month of Russo Espresso Makers is 250 when the unit price is \$140. The quantity demanded each month is 1000 when the unit price is \$110. The suppliers will market 750 espresso makers if the unit price is \$60 or lower. At a unit price of \$80, they are willing to make available 2250 units in the market. Both the demand and supply equations are known to be linear.

a. Find the demand equation

Notice the demand points given are: (250, \$140) and (1000, \$110)
As the demand function is linear all we need is the slope of the line through those 2 points and we can use the slope-point form of the equation.

The slope is:

$$m = \frac{p_1 - p_2}{x_1 - x_2} = \frac{140 - 110}{250 - 1000} = -\frac{30}{750} = -\frac{1}{25}$$

And we use point-slope form to find our equation of the demand line:

$p - p_1 = m(x - x_1)$ → $p - 140 = -1/25 * (x - 250)$
$p - 140 = (-1/25)x + 10$

$p = (-1/25)x + 150$ ← **the demand equation**

b. Find the supply equation

Notice the supply points given are: (750, \$60) and (2250, \$80)
Again the supply equation is said to be linear so we do basically the same thing as above.

The slope is:

$$m = \frac{p_1 - p_2}{x_1 - x_2} = \frac{60 - 80}{750 - 2250} = \frac{20}{1500} = \frac{1}{75}$$

And we use point-slope form to find our equation of the supply line:

$p - p_1 = m(x - x_1)$ → $p - 60 = 1/75 * (x - 750)$
$p - 60 = (1/75)x - 10$

$p = (1/75)x + 50$ ← **the supply equation**

c. Find the equilibrium quantity and price

Here we solve the system of equations created by the demand equation and the supply equation:

p = (-1/25)x + 150 ← the demand equation
p = (1/75)x +50 ← the supply equation
------------------------- subtract the 2nd equation from the first
0 = (-4/75)x + 100

Solve for x:

0 = (-4/75)x + 100 → -100 = (-4/75)x
7500 = 4x
1875 = x

Put 1875 in for x into the demand equation and solve for p:

p = (-1/25)x + 150 → p = (-1/25)*1875 + 150
p = -75 + 150
p = 75

So the solution is x = 1875 units and p = $75.

You may wish to check this by putting these values into the supply equation and check it comes out 'true:'

p = (1/75)x +50 → 75 = (1/75)*1875 + 50
75 = 25 + 50 = 75 so it checks okay.
