MA 162 - Exam #1 Grading and Keys

Below you will find some descriptions of how certain problems on the exam were graded. Please refer to this **BEFORE** emailing to ask about whether a question was graded correctly.

Question 3: If you had an incorrect answer in part (a), but used it correctly in parts (b) and (c) then you were still given credit for parts (b) and (c). One point was deducted in part (c) if you didn't use "per year".

Question 4 and 5: 3 points each all or nothing

Question 6:
0 points: No work
2 points: Many errors/didn't make much progress
4 points: Very few errors
6 points: completely correct

Question 7:
2 points for declaring the variables correctly
2 points for each correct equation
-1 for minor errors

3 for attempting to set up the equations

Question 8: Parts (a) and (b) were all or nothing for having the correct answer. One point was deducted on part (c) if you did not specify that the equation was for the cost of producing instead of cost when selling. Part (d) was 2 points for work and 2 points for the final answer provided that you had accompanying work.

Question 9: You could lose points on this question for arithmetic errors. The number of points depended on how many errors you made. In parts (a) and (b) this was usually a one point deduction for 1-2 errors, a two point deduction for 3-4 errors, and a three point deduction for 5-6 errors. For parts (c) and (d), the multiplication that was not possible was all or nothing and the multiplication you could do was approximately one point per correct entry.

Question 10: This question was graded by grouping together levels of mistakes. I used the following scale for the work you showed:

0 points: No work or no correct row operations.
2 points: Many errors/wrong row operations/didn't make much progress in getting to RREF form.
5 points: Some errors/wrong row operations/making some progress in getting to RREF form.
8 points: Few errors/wrong row operations/very close to RREF form.
10 points: No errors/wrong row operations or very minor errors.

The final four points were for the correct answer. Simply using your calculator to provide the answer with no support was worth zero points.

MA 162 - Finite Mathematics — Fall 2014

Exam #1 — September 22nd, 2014

Instructions: No books or notes may be used on this exam. Calculators are allowed, but not if they are on a cell phone or other communication device. You will have 2 hours to answer all of the following questions. Please write legibly and keep your paper as organized as possible. If you need more space on a question, then use the back of the page to continue your work and clearly indicate that you used the back on the front of the page. **If you do not indicate that you used the back, then your work on the back will not be graded.**

Show all your work! Answers without work or explanation may not receive full credit. Please use complete sentences where appropriate to explain your responses. On multiple choice and true/false questions be sure to clearly indicate your answer choice. If there is any question about which answer you were trying to select then the question will be graded as incorrect.

Good luck!

Name: Key - Version A

Section: ____________

Page	Score	Possible
page 1		14
page 2		10
page 3		12
page 4		8
page 5		10
page 6		12
page 7		14
Total		80

2 pts each

(1) Answer the following true/false questions by circling the correct option. No work is required for these questions.

(a) True / False : A system of two linear equations in two unknowns can have exactly two solutions.

(b) True / False : An over-determined system has more equations than variables.

(c) True / False : Multiplying a 3×2 matrix by a 3×2 matrix results in another 3×2 matrix.

4 pts each

(2) Each matrix shown below is the final form after the Gauss-Jordan elimination method is used. Find all solutions to each corresponding system. Assume that the variables are x, y, and z in that order (the first matrix has only x and y).

(a) $\left[\begin{array}{cc|c} 1 & 0 & 2 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{array}\right]$

$\boxed{\text{No solutions}}$ b/c last equations says $0 = 1$ ✗.

(b) $\begin{array}{c} \begin{array}{ccc} x & y & z \end{array} \\ \left[\begin{array}{ccc|c} 1 & 0 & -2 & 7 \\ 0 & 1 & 3 & 11 \\ 0 & 0 & 0 & 0 \end{array}\right] \end{array}$

Let $z = t$

$x - 2z = 7 \longrightarrow x = 7 + 2z$

$y + 3z = 11 \qquad y = 11 - 3z$

All solutions are of the form

$(7 + 2t, 11 - 3t, t)$ for some

real #, t.

(3) A copy machine originally bought in 2011 for \$5000 depreciates linearly until its scrap value is \$500 in 2020.

(a) Write an equation for $V(t)$, the value of the copy machine, where t is the age of the copy machine measured in years. That is, $t = 0$ corresponds to the year 2011.

We are given two points $(t, V(t))$ in the description: $(0, 5000)$ & $(9, 500)$

4 pts

$$V(t) = \left(\frac{5000 - 500}{0 - 9}\right)t + 5000$$

$$\boxed{V(t) = -500t + 5000}$$

(b) What is the value of the copy machine in 2014?

2014 corresponds to $t = 3$

4 pts

So $V(3) = -500(3) + 5000$

$= -1500 + 5000$

$= \boxed{\$3500}$

(c) Give an interpretation of the slope of your equation. That is, what does the slope tell you about the value of the copy machine?

2pts

The value of the copy machine decreases by \$500 every year.

All problems on this page refer to the following information.

The supply equation for the Smash-o-Matic Fruit Juicer is

$$4x - 3p + 180 = 0$$

where x is the number of juicers the supplier will make available each week when the unit price is $\$p$ each. The demand equation is

$$x + 5p - 530 = 0$$

where x is the quantity demanded when the price is $\$p$.

(4) In order to find the number of juicers people are willing to buy if the price is \$150 you should:

3pts

(a) set $x = 150$ and solve for p in $4x - 3p + 180 = 0$

(b) set $x = 150$ and solve for p in $x + 5p - 530 = 0$

(c) set $p = 150$ and solve for x in $4x - 3p + 180 = 0$

(d) set $p = 150$ and solve for x in $x + 5p - 530 = 0$

(5) According to the supply equation, if $p = 60$ then $x = 0$. What does this mean?

3pts

(a) No one will buy the juicer if the price is \$60.

(b) The supplier will not supply any juicers if the price is \$60.

(c) If the company gives away the juicers for free, then 60 people will take one.

(d) The supplier is willing to supply 60 juicers to be given away for free.

(6) Find the equilibrium price and equilibrium quantity. Show your work!

6pts

Solve the system $\begin{cases} 4x - 3p + 180 = 0 \\ x + 5p - 530 = 0 \end{cases}$

$$\begin{array}{c} \begin{array}{cc} x & p \end{array} \\ \left[\begin{array}{cc|c} 4 & -3 & -180 \\ 1 & 5 & 530 \end{array}\right] \end{array} \xrightarrow{R_1 \leftrightarrow R_2} \left[\begin{array}{cc|c} 1 & 5 & 530 \\ 4 & -3 & -180 \end{array}\right]$$

$$\xrightarrow{R_2 \to R_2 - 4R_1} \left[\begin{array}{cc|c} 1 & 5 & 530 \\ 0 & -23 & -2300 \end{array}\right] \xrightarrow{R_2 \to \frac{-1}{23} R_2} \left[\begin{array}{cc|c} 1 & 5 & 530 \\ 0 & 1 & 100 \end{array}\right]$$

$\boxed{p = 100}$ Equilibrium Price

Then $x + 5p = 530$ means $\boxed{x = 30}$ Equilibrium Quantity

8pts

(7) Setup but **DO NOT SOLVE** this problem. Your answer should be a system of equations with variables clearly defined.

A traveling office supply salesman sells paper, staples, and post-it notes to a variety of organizations. He sells to schools, small businesses, and large companies. He packs different amounts of each product depending on the type of company he visits on his sales trips. The table below shows the amount (in lbs) of each type of product he brings to visit one store of each type of company.

	School	Small Business	Large Company
Paper	100	50	175
Staples	5	2	8
Post-It Notes	15	20	25

On his most recent trip the salesman had a total of 700 lbs of paper, 55 lbs of staples, and 135 lbs of post-it notes. How many of each type of company did he visit on this sales trip?

Let x = # schools visited

Let y = # small businesses visited

Let z = # large companies visited

We need to solve:

$$100x + 50y + 175z = 700 \quad \text{(paper)}$$
$$5x + 2y + 8z = 55 \quad \text{(staples)}$$
$$15x + 20y + 25z = 135 \quad \text{(post-it)}$$

(8) A sporting goods store is considering adding bear traps to their inventory. A distributor tells the store that the cost function for producing x bear traps is

$$C(x) = 3000 + 75x$$

The store plans to sell the traps for \$105 each so the revenue function is

$$R(x) = 105x$$

Answer the following.

(a) How much are the fixed costs for producing bear traps for this distributor?

\$3000

2pts

(b) Find the profit function, $P(x)$, for the sale of bear traps?

$P(x) = R(x) - C(x)$

2pts

$= 105x - (3000 + 75x) = \boxed{30x - 3000}$

(c) What does the mathematical statement $C(5) = 3375$ mean in the context of this problem?

It costs \$3375 to get 5 bear traps from this distributor.

2pts

(d) How many bear traps must the company sell to break even?

To break even we need $P(x)=0$ or $R(x)=C(x)$

$P(x) = 0$ means $30x - 3000 = 0$

4pts

$30x = 3000$

$\underline{x = 100}$

$\boxed{\text{The company must sell 100 bear traps to break-even.}}$

(9) Do the following matrix computations. If a computation is not defined, then write "Not Possible" as your answer.

(a) $\begin{bmatrix} 2 & -1 & 8 \\ 3 & 5 & -10 \end{bmatrix} + \begin{bmatrix} 6 & -2 & 0 \\ 1 & -3 & 7 \end{bmatrix} = \begin{bmatrix} 8 & -3 & 8 \\ 4 & 2 & -3 \end{bmatrix}$

3pts

(b) $3\begin{bmatrix} 4 & 3 & 2 \\ -5 & 11 & -5 \end{bmatrix} = \begin{bmatrix} 12 & 9 & 6 \\ -15 & 33 & -15 \end{bmatrix}$

3pts

(c) $\begin{bmatrix} 2 & -1 & 0 \\ 1 & 5 & -3 \\ 1 & -2 & 4 \end{bmatrix} \cdot \begin{bmatrix} 6 & -2 & 2 \\ 1 & -3 & 7 \end{bmatrix} =$ NOT POSSIBLE

2pts

(d) $\begin{bmatrix} 7 & -1 \\ 1 & 5 \end{bmatrix} \cdot \begin{bmatrix} 3 & -2 \\ -4 & -3 \end{bmatrix} = \begin{bmatrix} 7\cdot 3 + (-1)(-4) & 7(-2) + (-1)(-3) \\ 1\cdot 3 + 5(-4) & 1(-2) + 5(-3) \end{bmatrix}$

4pts

$= \boxed{\begin{bmatrix} 25 & -11 \\ -17 & -17 \end{bmatrix}}$

14 pts

(10) Apply the Gauss-Jordan Method to put the following matrix in reduced row echelon form. Make sure to clear label your row operations using the notation that we have been using in class (for example, $R_2 \mapsto R_2 + 3R_1$).

$$\left[\begin{array}{cccc|c} 4 & 1 & 1 & 3 & 9 \\ 3 & 0 & 0 & 6 & 9 \\ 1 & 0 & 1 & 1 & -2 \end{array}\right] \xrightarrow{R_1 \longleftrightarrow R_3}$$

$$\left[\begin{array}{cccc|c} 1 & 0 & 1 & 1 & -2 \\ 3 & 0 & 0 & 6 & 9 \\ 4 & 1 & 1 & 3 & 9 \end{array}\right] \xrightarrow[R_3 \to R_3 - 4R_1]{R_2 \to R_2 - 3R_1} \left[\begin{array}{cccc|c} 1 & 0 & 1 & 1 & -2 \\ 0 & 0 & -3 & 3 & 15 \\ 0 & 1 & -3 & -1 & 17 \end{array}\right]$$

$$\xrightarrow{R_2 \leftrightarrow R_3} \left[\begin{array}{cccc|c} 1 & 0 & 1 & 1 & -2 \\ 0 & 1 & -3 & -1 & 17 \\ 0 & 0 & -3 & 3 & 15 \end{array}\right] \xrightarrow{R_3 \to -\frac{1}{3} R_3}$$

$$\left[\begin{array}{cccc|c} 1 & 0 & 1 & 1 & -2 \\ 0 & 1 & -3 & -1 & 17 \\ 0 & 0 & 1 & -1 & -5 \end{array}\right] \xrightarrow[R_1 \to R_1 - R_3]{R_2 \to R_2 + 3R_3} \boxed{\left[\begin{array}{cccc|c} 1 & 0 & 0 & 2 & 3 \\ 0 & 1 & 0 & -4 & 2 \\ 0 & 0 & 1 & -1 & -5 \end{array}\right]}$$

Row-Reduced Form

MA 162 - Finite Mathematics | Fall 2014
Exam #1 | September 22nd, 2014

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Show all your work! Answers without work or explanation may not receive full credit. Please use complete sentences where appropriate to explain your responses. On multiple choice and true/false questions be sure to clearly indicate your answer choice. If there is any question about which answer you were trying to select then the question will be graded as incorrect.

Good luck!

Name: Key - Version B

Section: ____________

Page	Score	Possible
page 1		14
page 2		10
page 3		12
page 4		8
page 5		10
page 6		12
page 7		14
Total		80

(1) Answer the following true/false questions by circling the correct option. No work is required for these questions.

(a) True / False : An under-determined system has fewer variables than equations.

2pts each

(b) True / False : Multiplying a 3×2 matrix by a 2×3 matrix results in a 3×3 matrix.

(c) True / False : A system of two linear equations in two unknowns can have exactly two solutions.

(2) Each matrix shown below is the final form after the Gauss-Jordan elimination method is used. Find all solutions to each corresponding system. Assume that the variables are x, y, and z in that order (the first matrix has only x and y).

(a) $\left[\begin{array}{cc|c} 1 & 0 & 2 \\ 0 & 1 & -4 \\ 0 & 0 & 0 \end{array}\right]$

one solution

$$\boxed{\begin{aligned} x &= 2 \\ y &= -4 \end{aligned}}$$

4pts each

(b) $\begin{array}{c} \begin{array}{ccc} x & y & z \end{array} \\ \left[\begin{array}{ccc|c} 1 & 0 & -5 & 6 \\ 0 & 1 & 2 & 13 \\ 0 & 0 & 0 & 0 \end{array}\right] \end{array}$

Let $z = t$.

$x - 5z = 6$ $\rightarrow$ $x = 6 + 5z$

$y + 2z = 13$ $\qquad$ $y = 13 - 2z$

All solutions are of the form

$(6 + 5t, 13 - 2t, t)$

for some real # t.

(3) A copy machine originally bought in 2010 for \$5000 depreciates linearly until its scrap value is \$500 in 2015.

(a) Write an equation for $V(t)$, the value of the copy machine, where t is the age of the copy machine measured in years. That is, $t = 0$ corresponds to the year 2010.

We are given two points $(t, V(t))$ in the description: $(0, 5000)$ + $(5, 500)$

4pts

$$V(t) = \left(\frac{5000 - 500}{0 - 5}\right) t + 5000$$

$$\boxed{V(t) = -900t + 5000}$$

(b) What is the value of the copy machine in 2014?

2014 corresponds to $t = 4$

4pts

$$\begin{aligned} \text{So} \quad V(4) &= -900(4) + 5000 \\ &= -3600 + 5000 \\ &= \boxed{\$1400} \end{aligned}$$

(c) Give an interpretation of the slope of your equation. That is, what does the slope tell you about the value of the copy machine?

2pts

The value of the copy machine decreases by \$900 every year.

All problems on this page refer to the following information.

The supply equation for the Smash-o-Matic Fruit Juicer is

$$3x - 4p + 930 = 0$$

where x is the number of juicers the supplier will make available each week when the unit price is \$$p$ each. The demand equation is

$$x + 5p - 1286 = 0$$

where x is the quantity demanded when the price is \$$p$.

3pts

(4) In order to find the number of juicers the supplier will provide if the price is \$350 you should:

(a) set $x = 350$ and solve for p in $3x - 4p + 930 = 0$

(b) set $x = 350$ and solve for p in $x + 5p - 1286 = 0$

(c) set $p = 350$ and solve for x in $3x - 4p + 930 = 0$

(d) set $p = 350$ and solve for x in $x + 5p - 1286 = 0$

3pts

(5) According to the demand equation, if $p = 0$ then $x = 1286$. What does this mean?

(a) No one will buy the juicer if the price is \$1286.

(b) The supplier will not supply any juicers if the price is \$1286.

(c) If the company gives away the juicers for free, then 1286 people will take one.

(d) The supplier is willing to supply 1286 juicers to be given away for free.

6pts

(6) Find the equilibrium price and equilibrium quantity. Show your work!

Solve the system $\begin{cases} 3x - 4p + 930 = 0 \\ x + 5p - 1286 = 0 \end{cases}$

$$\begin{array}{cc} x & p \\ \end{array}$$
$$\left[\begin{array}{cc|c} 3 & -4 & -930 \\ 1 & 5 & 1286 \end{array}\right] \xrightarrow{R_1 \leftrightarrow R_2} \left[\begin{array}{cc|c} 1 & 5 & 1286 \\ 3 & -4 & -930 \end{array}\right]$$

$$\xrightarrow{R_2 \to R_2 - 3R_1} \left[\begin{array}{cc|c} 1 & 5 & 1286 \\ 0 & -19 & -4788 \end{array}\right] \xrightarrow{R_2 \to -\frac{1}{19}R_2} \left[\begin{array}{cc|c} 1 & 5 & 1286 \\ 0 & 1 & 252 \end{array}\right]$$

$\boxed{p = 252}$ ↑ Equilibrium Price

Then $x + 5p = 1286$ means $\boxed{x = 26}$ ↑ Equilibrium Quantity

8pts

(7) Setup but **DO NOT SOLVE** this problem. Your answer should be a system of equations with variables clearly defined.

A traveling office supply salesman sells paper, staples, and post-it notes to a variety of organizations. He sells to schools, small businesses, and large companies. He packs different amounts of each product depending on the type of company he visits on his sales trips. The table below shows the amount (in lbs) of each type of product he brings to visit one store of each type of company.

	School	Small Business	Large Company
Paper	90	45	185
Staples	7	3	10
Post-It Notes	14	21	29

On his most recent trip the salesman had a total of 713 lbs of paper, 31 lbs of staples, and 123 lbs of post-it notes. How many of each type of company did he visit on this sales trip?

Let x = # schools visited

Let y = # small businesses visited

Let z = # large company visited

we need to solve.

$$90x + 45y + 185z = 713 \quad \text{(paper)}$$
$$7x + 3y + 10z = 31 \quad \text{(staples)}$$
$$14x + 21y + 29z = 123 \quad \text{(postit)}$$

(8) A sporting goods store is considering adding bear traps to their inventory. A distributor tells the store that the cost function for producing x bear traps is

$$C(x) = 2600 + 65x$$

The store plans to sell the traps for \$85 each so the revenue function is

$$R(x) = 85x$$

Answer the following.

(a) How much are the fixed costs for producing bear traps for this distributor?

\$2600

2pts

(b) Find the profit function, $P(x)$, for the sale of bear traps?

$P(x) = R(x) - C(x)$

2pts

$= 85x - (2600 + 65x) = \boxed{20x - 2600}$

(c) What does the mathematical statement $C(5) = 2925$ mean in the context of this problem?

It costs \$2925 to get 5 bear traps from this distributor.

2pts

(d) How many bear traps must the company sell to break even?

To break even we need $P(x) = 0$ OR $R(x) = C(x)$

4pts

$P(x) = 0$ means $20x - 2600 = 0$

$20x = 2600$

$x = 130$

The company must sell 130 bear traps to break even.

(9) Do the following matrix computations. If a computation is not defined, then write "Not Possible" as your answer.

(a) $\begin{bmatrix} 2 & -10 & 9 \\ 4 & 5 & -1 \end{bmatrix} + \begin{bmatrix} 2 & -2 & 0 \\ 8 & -4 & 6 \end{bmatrix} = \begin{bmatrix} 4 & -12 & 9 \\ 12 & 1 & 5 \end{bmatrix}$

3pts

(b) $3\begin{bmatrix} 1 & 7 & 5 \\ -3 & 12 & -2 \end{bmatrix} = \begin{bmatrix} 3 & 21 & 15 \\ -9 & 36 & -6 \end{bmatrix}$

3pts

(c) $\begin{bmatrix} 6 & -2 \\ 1 & 3 \end{bmatrix} \cdot \begin{bmatrix} 3 & 5 \\ -1 & 1 \end{bmatrix} = \begin{bmatrix} 6(3) + (-2)(-1) & 6(5) + (-2)(1) \\ 1 \cdot 3 + 3(-1) & 1(5) + 3(1) \end{bmatrix}$

4 pts

$= \begin{bmatrix} 20 & 28 \\ 0 & 8 \end{bmatrix}$

(d) $\begin{bmatrix} 5 & -1 & 0 \\ -1 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix} \cdot \begin{bmatrix} 6 & -4 & 2 \\ 1 & 3 & 7 \end{bmatrix} =$ Not Possible

2 pts

14pts

1

(10) Apply the Gauss-Jordan Method to put the following matrix in reduced row echelon form. Make sure to clear label your row operations using the notation that we have been using in class (for example, $R_2 \mapsto R_2 + 3R_1$).

$$\left[\begin{array}{cccc|c} 3 & 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 & -1 \\ 4 & 0 & 2 & 10 & 10 \end{array}\right] \xrightarrow{R_1 \longleftrightarrow R_2}$$

$$\left[\begin{array}{cccc|c} 1 & 0 & 0 & 1 & -1 \\ 3 & 1 & 0 & 1 & 1 \\ 4 & 0 & 2 & 10 & 10 \end{array}\right] \xrightarrow[R_3 \to R_3 - 4R_1]{R_2 \to R_2 - 3R_1} \left[\begin{array}{cccc|c} 1 & 0 & 0 & 1 & -1 \\ 0 & 1 & 0 & -2 & 4 \\ 0 & 0 & 2 & 6 & 14 \end{array}\right]$$

$$\xrightarrow{R_2 \to \frac{1}{2}R_2} \boxed{\left[\begin{array}{cccc|c} 1 & 0 & 0 & 1 & -1 \\ 0 & 1 & 0 & -2 & 4 \\ 0 & 0 & 1 & 3 & 7 \end{array}\right]}$$

Row-Reduced Form

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Show all your work! Answers without work or explanation may not receive full credit. Please use complete sentences where appropriate to explain your responses. On multiple choice and true/false questions be sure to clearly indicate your answer choice. If there is any question about which answer you were trying to select then the question will be graded as incorrect.

Good luck!

Name: Key - Version C

Section: ____________

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page 1		14
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page 3		12
page 4		8
page 5		10
page 6		12
page 7		14
Total		80

(1) Answer the following true/false questions by circling the correct option. No work is required for these questions.

2pts each

(a) True / False : A system of two linear equations in two unknowns can have exactly two solutions.

(b) True / False : An under-determined system has more variables than equations.

(c) True / False : Multiplying a 3×2 matrix by a 2×3 matrix results in a 3×3 matrix.

(2) Each matrix shown below is the final form after the Gauss-Jordan elimination method is used. Find all solutions to each corresponding system. Assume that the variables are x, y, and z in that order (the first matrix has only x and y).

4pts each

(a) $\left[\begin{array}{cc|c} 1 & 0 & 21 \\ 0 & 1 & 4 \\ 0 & 0 & 0 \end{array}\right]$

one solution

$$\boxed{\begin{aligned} x &= 21 \\ y &= 4 \end{aligned}}$$

(b) $\left[\begin{array}{ccc|c} 1 & 0 & -3 & 8 \\ 0 & 1 & 6 & -1 \\ 0 & 0 & 0 & 0 \end{array}\right]$

Let $z = t$

$x - 3z = 8$ → $x = 8 + 3z$
$y + 6z = -1$ → $y = -1 - 6z$

All solutions are of the form

$(8 + 3t, -1 - 6t, t)$ for some real number t.

(3) A copy machine originally bought in 2010 for \$4000 depreciates linearly until its scrap value is \$500 in 2015.

(a) Write an equation for $V(t)$, the value of the copy machine, where t is the age of the copy machine measured in years. That is, $t = 0$ corresponds to the year 2010.

We are given two points $(t, V(t))$ in the description $(0, 4000)$ + $(5, 500)$

4pts

$$V(t) = \left(\frac{4000 - 500}{0 - 5}\right) t + 4000$$

$$\boxed{V(t) = -700t + 4000}$$

(b) What is the value of the copy machine in 2014?

2014 corresponds to $t = 4$

4pts

$$V(4) = -700(4) + 4000$$

$$= -2800 + 4000$$

$$= \boxed{\$1200}$$

(c) Give an interpretation of the slope of your equation. That is, what does the slope tell you about the value of the copy machine?

The value of the copy machine decreases by \$700 every year.

2pts

All problems on this page refer to the following information.
The supply equation for the Smash-o-Matic Fruit Juicer is

$$3x - 4p + 894 = 0$$

where x is the number of juicers the supplier will make available each week when the unit price is \$$p$ each. The demand equation is

$$x + 5p - 1545 = 0$$

where x is the quantity demanded when the price is \$$p$.

(4) In order to find the price which will make 100 people want to buy the juicer you should:

(a) set $x = 100$ and solve for p in $3x - 4p + 894 = 0$

3pts (b) set $x = 100$ and solve for p in $x + 5p - 1545 = 0$

(c) set $p = 100$ and solve for x in $3x - 4p + 894 = 0$

(d) set $p = 100$ and solve for x in $x + 5p - 1545 = 0$

(5) According to the demand equation, if $x = 0$ then $p = 309$. What does this mean?

(a) No one will buy the juicer if the price is \$309.

(b) The supplier will not supply any juicers if the price is \$309.

3pts (c) If the company gives away the juicers for free, then 309 people will take one.

(d) The supplier is willing to supply 309 juicers to be given away for free.

(6) Find the equilibrium price and equilibrium quantity. Show your work!

Solve the system $\begin{cases} 3x - 4p + 894 = 0 \\ x + 5p - 1545 = 0 \end{cases}$

6pts

$$\begin{array}{cc} x & p \end{array}$$

$$\left[\begin{array}{cc|c} 3 & -4 & -894 \\ 1 & 5 & 1545 \end{array}\right] \xrightarrow{R_1 \leftrightarrow R_2} \left[\begin{array}{cc|c} 1 & 5 & 1545 \\ 3 & -4 & -894 \end{array}\right]$$

$$\xrightarrow{R_2 \to R_2 - 3R_1} \left[\begin{array}{cc|c} 1 & 5 & 1545 \\ 0 & -19 & -5529 \end{array}\right] \xrightarrow{R_2 \to -\frac{1}{19}R_2} \left[\begin{array}{ccc} 1 & 5 & 1545 \\ 0 & 1 & 291 \end{array}\right]$$

$\boxed{p = 291}$ ↑ Equilibrium Price

Then $x + 5p = 1545$ means $\boxed{x = 90}$ ↑ Equilibrium Quantity

8pts

(7) Setup but **DO NOT SOLVE** this problem. Your answer should be a system of equations with variables clearly defined.

A traveling office supply salesman sells paper, staples, and post-it notes to a variety of organizations. He sells to schools, small businesses, and large companies. He packs different amounts of each product depending on the type of company he visits on his sales trips. The table below shows the amount (in lbs) of each type of product he brings to visit one store of each type of company.

	School	Small Business	Large Company
Paper	87	53	150
Staples	6	4	12
Post-It Notes	11	19	31

On his most recent trip the salesman had a total of 710 lbs of paper, 39 lbs of staples, and 137 lbs of post-it notes. How many of each type of company did he visit on this sales trip?

Let x = # schools visited.
Let y = # small businesses visited
Let z = # large companies visited

We need to solve:

$87x + 53y + 150z = 710$ (paper)
$6x + 4y + 12z = 39$ (staples)
$11x + 19y + 31z = 137$ (post-it)

(8) A sporting goods store is considering adding bear traps to their inventory. A distributor tells the store that the cost function for producing x bear traps is

$$C(x) = 2900 + 54x$$

The store plans to sell the traps for \$85 each so the revenue function is

$$R(x) = 64x$$

Answer the following.

(a) How much are the fixed costs for producing bear traps for this distributor?

2pts

\$2900

(b) Find the profit function, $P(x)$, for the sale of bear traps?

2pts

$$P(x) = R(x) - C(x)$$
$$= 64x - (2900 + 54x) = \boxed{10x - 2900}$$

(c) What does the mathematical statement $C(5) = 3170$ mean in the context of this problem?

2pts

It costs \$3170 to get 5 bear traps from this distributor.

(d) How many bear traps must the company sell to break even?

4pts

To break even we need $P(x) = 0$ OR $R(x) = C(x)$.

$P(x) = 0$ means
$$10x - 2900 = 0$$
$$10x = 2900$$
$$x = 290$$

The company needs to sell 290 bear traps to break-even.

(9) Do the following matrix computations. If a computation is not defined, then write "Not Possible" as your answer.

3pts

(a) $\begin{bmatrix} 2 & 10 & 3 \\ 3 & -5 & -1 \end{bmatrix} + \begin{bmatrix} 1 & -2 & 0 \\ 1 & -4 & 7 \end{bmatrix} = \begin{bmatrix} 3 & 8 & 3 \\ 4 & -9 & 6 \end{bmatrix}$

3pts

(b) $2\begin{bmatrix} 1 & 7 & 6 \\ -3 & 13 & -4 \end{bmatrix} = \begin{bmatrix} 2 & 14 & 12 \\ -6 & 26 & -8 \end{bmatrix}$

4pts

(c) $\begin{bmatrix} 6 & -2 \\ 2 & -3 \end{bmatrix} \cdot \begin{bmatrix} 3 & 4 \\ -1 & -2 \end{bmatrix} = \begin{bmatrix} 6(3)+(-2)(-1) & 6(4)+(-2)(-2) \\ 2(3)+(-3)(-1) & 2(4)+(-3)(-2) \end{bmatrix}$

$= \boxed{\begin{bmatrix} 20 & 28 \\ 9 & 14 \end{bmatrix}}$

2pts

(d) $\begin{bmatrix} 2 & -1 & 0 \\ -5 & 3 & -3 \\ 4 & -2 & 1 \end{bmatrix} \cdot \begin{bmatrix} 0 & -4 & 3 \\ 1 & 3 & 9 \end{bmatrix} =$ Not Possible

14 pts

(10) Apply the Gauss-Jordan Method to put the following matrix in reduced row echelon form. Make sure to clear label your row operations using the notation that we have been using in class (for example, $R_2 \mapsto R_2 + 3R_1$).

$$\left[\begin{array}{cccc|c} 3 & 0 & 1 & 10 & -8 \\ 1 & 3 & -2 & -21 & 1 \\ 1 & 0 & 0 & 2 & -3 \end{array}\right] \xrightarrow{R_1 \leftrightarrow R_3}$$

$$\left[\begin{array}{cccc|c} 1 & 0 & 0 & 2 & -3 \\ 1 & 3 & -2 & -21 & 1 \\ 3 & 0 & 1 & 10 & -8 \end{array}\right] \xrightarrow[R_3 \to R_3 - 3R_1]{R_2 \to R_2 - R_1}$$

$$\left[\begin{array}{cccc|c} 1 & 0 & 0 & 2 & -3 \\ 0 & 3 & -2 & -23 & 4 \\ 0 & 0 & 1 & 4 & 1 \end{array}\right] \xrightarrow{R_2 \to R_2 + 2R_3}$$

$$\left[\begin{array}{cccc|c} 1 & 0 & 0 & 2 & -3 \\ 0 & 3 & 0 & -15 & 6 \\ 0 & 0 & 1 & 4 & 1 \end{array}\right] \xrightarrow{R_2 \to \frac{1}{3} R_2}$$

$$\boxed{\left[\begin{array}{cccc|c} 1 & 0 & 0 & 2 & -3 \\ 0 & 1 & 0 & -5 & 2 \\ 0 & 0 & 1 & 4 & 1 \end{array}\right]}$$ Row-Reduced Form