Math 141 - Exam 1 Review Answer Key

1. \[ y = -\frac{5}{3}x \]
2. \[ y = \frac{3}{5}x + \frac{33}{5} \]
3. \[ y = \frac{1}{2}x - 4 \]
4. \[ x = -7 \]
5. \[ y = 4x - 160 \]
6. (a) TRUE  
   (b) FALSE  
   (c) FALSE  
   (d) FALSE  
   (e) TRUE  
   (f) FALSE  
   (g) FALSE  
   (h) FALSE  
   (i) TRUE  
   (j) TRUE
7. I decided to change the equations in the problem so that the numbers worked out nicely. Using the demand equation \[ 31x + 11y - 825 = 0 \] and the supply equation \[ -14x + 11y - 330 = 0 \], the equilibrium quantity is \[ x = 11 \] and the equilibrium price is \[ y = $44. \]
8. Again, to make the numbers work out nicely, I changed the selling price per unit to 1.5 Galleons (instead of 2 Galleons). With this change, the answers are as follows:  
   (a) production cost per unit = 0.25 Galleons  
   (b) \( C(x) = 0.25x + 15 \)  
   (c) \( R(x) = 1.5x \)  
   (d) \( P(x) = 1.25x - 15 \)  
   (e) \( (12, 18) \)
9. \[ k = -\frac{6}{5} \]
10. (a) \[ y = 0.9857x + 35.3571 \]  
    (b) $35,145  
    (c) \( r = 0.9120 \)  
    Since the correlation coefficient \( r \) is very close to 1, the data have a strong linear relationship.
11. (a) Not in row-reduced form. Column 3 has a leading 1, but it is not a unit column (all other entries in column 3 should be 0).  
    (b) Is in row-reduced form. Unique solution: \[ x = 5, y = 3 \]  
    (c) Is in row-reduced form. Infinitely many solutions: Let \( y = t \) where \( t \) is any real number. Then the parametric solution is \( (-3t + 5, t, -7) \).  
    (d) Not in row-reduced form. The first nonzero entry in row 2 is not a 1.  
    (e) Is in row-reduced form. No solution.  
    (f) Not in row-reduced form. The leading 1 in the second row lies to the left of the leading 1 in the row above it.  
    (g) Not in row-reduced form. The row of all zeros should be below all rows with nonzero entries.
12. (a) Let $x$ equal the amount of money invested in the high risk stock.
Let $y$ equal the amount of money invested in the medium risk stock.
Let $z$ equal the amount of money invested in the low risk stock.
Then $x = 75,000$, $y = 200,000$, $z = 25,000$

(b) Let $x$ equal the number of small sodas sold that day.
Let $y$ equal the number of medium sodas sold that day.
Let $z$ equal the number of large sodas sold that day.
Then the parametric solution is $(t - 2, -2t + 25, t)$ where $t = 2, 3, 4, \ldots , 12$. To find a specific (particular) solution, pick any of the possible values of $t$ from the list and substitute that value into the parametric solution.

13. The final matrix will be
$$\begin{bmatrix} 1 & -2 & 0 & 3 \\ 0 & 18 & -8 & -15 \\ 0 & 1 & 1 & 3 \end{bmatrix}.$$  

14. I made another change to the problem here. In the second matrix, I changed the $x - 7$ in the row 3, column 1 position to just $x$, and in the third matrix, I changed the $y - 1$ in the row 1, column 1 position to just $y$. After making these changes, you find $x = -2$, $y = -\frac{5}{4}$, $z = -\frac{8}{3}$, and $u = \frac{2}{3}$.

15. $A = \begin{bmatrix} 22 & -21 \\ 26 & -33 \end{bmatrix}$

16. (a) Not possible. Matrices must be the same size (have the same dimensions) to add.
(b) Result will be $3 \times 3$. (Use your calculator to find the exact answer.)
(c) Not possible. $D^{-1}$ is $3 \times 3$ and $C$ is $2 \times 3$. Since the number of columns of $D^{-1}$ does not equal the number of rows of $C$, these matrices cannot be multiplied in the given order.
(d) Result will be $2 \times 3$. (Use your calculator to find the exact answer.)
(e) $I_3 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, the $3 \times 3$ identity matrix
(f) Not possible since $E$ is singular (i.e., $E^{-1}$ does not exist).
(g) Not possible. The number of columns of $C$ is not equal to the number of rows of $A$.
(h) Not possible. $C$ is not a square matrix, so it cannot have an inverse.

17. in text

18. $x = \frac{35}{2}$, $y = -\frac{77}{2}$, $z = -\frac{7}{2}$
19. I’m sorry about the crazy font on the graphic—it’s the best I could do on short notice. Reverse shading is demonstrated.

20. Let \( x \) equal the number of ounces of chicken that should be used in each bag. Let \( y \) equal the number of ounces of grain that should be used in each bag.

Minimize Cost \( C = 10x + y \)
subject to \( 10x + 2y \geq 200 \)
\( 5x + 2y \geq 150 \)
\( x \geq 0, \ y \geq 0 \)