1. A chemist must prepare 540 milliliters of a chemical solution. It is to be made up of 4 parts acid and 5 parts distilled water. If all parts are equal, then how much of water should be used?

(a) 300 milliliter See Ex 1: Page 46 (correct)
(b) 240 milliliter
(c) 340 milliliter
(d) 200 milliliter
(e) 320 milliliter

Let x be the number of ~~each~~ mililiters in each part then

$4x + 5x = 540$

$x = \frac{540}{9} = 60$

So amount of water $= 5x$

$= 5(60)$

$= 300$

2. The monthly revenue of a certain company is given by $R = 800p - 7p^2$, where p is the price in dollars of the product the company manufactures. At what price will the revenue be \$10,000 if the price must be greater than \$50?

(a) 100 See Q # 31, Page 51 (correct)
(b) 150
(c) 75
(d) 95
(e) 50

$R = 10,000$

$R = 800p - 7p^2$

So, $800p - 7p^2 = 10,000$

$7p^2 - 800p + 10,000 = 0$

$p = 100$ or 14.28

Since price is greater than \$50

So answer is $\boxed{p = 100}$

3. A company invests a total of \$30,000 of surplus funds at two annual rates of interest: 5% and $6\frac{3}{4}\%$. It wishes an annual yield of no less than $6\frac{1}{2}\%$. What is the least amount of money that the company must invest at the $6\frac{3}{4}\%$ rate?

(a) at least \$25714.29 See Q # 7, Page 57 (correct)

(b) at least \$25174.29

(c) at most \$25714.29

(d) at least \$27541.29

(e) at most \$27541.29

$6\frac{3}{4}\% x + 5\%(30000 - x) \geq 6\frac{1}{2}\%(30,000)$

$x \geq 25714.29$

4. Suppose a company offers you a sales position with your choice of two methods of determining your yearly salary. The first method pays \$35,000 plus a bonus of 3% of your yearly sales. The second method pays a straight 5% commission on your sales. If the yearly sales is greater than \$1,750,000, then which of the following statements is **True**?

See Q # 12, Page 58

(a) Second method is better because early sales is greater than \$1,750,000 (correct)

(b) First method is better because early sales is greater than \$1,750,000

(c) Both methods are equal

(d) First method is better because yearly sales less than \$1,750,000

(e) Second method is better because yearly sales less than \$1,750,000

If x is yearly Sales

$35000 + 3\% x \leq 5\% x$

$x \geq 1750000$

5. A straight line has slope 3 and y-intercept $(0, 1)$. Then which of the following statement is **WRONG**.

(a) The point $(-2, -1)$ lies on the line. See Q 62, Page 135 (correct)

(b) The point $(-1, -2)$ lies on the line.

(c) The line is perpendicular to the line $x + 3y - 6 = 0$

(d) The line intercepts the x-axis at $x = -\frac{1}{3}$

(e) The line is parallel to $3x - y + 2 = 0$

Put $(-2, -1)$ in Eq (i)

$-1 = 3(-2) + 1$

$= -6 + 1$

$-1 \neq -5$

So $(-2, -1)$ does not lies on the line.

$m = 3, \quad c = 1$

$y = mx + c$

$\boxed{y = 3x + 1}$ — (i)

6. The average daily cost, C, for a room at a city hospital has risen by \$59.82 per year for the years 1990 through 2000. If the average cost in 1996 was \$1128.50, what is an equation which describes the average cost during this decade, as a function of the number of years, T, since 1990?

(a) $C = 59.82T + 769.58$ See Q #71, Page 135 (correct)

(b) $C = 769.58T + 59.82$

(c) $T = 59.82C + 769.58$

(d) $T = 769.58C + 59.82$

(e) $C = 59.82T + 1128.5$

$m = 59.82$

$(6, 1128.50)$

$C = 59.82(T - 6) + 1128.5$

$= 59.82T + 769.58$

7. In 2008, the stock in a computer hardware company traded for \$37 per share. However, the company was in trouble and the stock price dropped steadily, to \$8 per share in 2018. Then which of the following statement is **TRUE**?

See Q# 63, Page # 135

(a) The stock price dropped an average of \$2.90 per year _____(correct)

(b) The stock price dropped an average of \$3.90 per year

(c) The stock price increased an average of \$2.90 per year.

(d) The stock price increased an average of \$3.90 per year.

(e) The stock price remains constant an average of \$2.90 per year.

(2008, 37) (2018, 8)

$m = -2.9$

So Stock price dropped an average of \$2.9 per year.

8. Which of the following lines are perpendicular

$\ell_1 : y = 3$ → horizontal line]
$\ell_2 : x = -\frac{1}{3}$ → vertical line] These are perpendicular.
$\ell_3 : 3x + y = 4$
$\ell_4 : x + 6y = 4$

(a) ℓ_1 and ℓ_2 See Q# 47, Page # 134 (correct)

(b) ℓ_2 and ℓ_3

(c) ℓ_3 and ℓ_4

(d) ℓ_1 and ℓ_4

(e) ℓ_2 and ℓ_4

9. Suppose consumers will demand 40 units of a product when the price is \$12.75 per unit and 25 units when the price is \$18.75 each. When 37 units are demanded, and assuming that the demand equation is linear, then price per unit is

(a) \$13.95 See Q# 15, Page # 140 (correct)
(b) \$13.00
(c) \$14.95
(d) \$15.95
(e) \$12.95

Given that $(40, 12.75)$
$(25, 18.75)$
we need to find P when $q = 37$
Use the Concept of Equation of line passing through two points. we get
$P = -0.4q + 28.75$
$P = -0.4(37) + 28.75 = 13.95$

10. A house purchased for \$255,000 is expected to double in value in 15 years. Then a linear equation that describes the house's value after t years is

(a) $17000t + 255000$ See Q# 26, Page # 140 (correct)
(b) $15000t + 255000$
(c) $255000t + 17000$
(d) $15t + 255000$
(e) $255t + 155000$

$m = \frac{255000}{15} = 17000$
So the required linear Equation is
$17000t + 255000$

11. What are the vertex and axis of symmetry of the parabola $y = -x^2 + 6x + 3$?

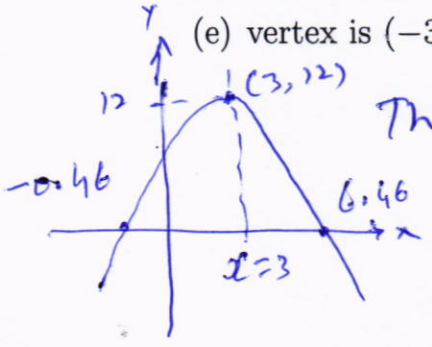
(a) vertex is $(3, 12)$; axis of symmetry is $x = 3$ See Ex 3, Page 144 (correct)

(b) vertex is $(12, 3)$; axis of symmetry is $x = 3$

(c) vertex is $(3, 12)$; axis of symmetry is $y = 3$

(d) vertex is $(12, 3)$; axis of symmetry is $y = 3$

(e) vertex is $(-3, 12)$; axis of symmetry is $x = -3$



The x-Coordinate of the vertex is $-\frac{b}{2a}$

$= \frac{-(6)}{2(-1)} = 3$

y-Coordinate $= -(3)^2 + 6(3) + 3$

$= 12$

$(3, 12)$.

12. The demand function for an appliance company's line of washing machines is $p = 300 - 5q$, where p is the price (in dollars) per unit when q units are demanded (per week) by consumers. Find the level of production that will maximize the manufacturer's total revenue, and determine this revenue.

(a) 30 units; \$4500 maximum revenue See Q # 30, Page 147 (correct)

(b) 30 units; \$5500 maximum revenue

(c) 35 units; \$4500 maximum revenue

(d) 25 units; \$4500 maximum revenue

(e) 40 units; \$6500 maximum revenue

$r = pq$

$= (300 - 5q)q$

$r = -5q^2 + 300q$

maximum revenue at $q = -\frac{b}{2a}$

$= \frac{-(300)}{2(-5)} = 30$

max. revenue is $r = -5(30)^2 + 300(30)$

$= 4500$

13. Given the system of linear equations

$$\begin{cases} 2x - y = 1 \\ -x + ky = c, \end{cases}$$

where k and c are real constants. Which of the following statements is **True**?

see Ex 3, Page 152

(a) For $k = \frac{1}{2}$, $c = -\frac{1}{2}$, system has infinitely many solutions _____(correct)

(b) For $k = \frac{1}{2}$, $c = -\frac{1}{2}$, system has no solutions

(c) For $k = \frac{1}{2}$, $c = -\frac{1}{2}$, system has unique solutions

(d) For $k \neq \frac{1}{2}$, $c \neq -\frac{1}{2}$, system has infinitely many solutions

(e) For $k \neq \frac{1}{2}$, $c \neq -\frac{1}{2}$, system has no solutions

System will have infinitely many Solution if

$-1+2k = 0$ and $1+2c = 0$

$k = 1/2$ $\quad c = -1/2$

$2x - y = 1$

$2(-x + ky = c)$

$-y + 2ky = 1 + 2c$

$(-1+2k)y = 1+2c$

14. The value of k, where the following system

$$\begin{cases} 3x + 2y = 2 \\ 2x - ky = 0, \end{cases}$$

has no solution is

(a) $-\frac{4}{3}$ See Ex 2. Page 152 (correct)

(b) $\frac{4}{3}$

(c) 0

(d) 2

(e) -2

Eleminate x in the given System

System has no Solution

So

$4 + 3k = 0$

$k = -4/3$

$2(3x + 2y) = 4$

$3(2x - ky) = 0$

$4y + 3ky = 4$

$(4+3k)y = 4$

15. The number of solutions of the system

$$\begin{cases} x^2+y^2=7 \\ x^2-y^2=1, \end{cases}$$

is

(a) Four (correct)

(b) Three

(c) Two

(d) One

(e) No solution

$x^2 = 1+y^2$ put in Eq ii

$1+y^2+y^2 = 7$

$2y^2 = 6$

$y = \pm\sqrt{3}$ See Q # 11, Page 160.

For $y=\sqrt{3}$ use $x^2 = 1+y^2$

$x = 2, x = -2$

For $y = -\sqrt{3}$

$x^2 = 1+y^2$

$x = 2, -2$

$(2, \sqrt{3})$ $(-2, \sqrt{3})$, $(2, -\sqrt{3})$ $(-2, -\sqrt{3})$

16. If one solution of the following system is $x = 1$, $y = 1$

$$\begin{cases} x-y^2=0 \\ 3x+2y-5=0, \end{cases}$$

$x = y^2$

Then the other solution is

(a) $x = \frac{25}{9}, y = -\frac{5}{3}$ (correct)

(b) $x = \frac{9}{25}, y = -\frac{3}{5}$

(c) $x = \frac{49}{2}, y = -\frac{7}{2}$

(d) $x = 1, y = -1$

(e) $x = 0, y = 0$

See Q # 3, Page 160

$3y^2+2y-5=0$

$3y^2+5y-3y-5=0$

$y(3y+5)-1(3y+5)=0$

$y = -5/3, 1$

$x = \frac{25}{9}$

17. Let $p = \frac{8}{100}q + 50$ be the supply equation for a manufacturer's product, and suppose the demand equation is $p = -\frac{7}{100}q + 65$. Determine how the original equilibrium price will be affected if the company is given a government subsidy of \$0.75 per unit.

See Q #23, Page #167

(a) the original equilibrium price decreases by \$0.35 _____(correct)

(b) the original equilibrium price decreases by \$0.70

(c) the original equilibrium price decreases by \$0.30

(d) the original equilibrium price increases by \$0.35

(e) the original equilibrium price increases by \$0.70

Before Subsidy, find original Equalibrium Price and quanity.

$\frac{8}{100}q + 50 = -\frac{7}{100}q + 65$

$q = 100$, $P = 58$

After Subsidy

$\frac{8}{100}q + 50 - 0.75 = \frac{-7}{100}q + 65$

$P = 57.65$

$q = 105$

Price decreases by \$0.35

18. The solution of the following system

$$\begin{cases} x + y + 7z = 0 \\ x - y - z = 0 \\ 2x - 3y - 6z = 0 \\ 3x + y + 13z = 0 \end{cases}$$

is

(a) $x = -3r,\ y = -4r,\ z = r$ _____(correct)

(b) $x = 4r,\ y = -4r,\ z = r$

(c) $x = -4r,\ y = -3r,\ z = r$

(d) $x = -3r,\ y = r,\ z = -4r$

(e) $x = 3r,\ y = 4r,\ z = r$

See Q #22, Page 277

$$\begin{bmatrix} 1 & 1 & 7 \\ 1 & -1 & -1 \\ 2 & -3 & -6 \\ 3 & 1 & 13 \end{bmatrix} \xrightarrow[R_4 - 3R_1]{R_2 - R_1,\ R_3 - 2R_1} \begin{bmatrix} 1 & 1 & 1 \\ 0 & -2 & -8 \\ 0 & -5 & -20 \\ 0 & -2 & -8 \end{bmatrix} \xrightarrow[-\frac{1}{2}R_4]{-\frac{1}{2}R_2,\ -\frac{1}{5}R_3}$$

$$\xrightarrow[R_4 - R_2]{R_3 - R_2} \begin{bmatrix} 1 & 1 & 7 \\ 0 & 1 & 4 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

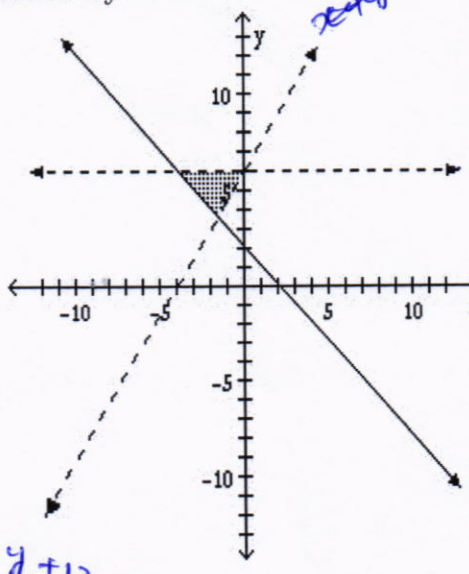
$z = r$

$y = -4r$

$x = -3r$

19. The shaded region represents the feasible region in the following diagram is described by

See P #23, Page # 298.



$y<6$

$x+y-2\geq 0$

$3x-2y+12<0$

(a) $y < 6,\ \ x + y - 2 \geq 0,\ \ 3x - 2y + 12 < 0$ (correct)

(b) $x < 6,\ \ 3x + 5y - 4 > 0,\ \ 4x - 2y + 9 \leq 0$

(c) $y < 6,\ \ 4x + 4y - y > 0,\ \ x - y + 2 \geq 0$

(d) $y < 6,\ \ 3x + 2y - 8 \leq 0,\ \ 2x - 4y + 5 > 0$

(e) $y \leq 6,\ \ 4x + 5y - 5 < 0,\ \ x - 2y + 8 \geq 0$

20. Let $x = A$ and $y = B$ be the numbers of units of two different car models, and consider the following linear programming model:

Maximize $P = 7x + 2y$ subject to

$$\begin{cases} x \geq 0 \\ y \geq 0 \\ 2x + y \leq 80 \\ 3x + y \leq 50 \\ 5x + y \leq 70, \quad \text{Then } A + B = \end{cases}$$

See Q #13 Page #306

(a) 30 (correct)

(b) 40

(c) 20

(d) 50

(e) 60

$x = 20,\ y = 10$

$A + B = 30$

Math 105, 221, Major Exam I

Answer KEY

Q	MASTER	CODE01	CODE02	CODE03	CODE04
1	A	A 4	E 15	D 18	D 8
2	A	A 20	C 6	D 19	B 1
3	A	C 8	C 20	B 10	B 19
4	A	D 2	C 5	C 20	D 20
5	A	A 15	B 2	E 2	C 6
6	A	D 19	C 19	B 12	E 2
7	A	C 14	C 8	C 8	C 12
8	A	A 1	E 3	E 3	B 18
9	A	D 12	E 7	B 4	A 14
10	A	C 9	C 4	B 13	C 3
11	A	D 11	B 18	D 16	C 10
12	A	D 16	E 17	B 17	A 17
13	A	D 17	A 11	A 1	E 9
14	A	A 3	C 1	D 6	E 16
15	A	C 18	D 12	E 9	D 5
16	A	D 13	D 10	D 14	A 4
17	A	D 5	A 13	E 7	A 15
18	A	D 7	A 16	B 15	D 11
19	A	C 6	A 14	D 5	E 7
20	A	D 10	C 9	C 11	D 13