PART 1 - FREE RESPONSE REVIEW

1) Solve $y = mx + b$ for x.

2) Solve $y - y_1 = m(x - x_1)$ for x_1.

3) Solve $k = \frac{n(t-1)}{2}$ for t.

4) Solve $P = \frac{nRT}{V}$ for R.

5) Find the function value of $f(x) = \frac{1}{(x+4)(x-3)}$ for $f(2)$.

6) Suppose that $f(x) = x^2 - 1$ and $g(x) = 2x$. Find $f(g(3))$.

7) Suppose that $f(x) = x + 3$ and $g(x) = 2x^2$. Find $g(f(2))$.

8) A tree was planted 5 years ago and is now 10 feet high. Two years ago it was 8 feet high. Fit a linear equation to the data.

9) A strange thermometer reads 25^0 F at a real temperature of 77^0 F, It reads 45^0 F at a real temperature of 113^0 F. Fit a linear equation to the data.

10) The swim team paid $446 for team suits. The men's suits cost $18 each and the women's $32 each. If there are 17 members on the team, how many men are there? How many women?

11) Sheri, Bob and Mark can inspect 40 disk drives per hour when all three are working. Sheri and Bob working together can inspect 28 per hour, and Sheri and Mark together can inspect 27 per hour. How many can each person inspect per hour?

12) A trail mix company has 200 lb of peanuts and 160 lb of raisins. A batch of house mix takes 20 lb of peanuts and 10 lb of raisins. A batch of fancy mix takes 10 lb of peanuts and 20 lb of raisins. Profit from each batch of house mix is $50 and from each batch of fancy mix $60. How much of each type should be made to maximize profits? What is the maximum profit?

13) Jordan, James, and Alex can plant 16 trees per hour when all three of them are working. Together, Jordan and Alex can plant 10 trees per hour. When Jordan and James work together, they can plant 11 trees per hour. How many trees per hour can each of them plant?

14) Solve: $$\begin{aligned} x+y+z&=-7 \\ -x+2y+2z&=-17 \\ 2x+y-z&=4 \end{aligned}$$

15) Graph the system of inequalities: $$\begin{aligned} 2x+3y&\le 6 \\ 4x-3y&\le 12 \end{aligned}$$

16) Graph the system of inequalities: $$\begin{aligned} 3x+2y&\le 6 \\ 3x-2y&\ge 6 \end{aligned}$$

17) Simplify $(x^2 - 2x + 9) - (5x^2 - 3x + 4)$

18) Simplify $(x^3y - 3x^2y + 2xy) - (-3x^2y + 2xy - 1)$

19) Simplify $3a^2b(5a + 1)$

20) Simplify $(3x - 2)^2$

21) Simplify: $(5x + 9)(3x + 4)$

22) Simplify: $(2a + b)^3$

23) Factor $49x^2 - 35x$

24) Factor $p^2 + 18p + 81$

25) Factor $z^2 - 12z + 36$

26) Factor $r^2 - 121$

27) Factor $7x^2 - 42x + 63$

28) Factor $x^2 - x - 30$

29) Factor $x^2 + 19x + 70$

30) Factor $2x^2 + 7x + 6$

31) Factor $14x^2 + 35x + 21$

32) Factor $x^3 - y^3$

33) Factor $7a^2x - 63b^2x$

34) Factor $64x^2 - 12x$

35) Factor $p^2 + 14p + 49$

36) Factor $z^2 - 16z + 64$

37) Factor $r^2 - 144$

38) Factor $7x^2 - 28x + 28$

39) Factor $x^2 - 13x - 30$

40) Factor $x^2 + 12x - 28$

41) Factor $2x^2 - 8x - 10$

42) Factor $21x^2 - 7x - 14$

43) Factor $a^3 + b^3$

44) Factor $12x^2y - 3z^2y$

45) Solve $\frac{1}{p} - \frac{1}{q} = \frac{1}{r}$ for *p*.

46) Solve $\begin{aligned} 2x - 3y - 2z &= 4 \\ -2x + 2y + z &= -5 \\ -2x + 4y + z &= -1 \end{aligned}$

47) Solve $\begin{aligned} 2x + 3y + z &= 0 \\ x + 2y + 3z &= -3 \\ 3x + y + z &= 4 \end{aligned}$

48) Find an equation in standard form perpendicular to x – y = 3 through the point (-4,8)

49) If the graphs of x + y = 3 and x + *k*y = 12 intersect on the y-axis, then find *k*.

50) Use Cramer's Rule to solve for y in the system of linear equations:

$$\begin{aligned} 3x + 2y - 10z &= 5 \\ x - y + z &= 10 \\ -7x \quad + 2z &= 1 \end{aligned}$$

51) a chemist has one solution that is 12% lime and a second that is 60% lime. How many liters of each does he need to make 10 liters of solution that is 30% lime?

52) Two machines A and B produce items at the rate of 6 per hour and 4 per hour respectively. Under a certain production plan the total number of items needed is at least 50 items, and the total number of man-hours available for running the machines is at most 10 hours. For maintenance reasons, machine A must be run no more than 9 hours. If it costs $100 per hour to run machine A and $65 per hour to run machine B, what would be the most economical number of hours to run each machine and yet still meet production requirements?

53) If $x + \frac{1}{x} = 4$, find the value of $x^3 + \frac{1}{x^3}$.

54) If $f(x) = \frac{1}{x}$ and $g(x) = x^2 + 1$ and $h(x) = \sqrt{x - 5}$ Determine each of the following: f(g (h (5.25)))

55) For any three real numbers $a, b, c,$ with $b \neq c$, the operation $\otimes(a,b,c) = \dfrac{a}{b-c}$. What is $\otimes(\otimes(1,2,3), \otimes(2,3,1), \otimes(3,1,2))$?

56) Solve
$$\begin{aligned} 4x - y + 2z &= 1 \\ x + 3y - z &= 2 \\ 7x + 4y + 5z &= 3 \end{aligned}$$

57) Graph the function $f(x) = |x - 2| + 2$

58) Let $f(x) = 2x^2 - x + 4$ and $g(x) = x^2 + 5$ Find (a) $(f + g)x$ and (b) $(f - g)x$

59) Let $f(x) = 2x^2 - 7$ and $g(x) = 3x + 1$ Find (a) $f(g(x))$ and (b) $g(f(x))$

60) Find P(-2) if $P(x) = 3x^4 + 7x^3 + 12x^2 + 21x + 9$

61) True or False: (-1, 5, 2) is a solution of $2x - 3y - z = -15$.

62) Find the solution to the system of linear equations with the augmented matrix:
$$\left[\begin{array}{cc|c} 4 & -1 & 6 \\ -1 & 2 & -5 \end{array}\right]$$

63) Given A = $\begin{bmatrix} 2 & 4 & -1 \\ 1 & 0 & 4 \\ 8 & 1 & 2 \end{bmatrix}$ and B = $\begin{bmatrix} 1 & 1 & 1 \\ -1 & 0 & 0 \\ 4 & 10 & -2 \end{bmatrix}$ find 2A – 3B

64) Given A = $\begin{bmatrix} 2 & 4 & -1 \\ 1 & 0 & 4 \\ 8 & 1 & 2 \end{bmatrix}$ and B = $\begin{bmatrix} 1 & -1 & 1 \\ 0 & -2 & 0 \\ 4 & 10 & 7 \end{bmatrix}$ find AB

65) Find an equation of the line that passes through (8, 17) perpendicular to the line $x + 2y = 2$

66) How does the graph of $3|x + 2| - 1$ compare to the "parent" graph of $f(x) = |x|$? Discuss horizontal and vertical translations, stretches or shrinks as they apply.

67) If $f(x) = 2x^2 - x + 4$ and $g(x) = x^2 + 5$ then find $(f + g)(x)$.

68) If $f(x) = \dfrac{1}{x^2}$ and $g(x) = \sqrt{x^2 + 4}$ then $f(g(x))$ is

69) Describe ALL of the transformations of the graph of $f(x)=\sqrt{x}$ for the graph of $g(x)=\frac{1}{3}\sqrt{x+4}$.

70) Find the determinant of the matrix at the right $\begin{bmatrix} 3 & -1 \\ 6 & 2 \end{bmatrix}$

71) Given matrix A, find A^{-1} the inverse matrix. $A=\begin{bmatrix} 1 & 2 \\ -3 & 5 \end{bmatrix}$

72) If $f(x) = 2x^2 - x + 4$ and $g(x) = x^3 - x$ then find $(f-g)(x)$.

73) If $f(x)=x^2-2x$ and $g(x)=2x+3$ then $f(g(x))$ is

74) Describe ALL of the transformations of the graph of $f(x)=\sqrt{x}$ for the graph of $g(x)=2\sqrt{-x}$.

75) Find the determinant of the matrix at the right $\begin{bmatrix} 6 & -4 \\ 2 & -1 \end{bmatrix}$

76) Given matrix A, find A^{-1} the inverse matrix. $A=\begin{bmatrix} 5 & 1 \\ -2 & 3 \end{bmatrix}$

77) If $x+\frac{1}{x}=2$, then what is the value of $x^2+\frac{1}{x^2}$?

78) If $x^2 - y^2 = 77$ and $x + y = 11$, then what is the value of x?

79) If $f(x)=\frac{1}{2}x-3$, find the value of c in the following table:

$f(x)$	x
2	10
9	d
d	c

80) A random sample of 11 students provided the following data:
x = midterm score out of 100 points, and
y = final exam score out of 150 points

x	66	71	80	76	63	73	81	68	84	83	79
y	130	132	132	134	129	133	136	132	138	136	135

enter the data: x values into L1 and y values into L2

(a) Obtain the scatterplot of the data and copy it as accurately as possible in the box at the right.

(b) Write the window values:
Xmin = ______ Xman = ______ Ymin = _______ Ymax = ______

(c) Using the data from L_1 above, determine

the mean_______________the median______________the mode_______________

Graph each of the following:

81. 2x + 5y = 10

82. $y-\frac{1}{2}=-\frac{2}{3}(x+1)$

83. $2y\geq\frac{2}{3}x+5$

84. f(x) = -2[x + 1] + 3

85. $g(x)=-\frac{1}{3}\left[-\frac{1}{2}x-1\right]+1$

86. $y=-\left[2x-6\right]$

87. $\frac{x}{2}-\frac{y}{4}=1$

88. $\begin{cases} y\leq 2 \\ y+\frac{1}{3}\geq\frac{1}{2}(x-1) \\ x>-1 \end{cases}$

89. $h(x)=-\left|2x-3\right|+2$

90. $y=\frac{2}{3}\left|3-x\right|+1$

The following essay questions are comparable in difficulty to those on the exam. These are not, however, necessarily the exam questions.

1. Define linear programming. Give an illustration of its use in society and provide four possible constraints.
2. Discuss the difference between the mean, the median, and the mode. Give one strength and one weakness of each measure of central tendency.
3. Is a linear regression always accurate? How does a linear regression assist us in interpreting data?
4. Given the parent graph f(x), discuss the transformations to f(x) for the graphs of f(x + c), f(x) +c, f(cx), cf(x), f(-x), -f(x)
5. Explain the difference between scalar multiplication and multiplication of matrices.

Terms, Formulas, Definitions

Functions: domain, range, zeros, operations on functions:
sum(f+g)x = f(x) + g(x), difference(f- g)x = f(x)-g(x),
Composite functions: f(g(x)) x is the domain of g and g(x) is the domain of f.

Reflections and Symmetry
Y=-f(x) reflects the graph of y=f(x) across the x-axis (replace each (x,y) with (x, -y))
Y=f(-x) reflects the graph of y=f(x) across the y-axis (replace each (x,y) with (-x,y))
y-k = f(x-h) translates the graph of y=f(x) h units horizontally and k units vertically (replace (x,y) with (x+h, y+k)
y = cf(x) stretches or shrinks the graph vertically by a factor c (replace (x,y) with (x, cy))
y= f(cx) stretches or shrinks the graph horizontally by a factor of c (replace (x,y) with (x/c, y)

Linear Functions
Equations of lines, slope, midpoint or a line segment, parallel & perpendicular lines, distance between two points, linear inequalities, systems of linear inequalities, linear programming, lines of regression, solving systems by Cramer's rule, graphing, substitution, elimination

Data Analysis
Mean, median, mode, maximum, minimum, range, scatterplot, linear regression

MATRICES & DETERMINANTS

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} + \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} a+e & b+f \\ c+g & d+h \end{bmatrix} \qquad \begin{bmatrix} a & b \\ c & d \end{bmatrix} - \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} a-e & b-f \\ c-g & d-h \end{bmatrix}$$

$$m\begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} ma & mb \\ mc & md \end{bmatrix} \qquad \begin{bmatrix} a & b \\ c & d \end{bmatrix} \cdot \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} ae+bg & af+bh \\ ce+dg & cf+dh \end{bmatrix}$$

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}^{-1} = \frac{1}{ad-bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

If $a_1x + b_1y + c_1z = d_1$ $a_2x + b_2y + c_2z = d_2$ $a_3x + b_3y + c_3z = d_3$

Then $\begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} d_1 \\ d_2 \\ d_3 \end{bmatrix}$

Gauss Jordan

$$\left|\begin{array}{ccc|c} a_1 & b_1 & c_1 & d_1 \\ a_2 & b_2 & c_2 & d_2 \\ a_3 & b_3 & c_3 & d_3 \end{array}\right| \rightarrow \left|\begin{array}{ccc|c} 1 & 0 & 0 & x \\ 0 & 1 & 0 & y \\ 0 & 0 & 1 & z \end{array}\right|$$

Cramer's Rule: $x = \dfrac{\begin{bmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{bmatrix}}{\begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix}}$ $y = \dfrac{\begin{bmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{bmatrix}}{\begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix}}$ $z = \dfrac{\begin{bmatrix} a_1 & b_1 & d_1 \\ a_2 & b_2 & d_2 \\ a_3 & b_3 & d_3 \end{bmatrix}}{\begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix}}$