Math 1010 Final Exam
Intermediate Algebra
Fall Semester 2013 Form E

Instructor Name:_____ Section Number: _____
Student Name: _____ ID Verification: _____

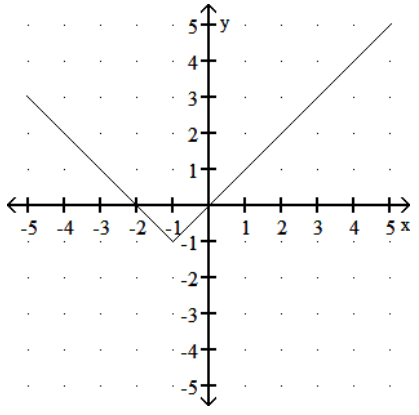
Time Limit: 120 minutes
All problems are weighted equally. Graphing/programmable calculators, notes, books, cell/head phones, or any devices that can connect to the Internet are NOT allowed. Scientific calculators with no more than a basic numeric store and recall memory may be used.

This exam has two parts:
Part I - Ten multiple choice questions - answer all
Part II - Fifteen open ended questions - answer all

Instructions: Part I: Questions 1 - 10, Multiple Choice. answer all TEN questions. Circle the correct answer. There will be no partial credit awarded on this part of the exam.

Part I: Multiple Choice

1) A function of x is depicted in the graph. Find any input values that produce the output of f(x) = 1.



A) x = -3 and x = 1 B) x = -3 C) x = 3 and x = -1 D) x = 2 and x = -1

2) Find the distance between the points

(3, 2) and (-2, -1)

A) 2 B) 4 C) $\sqrt{34}$ D) 15

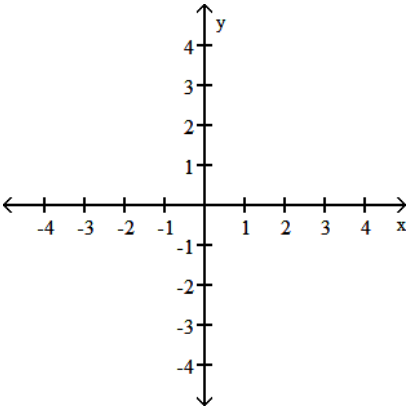
3) Find the domain of the function.

$f(x) = \sqrt{4 - x}$

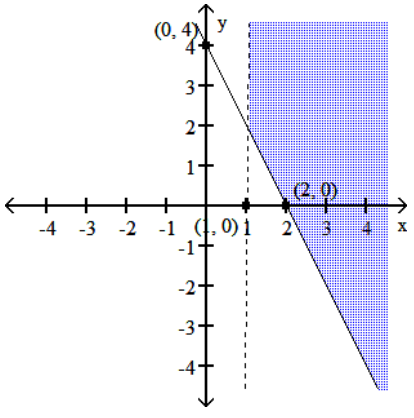
A) $[4,\infty)$ B) $(-\infty,4]$ C) $(-\infty,4) \cup (4,\infty)$ D) $(-\infty,4)$

4) Graph the system of linear inequalities.

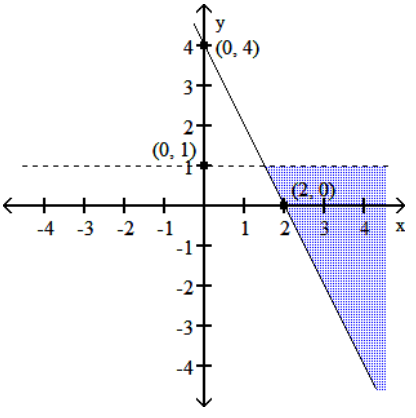
$2x + y \leq 4$ and $y - 1 < 0$



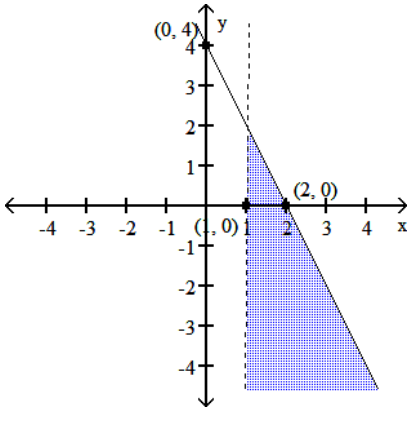
A)



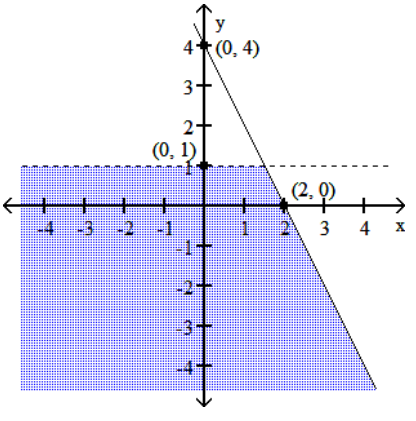
B)



C)



D)



5) Perform the indicated operation and simplify. Write the answer in the form a + bi.

$$\frac{4}{2+i}$$

A) $\frac{8}{3} - \frac{4}{3}i$ B) $\frac{8}{3} + \frac{4}{3}i$ C) $\frac{8}{5} + \frac{4}{5}i$ D) $\frac{8}{5} - \frac{4}{5}i$

6) Perform the indicated operations and simplify.

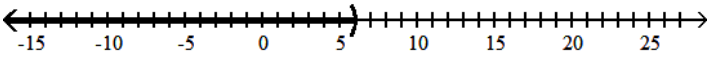
$$\frac{5}{x+3} - \frac{x}{x-6} + \frac{x^2+30}{x^2-3x-18}$$

A) $\frac{2x}{(x+3)(x-6)}$ B) $\frac{2x}{(x-3)(x+6)}$ C) $\frac{2x^2+8x-60}{(x-3)(x+6)}$ D) $\frac{8x}{(x+3)(x-6)}$

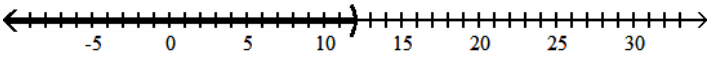
7) Solve and graph.

$|x - 9| < 3$

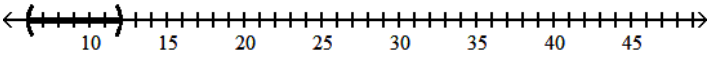
A) $(-\infty, 6)$



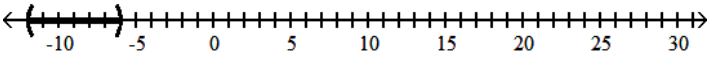
B) $(-\infty, 12)$



C) (6, 12)



D) (-12, -6)



8) Martha can rake the leaves in her yard in 4 hours. Her younger brother can do the job in 6 hours. How long will it take them to do the job if they work together?

A) 6 hr B) $\frac{12}{5}$ hr C) 12 hr D) $\frac{5}{12}$ hr

9) Solve. Where appropriate, include approximations to the nearest thousandth. If no solution exists, state this.

$\log_5 (9x - 4) = 1$

A) 0 B) $\frac{9}{5}$ C) 1 D) No solution

10) Simplify the expression. Assume that all variables are positive when they appear.

$\sqrt{49x^2y^5}$

A) $7x^2y^2\sqrt{7y^3}$ B) $7xy^2\sqrt{y}$ C) $7xy$ D) $7\sqrt{x^2y^5}$

Instructions: Part 2: Questions 11 - 25, Open Ended. Answer all FIFTEEN questions. Partial credit awarded on this part of the exam.

Part 2: Open Ended

11) Factor completely.

$x^3 - 4x$

12) Find the domain of the function.

$$f(x) = \frac{x-1}{(x + 4)(x - 9)}$$

13) Find the center and the radius of the circle.

$x^2 + y^2 - 6x + 16y + 48 = 0$

14) Find an equation of the line containing the given pair of points. Write your final answer as a linear function in slope-intercept form.

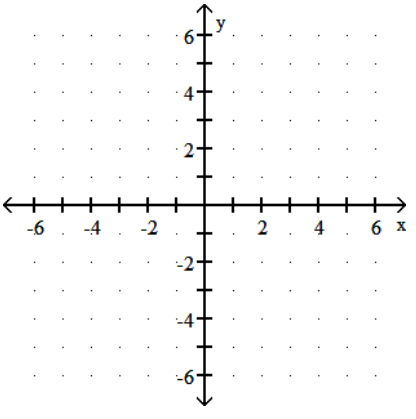
(7, -5) and (4, -3)

15) Factor completely.

$y^3 - 6y^2 - 9y + 54$

16) Sketch the graph. Label at least three points on the graph. Give exact values for y (no decimal approximations).

$y = 4^x - 1$



17) A projectile is thrown upward so that its distance, in feet, above the ground after t seconds is $g(t) = -15t^2 + 360t$. What is its maximum height?

18) Simplify.

$$\frac{4 + \frac{2}{x}}{\frac{x}{4} + \frac{1}{8}}$$

19) There were 510 people at a play. The admission price was \$2.00 for adults and \$1.00 for children. The admission receipts were \$720.

A) Write down the system of equations which represents this situation.

B) Solve the system that you wrote down in part A).

C) How many of each type of ticket were sold. Please answer with a complete sentence.

20) Solve the system. Leave your answer as an ordered triplet.

$$\begin{aligned} x - y + 5z &= 21 \\ 5x + z &= 4 \\ x + 3y + z &= 1 \end{aligned}$$

21) DO NOT SOLVE THE EQUATION.
Chuck and Dana agree to meet in Chicago for a business meeting. Chuck travels 66 miles in the same time that Dana travels 54 miles. If Chuck's rate of travel is 6 mph more than Dana's and if you let r be the rate that Dana travels, write an equation in r which could be solved to find the rate at which Dana travels. DO NOT SOLVE THE EQUATION.

22) Solve.

$\sqrt{7x - 3} = 5$

23) Solve.

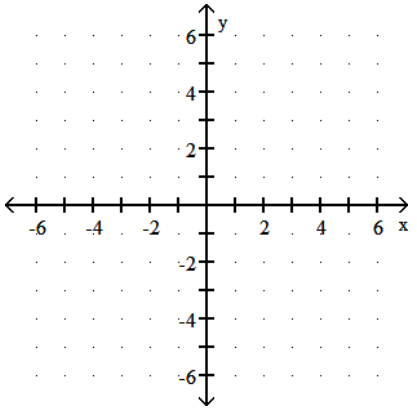
$2x^2 + 10x = -2$

24) Solve.

$$\frac{x}{x+1} + \frac{6}{x} = \frac{1}{x^2 + x}$$

25) Graph the function. Label the vertex and (at least) one other point on the graph, and draw the axis of symmetry. Write the equation of the axis of symetry.

$f(x) = -(x + 4)^2 + 2$



Final Exam

key: Math 1010 version E

Each question is worth 8 points.

Part I: no partial credit

Part II: partial credit as described in this rubric.
(shown in blue)

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Part I: Multiple Choice

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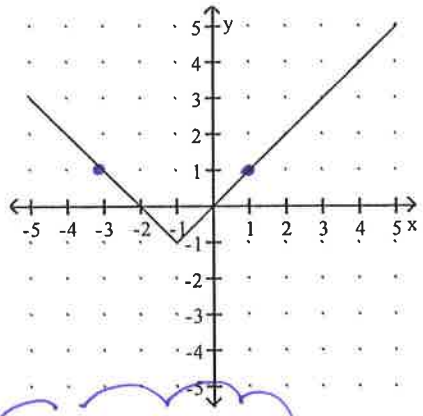


A) x = -3 and x = 1 B) x = -3 C) x = 3 and x = -1 D) x = 2 and x = -1

2) Find the distance between the points
pt 1 pt 2
(3, 2) and (-2, -1)

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

A) 2 B) 4 C) $\sqrt{34}$ D) 15

$d = \sqrt{(-2-3)^2 + (-1-2)^2}$

$d = \sqrt{(-5)^2 + (-3)^2}$

$d = \sqrt{25+9} = \sqrt{34}$

3) Find the domain of the function.

$f(x) = \sqrt{4 - x}$

A) $[4, \infty)$ B) $(-\infty, 4]$ C) $(-\infty, 4) \cup (4, \infty)$ D) $(-\infty, 4)$

$4 - x \geq 0$

$4 \geq x$

$x \leq 4$

4) Graph the system of linear inequalities.

$2x + y \leq 4$ and $y - 1 < 0$

$2x + y \leq 4$

$-2x \quad -2x$

$y \leq -2x + 4$

solid line

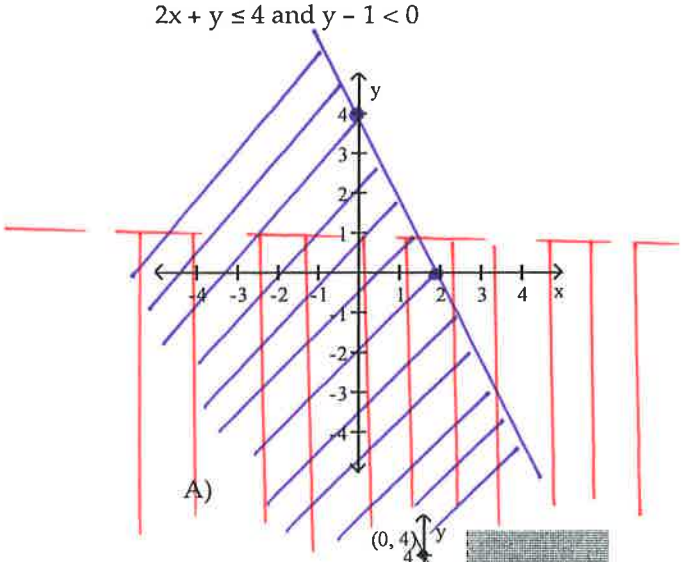
shade below

$y - 1 < 0$

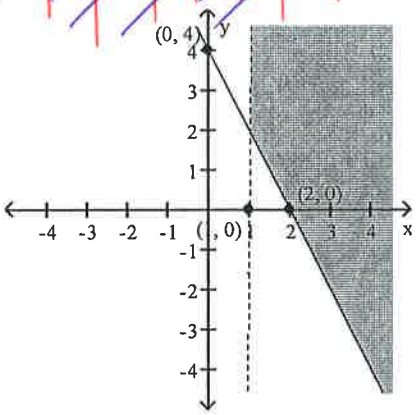
$y < 1$

dashed line

shade below



A)



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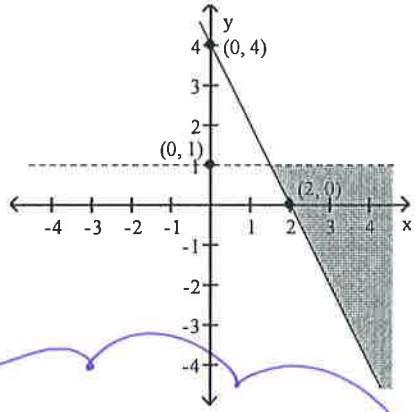

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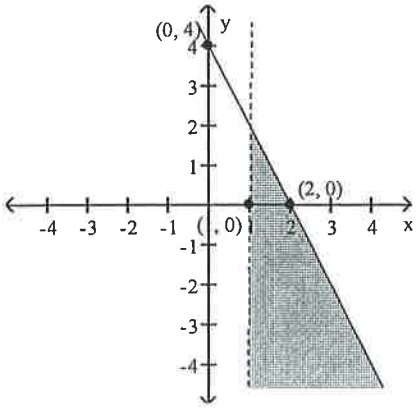
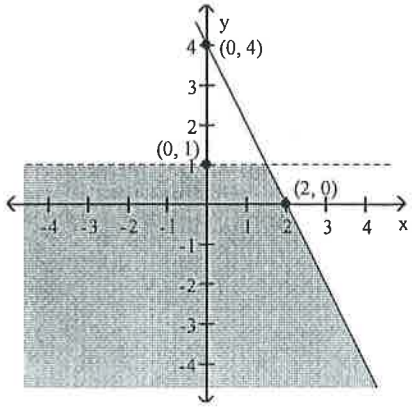


D)



5) Perform the indicated operation and simplify. Write the answer in the form a + bi.

$\left(\frac{4}{2+i}\right)\left(\frac{2-i}{2-i}\right) = \frac{8-4i}{4-2i+2i-i^2} = \frac{8-4i}{4+1} = \frac{8-4i}{5} = \frac{8}{5} - \frac{4}{5}i$

A) $\frac{8}{3} - \frac{4}{3}i$ B) $\frac{8}{3} + \frac{4}{3}i$ C) $\frac{8}{5} + \frac{4}{5}i$ D) $\frac{8}{5} - \frac{4}{5}i$

6) Perform the indicated operations and simplify. $x^2 - 3x - 18 = (x+3)(x-6)$

$$\frac{5}{x+3} - \frac{x}{x-6} + \frac{x^2+30}{x^2-3x-18}$$

A) $\frac{2x}{(x+3)(x-6)}$ B) $\frac{2x}{(x-3)(x+6)}$ C) $\frac{2x^2+8x-60}{(x-3)(x+6)}$ D) $\frac{8x}{(x+3)(x-6)}$

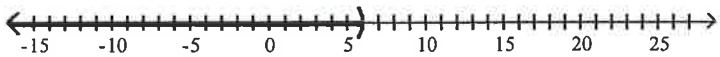
$\frac{5}{(x+3)}\frac{(x-6)}{(x-6)} - \frac{x}{(x-6)}\frac{(x+3)}{(x+3)} + \frac{x^2+30}{(x-6)(x+3)}$

$\frac{5x-30 - x^2-3x+x^2+30}{(x+3)(x-6)}$ $\frac{2x}{(x+3)(x-6)}$

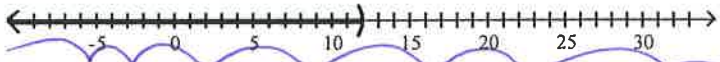
7) Solve and graph.

$|x-9| < 3$

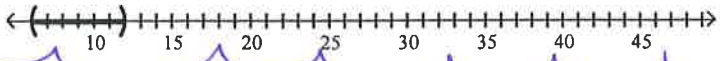
A) $(-\infty, 6)$



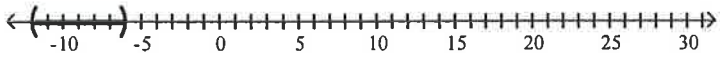
B) $(-\infty, 12)$



C) (6, 12)



D) (−12, −6)



$|x-9| < 3 \rightarrow -3 < x-9 < 3$

$+9 \quad +9 \quad +9$

$6 < x < 12$

$(6, 12)$

8) Martha can rake the leaves in her yard in 4 hours. Her younger brother can do the job in 6 hours. How long will it take them to do the job if they work together?

A) 6 hr B) $\frac{12}{5}$ hr C) 12 hr D) $\frac{5}{12}$ hr

$\frac{1}{4} + \frac{1}{6} = \frac{1}{x}$

$12x\left(\frac{1}{4}\right) + 12x\left(\frac{1}{6}\right) = 12x\left(\frac{1}{x}\right)$

$3x + 2x = 12$

$5x = 12$

$x = \frac{12}{5}$ hours

9) Solve. Where appropriate, include approximations to the nearest thousandth. If no solution exists, state this.

$\log_5 (9x - 4) = 1$

A) 0 B) $\frac{9}{5}$ C) 1 D) No solution

$5^1 = 9x - 4$

$+4 \quad +4$

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

$x = 1$

10) Simplify the expression. Assume that all variables are positive when they appear.

$\sqrt{49x^2y^5}$

A) $7x^2y^2\sqrt{7y^3}$ B) $7xy^2\sqrt{y}$ C) $7xy$ D) $7\sqrt{x^2y^5}$

$\sqrt{49x^2y^5} = \sqrt{(7)^2(x)^2(y^2)^2 \cdot y}$

$= 7xy^2\sqrt{y}$

Instructions: Part 2: Questions 11 - 25, Open Ended. Answer all FIFTEEN questions. Partial credit awarded on this part of the exam.

Part 2: Open Ended

11) Factor completely.

$x^3 - 4x$

$x^3 - 4x = x(x^2 - 4) = x(x-2)(x+2)$ 4pts.

4pts

12) Find the domain of the function.

$f(x) = \frac{x-1}{(x+4)(x-9)}$

$\{x \mid x \neq -4, x \neq 9\}$

4pts. answer in a correct form.

(Arg. I did not put what form!)

4pts.
$(x+4)(x-9) \neq 0$

$x+4 \neq 0 \quad x-9 \neq 0$

$x \neq -4 \quad x \neq 9$

13) Find the center and the radius of the circle.

$x^2 + y^2 - 6x + 16y + 48 = 0$

$x^2 - 6x + y^2 + 16y = -48$

2pts. $(x^2 - 6x + 9) + (y^2 + 16y + 64) = -48 + 9 + 64$

2pts. $(x-3)^2 + (y+8)^2 = 25$

center: $(3, -8)$ 2pts.

radius: $r = 5$ 2pts.

14) Find an equation of the line containing the given pair of points. Write your final answer as a linear function in slope-intercept form.

(7, -5) and (4, -3)

$m = \frac{y_2 - y_1}{x_1 - x_2}$ $m = \frac{-3-(-5)}{4-7} = \frac{2}{-3}$ 3pts.

$y - y_1 = m(x - x_1)$

$y - (-3) = -\frac{2}{3}(x - 4)$

$y + 3 = -\frac{2}{3}(x - 4)$ 3pts.

$y + 3 = -\frac{2}{3}x + \frac{8}{3}$

$-3 \qquad -3$

$y = -\frac{2}{3}x - \frac{1}{3}$

$f(x) = -\frac{2}{3}x - \frac{1}{3}$ 2pts.

15) Factor completely.

$y^3 - 6y^2 - 9y + 54$

$y^3 - 6y^2 - 9y + 54$

$y^2(y-6) - 9(y-6)$ 4pts.

$(y-6)(y^2-9)$

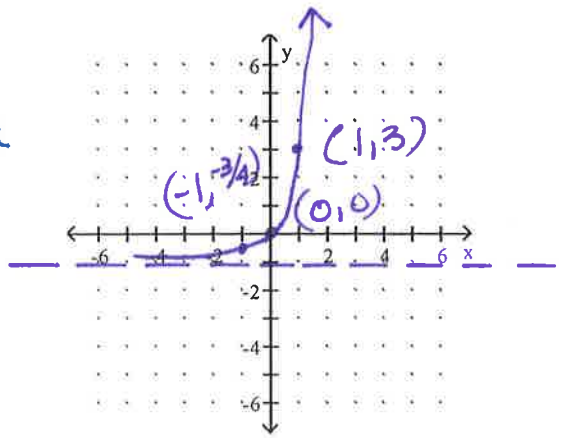
$(y-6)(y-3)(y+3)$ 4pts.

16) Sketch the graph. Label at least three points on the graph. Give exact values for y (no decimal approximations).

$y = 4^x - 1$

points may vary

x	y
-1	$-\frac{3}{4}$
0	0
1	3
2	15



3pts. graph in exponential form

2pts. shift down 1

1pt. for each labeled point

Method may vary.

17) A projectile is thrown upward so that its distance, in feet, above the ground after t seconds is $g(t) = -15t^2 + 360t$. What is its maximum height?

$h = \frac{-b}{2a}$ $a = -15$, $b = 360$ $\quad h = \frac{-(360)}{2(-15)} = \frac{-360}{-30} = 12$ } 4pts.

$k = g(h) = g(12) = -15(12)^2 + 360(12)$

$= -2160 + 4320 = 2160$ ft } 4pts.

18) Simplify.

Method may vary. LCD = 8x

$$\frac{\left(4+\frac{2}{x}\right)}{\left(\frac{x}{4}+\frac{1}{8}\right)} \cdot \frac{8x}{1} \cdot \frac{8x}{1} = \frac{4(8x) + \frac{2}{x}(8x)}{\frac{x}{4}(8x) + \frac{1}{8}(8x)} = \frac{32x + 16}{2x^2 + x}$$ 2pts.

4pts.

$$= \frac{16(2x+1)}{x(2x+1)} = \frac{16}{x}$$

1pt. 1pt.

19) There were 510 people at a play. The admission price was \$2.00 for adults and \$1.00 for children. The admission receipts were \$720.

A) Write down the system of equations which represents this situation.

2pts. { let x = number of children tickets
let y = number of adult tickets

$x + y = 510$
$(1.00)x + (2.00)y = 720$ 2pts.

B) Solve the system that you wrote down in part A).

$x + y = 510$
$y = 510 - x$

$x + 2(510 - x) = 720$
$x + 1020 - 2x = 720$
$-1020 \quad -1020$
$-x = -300$

2pts.
$x = 300$
$y = 510 - 300$
$y = 210$

C) How many of each type of ticket were sold. Please answer with a complete sentence.

300 children's tickets were sold.
210 adult tickets were sold. 2pts.

Method may vary

20) Solve the system. Leave your answer as an ordered triplet.

$x - y + 5z = 21$
$5x + z = 4$
$x + 3y + z = 1$

$r_2 - r_3$

$5x + z = 4$
$-x - 3y + z = -1$
$4x - 3y = 3$ } 3pts.

$r_1 - 5r_2$

$5x + z = 4$
$4x - 3y = 3$
$-24x - y = 1$

$x - y + 5z = 21$
$-25x - 5z = -20$
$-24x - y = 1$ } 2pts.

$-3r_3 + r_2$

$5x + z = 4$
$4x - 3y = 3$
$x = 0$ } 2pts.

$72x + 3y = -3$
$4x - 3y = 3$
$76x = 0$
$x = 0$

$-3y = 3$
$y = -1$

$z = 4$

$(0, -1, 4)$ 1pt.

21) DO NOT SOLVE THE EQUATION.
Chuck and Dana agree to meet in Chicago for a business meeting. Chuck travels 66 miles in the same time that Dana travels 54 miles. If Chuck's rate of travel is 6 mph more than Dana's and if you let r be the rate that Dana travels, write an equation in r which could be solved to find the rate at which Dana travels. DO NOT SOLVE THE EQUATION.

2pts $66 = (r+6)t$

$\frac{66}{r+6} = t$

2pts $54 = rt$

$\frac{54}{r} = t$

$d = r \cdot t$

	d	r	t
Chuck	66	r+6	t
Dana	54	r	t

2pts.

$\frac{66}{r+6} = \frac{54}{r}$ 2pts.

22) Solve.

4pts. $\left(\sqrt{7x-3}\right)^2 = (5)^2$

$7x - 3 = 25$
$+3 \quad +3$
$7x = 28$ 2pts.

$\frac{7x}{7} = \frac{28}{7}$

$x = 4$ 2pts.

Method may vary. Answers may vary.

23) Solve.

$2x^2 + 10x = -2$

$2x^2 + 10x + 2 = 0$

$a = 2$, $b = 10$, $c = 2$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

4pts. choose an appropriate method

$x = \frac{-(10) \pm \sqrt{(10)^2 - 4(2)(2)}}{2(2)} = \frac{-10 \pm \sqrt{100 - 16}}{4}$

4pts. carry out calculations.

$= \frac{-10 \pm \sqrt{84}}{4} = \frac{-10 \pm 2\sqrt{21}}{4} = \frac{-5 \pm \sqrt{21}}{2}$

or $-\frac{5}{2} \pm \frac{\sqrt{21}}{2}$

24) Solve.

$\frac{x}{x+1} + \frac{6}{x} = \frac{1}{x^2 + x}$

LCD $= x(x+1)$

$x(x+1)\left(\frac{x}{x+1}\right) + x(x+1)\left(\frac{6}{x}\right) = x(x+1)\left(\frac{1}{x(x+1)}\right)$

3pts. clear fractions.

$x^2 + 6(x+1) = 1$

$x^2 + 6x + 6 = 1$

$x^2 + 6x + 5 = 0$

3pts.

$(x+1)(x+5) = 0$

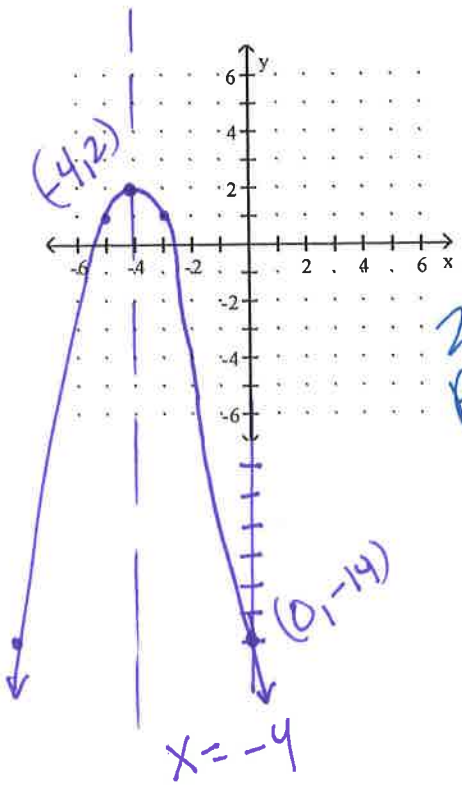
$x + 1 = 0$ $\quad x + 5 = 0$

$x = -1$ extraneous 1 pt.

$x = -5$ 1 pt.

25) Graph the function. Label the vertex and (at least) one other point on the graph, and draw the axis of symmetry. Write the equation of the axis of symetry.

$f(x) = -(x + 4)^2 + 2$



Vertex: $(-4, 2)$ 3pts.

1pt. axis of symmetry: $x = -4$

other points may vary

1pt.

x	y
-5	1
-4	2
-3	1
0	-14

2pts. parabolic shape opens down

1pt. graph passes through vertex and axis of symmetry