Math 3
Practice U2 Test
Inequalities – Linear Programming Name:_________________________ Period:_____

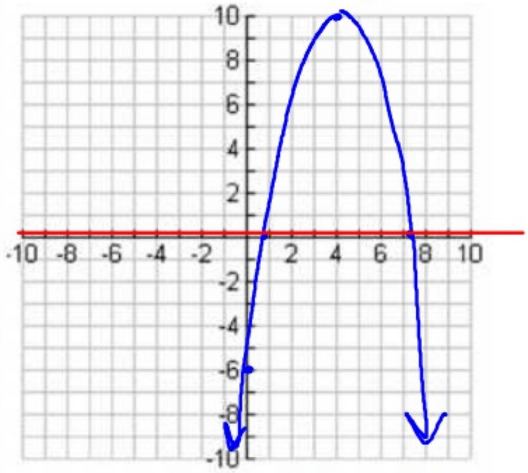
Directions: Be sure to show all your work and explain your answers to get full credit.

1. Solve $8x - x^2 \le 6$. Show your solution on a number line graph and then write it using interval notation.

$a = -1 \quad b = 8 \quad c = -6$

Sketch $8x - x^2 \le 6$

$-x^2 + 8x - 6 \le 0$



Vertex: $-\frac{b}{2a} = \frac{-8}{2(-1)} = 4$

$-(4)^2 + 8(4) - 6$

$-16 + 32 - 6$

10

$(4, 10)$

y-intercept: $(0, -6)$

x-intercepts: $f(1) = -(1)^2 + 8(1) - 6$

$-x^2 + 8x - 6 = 0$

$x^2 - 8x + 6 = 0$

$a = 1 \quad b = -8 \quad c = 6$

$\frac{8}{2(1)} \pm \frac{\sqrt{(-8)^2 - 4(1)(6)}}{2(1)}$

$4 \pm \frac{\sqrt{64 - 24}}{2}$

$4 \pm \frac{\sqrt{40}}{2}$

$4 + 3.16 = 7.16$

$4 - 3.16 = 0.84$

Give the Solution Set in the following ways:

f(0) -6 ✓ | .84 | f(1) ✗ | 7.16 | ✓ f(8)

Symbols: $x \le .84$ or $x \ge 7.16$

Number line:

Interval: $(-\infty, .84] \cup [7.16, \infty)$

2. Suppose that Lee wants to buy macadamia nuts and banana chips for an after-school snack. Both are available in bulk at the store. Macadamia nuts cost \$8 per pound, and banana chips cost \$5 per pound. He has at most \$4 to spend.

3.

a. If Lee buys 0.3 pounds of Macadamia nuts and 0.4 pounds of banana chips, does he meet his amount to spend? Explain and show your work.

$.03(8) + .4(5)$

$2.4 + 2 = 4.40$

No \$.40 to much

\$4.40 ≤ \$4.00

NO

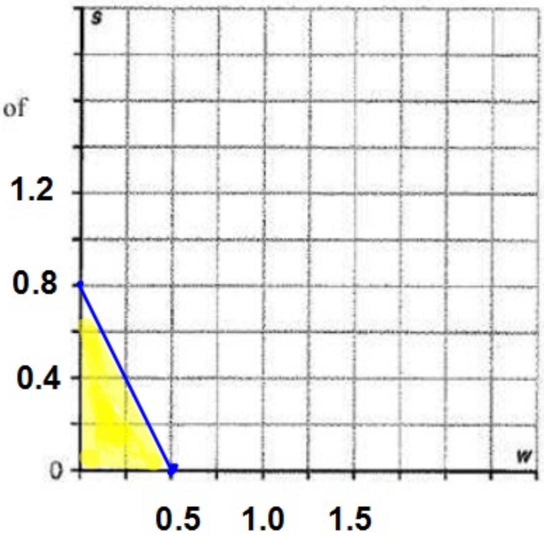
b. Write an inequality whose solution will give the combinations for which Lee can buy.

X = macadamia Nuts

Y = Banana Chips

$8x + 5y \leq 4$

c. Draw a graph that uses shading to show the region of the coordinate plan that contains all points that satisfy the inequality you wrote in Part b.



4. The Fine Threads Company produces sleeveless and regular t-shirts. It takes 1 hour to produce each sleeveless t-shirt and 1.5 hours to produce each regular t-shirt. The company has a total of 975 hours of production time available. Due to demand, the total number of shirts produced in a week should not exceed 800.

a. Would it be feasible for Fine Threads to produce 400 sleeveless and 400 regular t-shirts each week? Justify your answer.

$400 + 400 = 800$

$1(400) + 1.5(400)$

$400 + 600 \leq 975$

$1000 \leq 975$

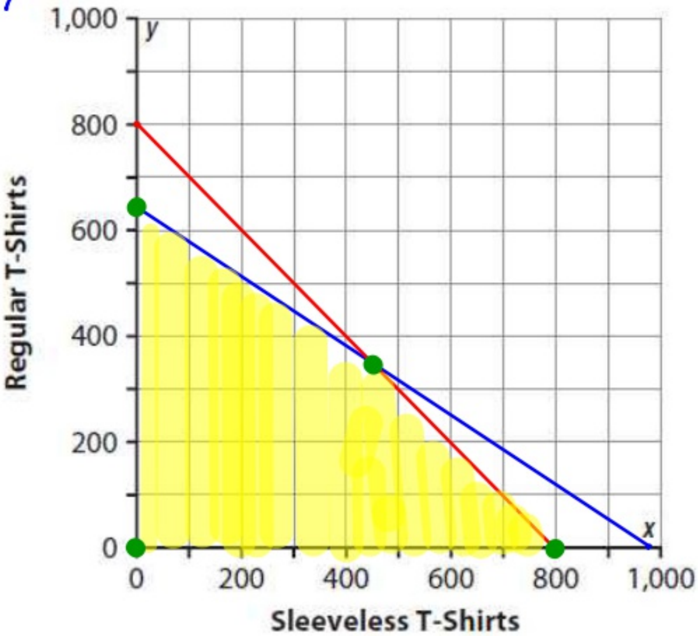
No not possible to produce 400 sleeveless and 400 Regular Shirts

b. Write an inequality that expresses the constraint on production time.

x = Regular

y = Sleeveless

$x + 1.5y \leq 975$



c. Write an inequality that expresses the constraint on demand for shirts.

$x + y \leq 800$

d. Graph the inequalities from above and identify the feasible region for this problem.

e. On your graph in Part d, identify the coordinates of all vertices of the feasible region. Indicate how you obtained the coordinates for each vertex.

(0,0) (800,0) (0,650)

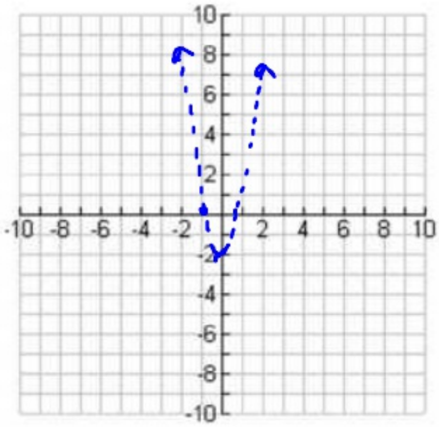
(450,350)

$3x^2 + x - 2 < 0$ $\quad a=3 \quad b=1 \quad c=-2$

5. Solve the inequality: $3x^2 - 2x + 3 < -3x + 5$ Show all your work and clearly identify your solution.

$+3x - 5 \quad +3x - 5$

Sketch: $3x^2 - 2x + 3 < -3x + 5$



Vertex: $-\frac{b}{2a} = \frac{-1}{2(3)} = -\frac{1}{6}$

$3\left(-\frac{1}{6}\right)^2 + \left(-\frac{1}{6}\right) - 2 \qquad \left(-\frac{1}{6}, -\frac{25}{12}\right)$

$3\left(\frac{1}{36}\right) - \frac{1}{6} - \frac{2}{1} \qquad (-.1\bar{6}, -2.08)$

$\frac{1}{12} - \frac{1}{6} - \frac{2}{1}$

$\frac{1}{12} - \frac{2}{12} - \frac{24}{12} = -\frac{25}{12}$

y-intercept $(0, -2)$

x-intercepts:

$3x^2 + x - 2 = 0 \qquad \frac{-6}{3 \cdot -2}$

$(3x^2 + 3x)(-2x - 2)$

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

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

$3x - 2 = 0 \qquad x + 1 = 0$

$3x = 2 \qquad x = -1$

$x = \frac{2}{3}$

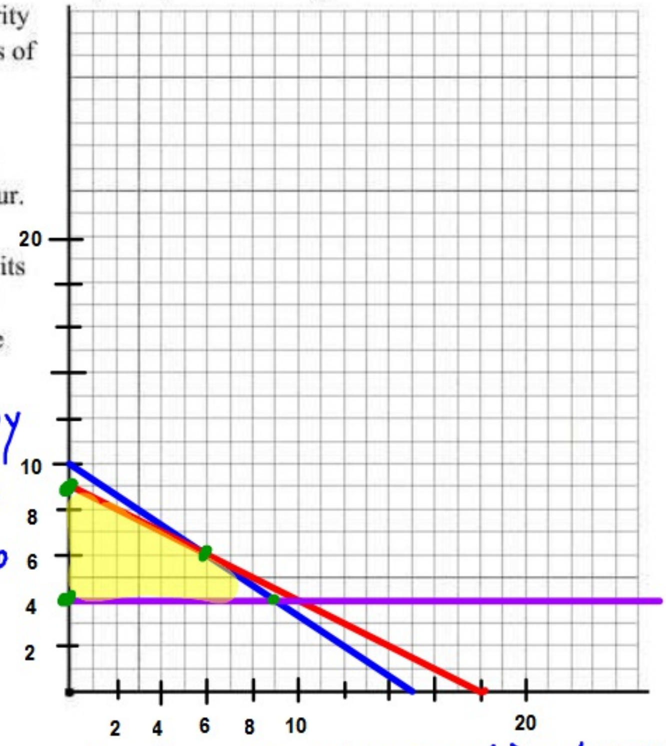
Give the Solution Set in the following ways:

Symbols: $-1 < x < \frac{2}{3}$

Number line:

Interval: $\left(-1, \frac{2}{3}\right)$

6. Flywithus Airlines is updating its security system at a major airport. The budget for new metal detectors is $75,000. The airline has a maximum of 18 security guards available for each shift. There are two types of metal detectors available. Unit A costs $5000, requires one security guard, and can process 300 people per hour. Unit B costs $7500, requires two security guards, and can process 500 people per hour. Since unit B has a better reliability record, the purchasing agent has mandated that at least four units must be type B. Determine the number of units of each type that should be purchased to maximize the number of people processed.



x = Unit A

y = Unit B

$N = 300x + 500y$

x=15

$5000x + 7500y \leq 75000$ y=10

x=18

$x + 2y \leq 18$ y=9

$y \geq 4$

$x \geq 0$

$y \geq 0$

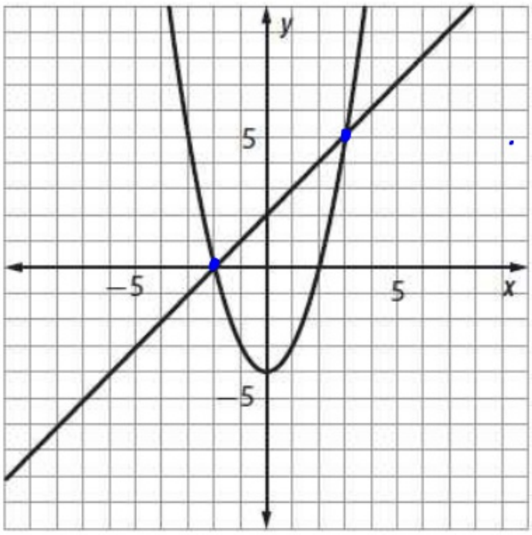
(0,9) = 300(0) + 500(9) = 4500

(0,4) = 300(0) + 500(4) = 2000

(9,4) = 300(9) + 500(4) = 4700

(6,6) = 300(6) + 500(6) = 4800

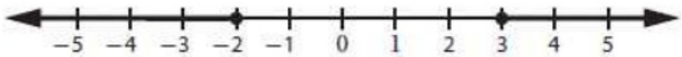
Flywithus should buy 6 unit As and 6 Unit Bs to maximize the # of people processed @ 4800.



7. Shown on the coordinate grid below are graphs of $y = x^2 - 4$ and $y = x + 2$.
Curve Line

For each part below, fill in the blank with $<, \leq, >,$ or $\geq$ so that the indicated solution is the solution to the inequality. In each case, explain your reasoning.

a. $x^2 - 4$ $\underline{\geq}$ $x + 2$ has solution

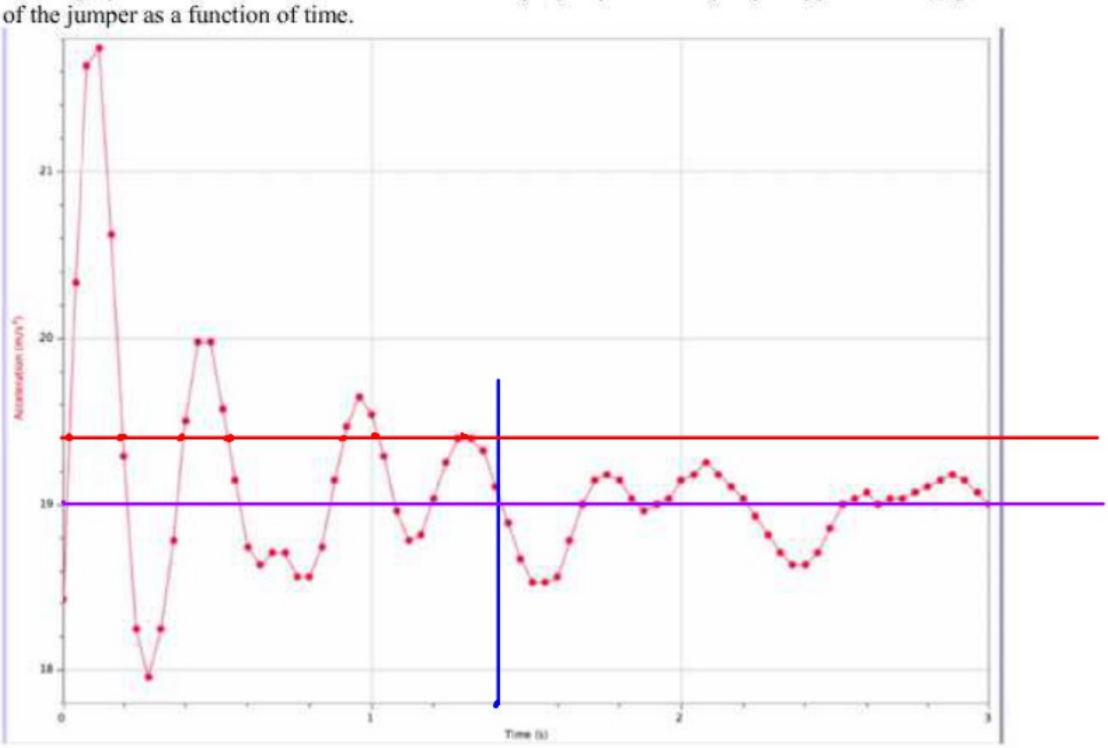


b. $x^2 - 4$ $\underline{<}$ $x + 2$ has solution: $(-2, 3)$

c. $x^2 - 4$ $\underline{>}$ $x + 2$ has solution $(-\infty, -2) \cup (3, \infty)$.

d. $x^2 - 4$ $\underline{\leq}$ $x + 2$ has solution $-2 \leq x \leq 3$.

8. The graph below shows the acceleration of a bungee jumper for one jump. Suppose that $a(t)$ gives the acceleration of the jumper as a function of time.



a. Evaluate $a(1.4)$. 19 m/s

b. Solve $a(t) = 19.4$ and describe what it tells you about the acceleration of the jumper.

t = .02, .2, .4, .55, .9, 1.05

At the above times the jumper is going 19.4 m/s

c. Write a question that can be answered by solving the inequality $a(t) < 19$.

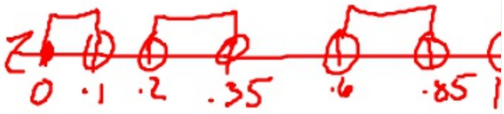
At what times is the jumpers acceleration Less than 19 m/s

d. Solve the inequality $a(t) < 19$ and display your solution on a number line graph, using symbols, and using interval notation.

Solution using symbols:

$0 \le t < .01$ or $.2 < t < .35$ or $.6 < t < .85$ or $1.85 < t < 1.86$ or $2.21 < t < 2.5$ or $1.1 < t < 1.2$ or $1.405 < t < 1.7$

Number line graph:



Interval Notation:

$[0, .01) \cup (.2, .35) \cup (.6, .85) \cup (1.1, 1.2)$
$\cup (1.405, 1.7) \cup (1.85, 1.86) \cup (2.21, 2.5)$

9. A farmer has 10 acres to plant in wheat and rye. He has to plant at least 7 acres. However, he has only \$1200 to spend and each acre of wheat costs \$200 to plant and each acre of rye costs \$100 to plant. Moreover, the farmer has to get the planting done in 12 hours and it takes an hour to plant an acre of wheat and 2 hours to plant an acre of rye. If the profit is \$500 per acre of wheat and \$300 per acre of rye how many acres of each should be planted to maximize profits?

x = acres of wheat

y = acres of rye

$P = 500x + 300y$

$x + y \leq 10$

$x + y \geq 7$

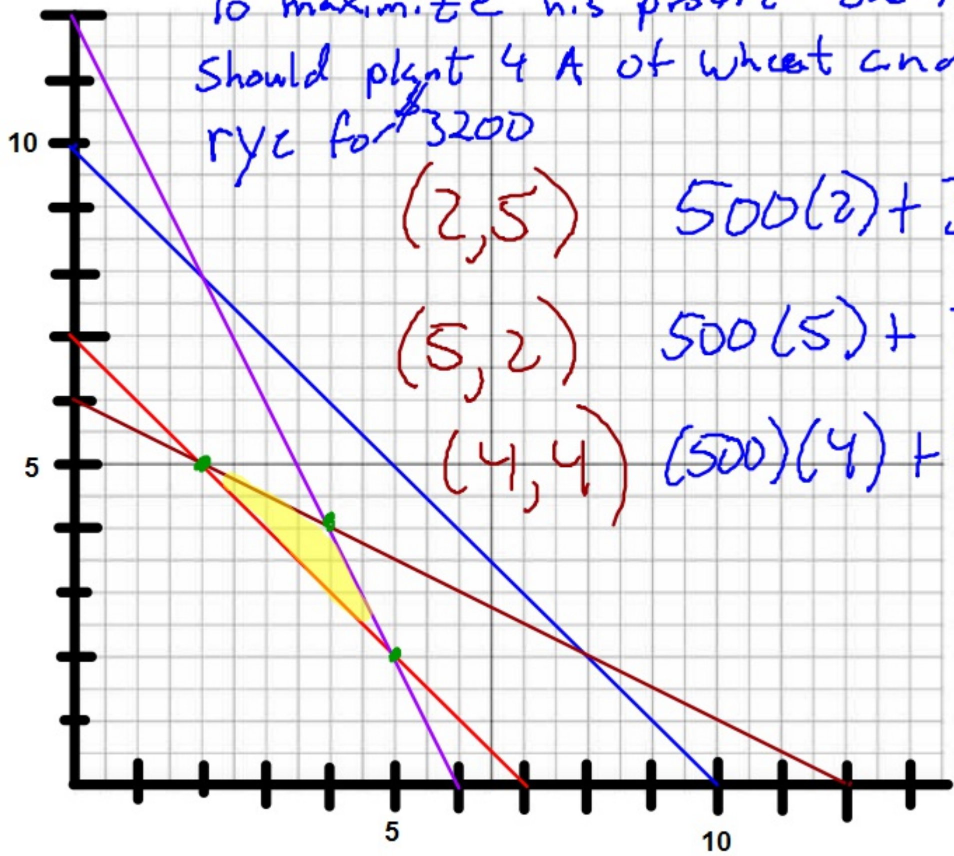
$200x + 100y \leq 1200$

$x + 2y \leq 12$

$x \geq 0$

$y \geq 0$

To maximize his profit the farmer should plant 4 A of wheat and 4A of rye for \$3200



(2,5) $500(2) + 300(5) = 2500$

(5,2) $500(5) + 300(2) = 3100$

(4,4) $(500)(4) + 300(4) = 3200$