MAT 121 Test 1 - Fall, 2015 (5 pts) Name KEY

100 Points Covers Chapter 1 SUBMIT PROBLEMS ON SEPARATE PAPER. IN ORDER. FOLLOW HOMEWORK RULES (ONE-SIDE ONLY, MARGIN).

Find all real or imaginary solutions in #s 1 – 4.

1. (5 pts) $3x-6=-5x+17$

2. (5 pts) $\frac{1}{3}x+\frac{1}{6}=\frac{1}{14}$

3. (5 pts) $3x^2=7$

4. (5 pts) $2x^2-20x+148=0$ (Leave your final answer in simplified radical form.)

5. (10 pts) Compute the discriminant for each of the following equations and tell me what it tells you about the solutions of the equations, *without having to solve them*, i.e., don't solve.

   a. $16x^2+40x+25=0$

   b. $5x^2-8x-8=0$

6. (10 pts) Solve $x^2-6x-17=0$ by completing the square.

7. (5 pts) Find an equation of the line through $(3,5)$ and $(-2,7)$. Point-slope is preferred, but not required.

8. (5 pts) Find an equation of the line thru $(3,5)$ that is *perpendicular* to the line $y=7x-11$.

9. (5 pts each) Sketch the graph of the line. Include intercepts.

   a. $x=-100$

   b. $y=25$

   c. $3x+4y=24$

Solve the inequalities. Give you answer as a set and as an interval. You may want to use a number line graph to help you write your answer, but it is not required.

10. (5 pts) $3x+9\geq 11x-34$

11. (5 pts) $|3x-13|\geq -2$

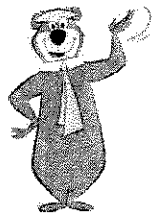
12. (5 pts) $|3x-13|\geq 5$

13. (5 pts) $|3x-13|<5$

Define variables, units and write the equation(s) to *set up* the problem, but don't go all the way and solve it.

14. (5 pts) How much 25% nitrate solution must be added to a 60% nitrate solution to obtain 50 liters of 37% nitrate solution?

15. (5 pts) John can do a job in 8 hours that takes Bob 12 hours. Suppose John sleeps in on the day they were to work together and shows up 3 hours late. How many hours does Bob end up working, if they finish the job together? How many hours does John end up working that day?



BONUS (10 pts) Answer *one* of the following for up to 10 points.

1. Give the center and radius of the circle. This will involve completing the square to obtain Standard Form. Then sketch it: $x^2+y^2-10x+22y=-130$

2. Find the equation in standard form, of the circle that passes through $(13,4)$, with center $(9,10)$

121 TEST 1 FALL '15 F2F

(1) $3x-6 = -5x+17$

SP'15

$8x = 23$

$\boxed{x = \frac{23}{8}}$

(2) $\frac{1}{3}x + \frac{1}{6} = \frac{1}{14}$ LCD = 2·3·7

SP'15

$\frac{x}{3}\cdot\frac{14}{14} + \frac{1}{6}\cdot\frac{7}{7} = \frac{1}{14}\cdot\frac{3}{3}$

$\frac{14x+7}{LCD} = \frac{3}{LCD}$

SP'15

$14x+7 = 3$

$14x = -4$

$x = -\frac{4}{14} = \boxed{-\frac{2}{7} = x}$

(3)

SP'15

$3x^2 = 7$

$x^2 = \frac{7}{3}$

$\boxed{x = \pm\sqrt{\frac{7}{3}}}$

$= \frac{\pm\sqrt{7}}{\sqrt{3}} = \pm\frac{\sqrt{21}}{3} = x$

(2)

(4) Sp'13

$2x^2 - 20x + 148 = 0$

$x^2 - 10x + 74 = 0$

$b^2 - 4ac = (-10)^2 - 4(1)(74)$

$= 100 - 296$

$= -196$ ⟹

$\sqrt{-196} = 14i$

$x = \frac{10 \pm 14i}{2} = \boxed{5 \pm 7i = x}$

'74 × 4 = 296

2 | 296
2 | 148
2 | 74
7 | 37
7

$x^2 - 10x + 5^2 = -74 + 25$

$(x-5)^2 = -49$

Yup

(5) Sp'13

(a) $16x^2 + 40x + 25 = 0$

$(4x)^2 + 2(4x)(5) + 5^2 = 0$

Perfect Square!

$b^2 - 4ac = 0$ ⟹ 1 real solution.

$b^2 - 4ac = (40)^2 - 4(16)(25)$

$= 1600 - 1600$

$= 0$

(b) $5x^2 - 8x - 8 = 0$ ($a = 5$, $b = -8$, $c = -8$)

$b^2 - 4ac = (-8)^2 - 4(5)(-8)$

$= 64 + 160$

$= 224 > 0$ ⟹ 2 real solutions

2 | 224
2 | 112
2 | 56
2 | 28
2 | 14
7

121 TEST 1

(4) $2x^2 - 20x + 148 = 0$

$a=2,\ b=-20,\ c=148$

$b^2-4ac = (-20)^2 - 4(2)(148)$

$= 400 - 1184$

$= -784$

$\sqrt{-784} = 2 \cdot 2 \cdot 7i$

$= 28i$

$x = \dfrac{20 \pm 28i}{2(2)} = \dfrac{4(5 \pm 7i)}{4} = 5 \pm 7i$

2 | 784
2 | 392
2 | 196
2 | 98
7 | 49
7

Because so few took advantage of factoring-out the "2."

121 TEST 1 FALL '15

(6) $x^2 - 6x - 17 = 0$

(10pts) $x^2 - 6x \cdot \quad = 17$

$x^2 - 6x + 3^2 = 17 + 9$

$(x-3)^2 = 26$

$x - 3 = \pm\sqrt{26}$

$\boxed{x = 3 \pm \sqrt{26}}$

$(-\frac{2}{5})(-3) + 5$

$= \frac{6}{5} + \frac{25}{5} = \frac{31}{5}$

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7-5}{-2-3} = \frac{2}{-5}$

(7) $(x_1, y_1) = (3, 5)$

(5pts) $(x_2, y_2) = (-2, 7)$

$\boxed{y = -\frac{2}{5}(x-3) + 5}$

$y = -\frac{2}{5}x + \frac{31}{5}$

(8) $(x_1, y_1) = (3, 5)$ want $\perp$ to $y = 7x - 4$

$m = 7 \Rightarrow m_\perp = -\frac{1}{7} \Rightarrow$

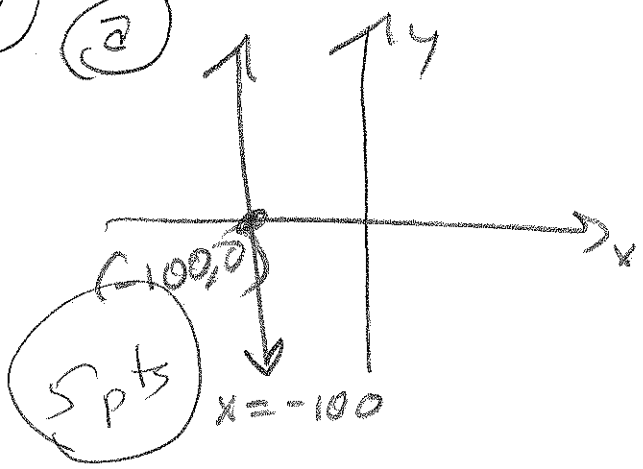
$y = m(x - x_1) + y_1$

(5pts) $\boxed{y = -\frac{1}{7}(x-3) + 5}$

$\frac{3}{7} + \frac{35}{7} = \frac{38}{7}$

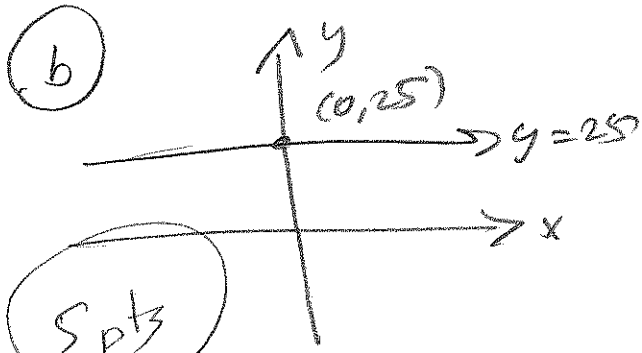
$y = -\frac{1}{7}x + \frac{38}{7}$ for those who just can't stop themselves.

(9) (a)



5 pts

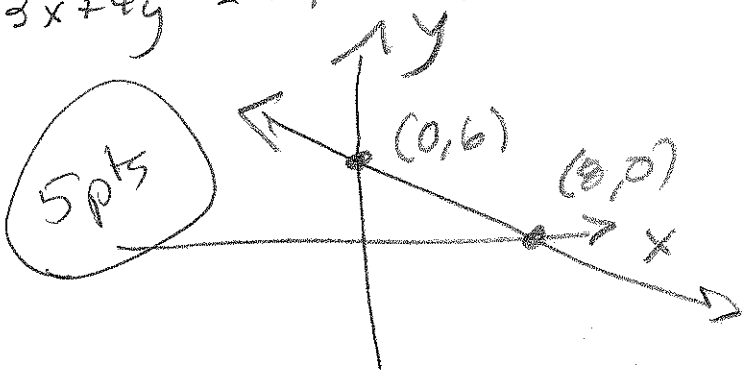
(b)



5 pts

(c) $3x+4y=24$

x	y
0	6
8	0



5 pts

(10) $3x+9 \geq 11x-34$

$-8x \geq -43$

$\{x \mid x \leq \frac{43}{8}\}$

5 pts

$= (-\infty, \frac{43}{8}]$

(11) $|3x-13| \geq -2$

$\{x \mid x \in \mathbb{R}\}$

$= (-\infty, \infty)$

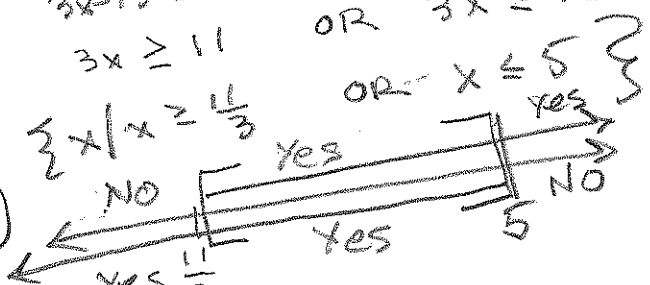
5 pts

THE HARD WAY Always

$3x-13 \geq -2$ OR $3x-13 \leq +2$

$3x \geq 11$ OR $3x \leq 15$

$\{x \mid x \geq \frac{11}{3}\}$ OR $x \leq 5\}$



OR

$= (-\infty, \infty)$

I'm the OR, one yes is enough.

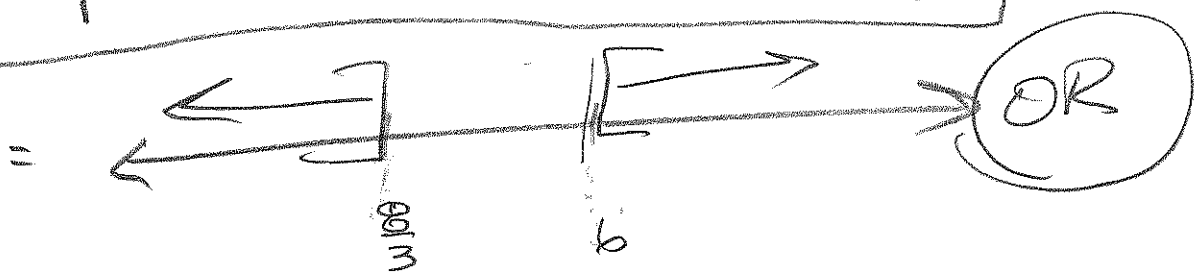
121 TEST 1 FALL '15

(12) Split $|3x-13| \geq 5$

$3x-13 \geq 5$ or $3x-13 \leq -5$

$3x \geq 18$ $\qquad$ $3x \leq 8$

$\{x \mid x \geq 6$ OR $x \leq \frac{8}{3}\}$



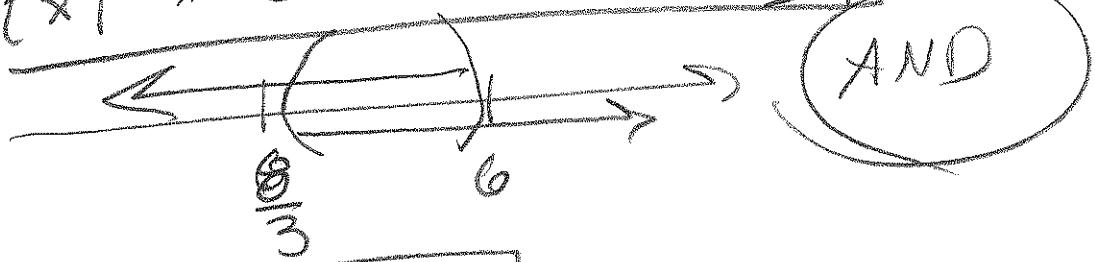
$= (-\infty, \frac{8}{3}] \cup [6, \infty)$

(13) Split $|3x-13| < 5$

$3x-13 < 5$ and $3x-13 > -5$

$3x < 18$ and $3x > -8$

$\{x \mid x < 6$ and $x > \frac{8}{3}\}$



$= (\frac{8}{3}, 6)$

12) TEST 1

(14) Let x = amt of 25% nitrate soln (Liters)

y = " " 60% " " "

Then $x + y = 50$ and

(5pts) $.25x + .60y = (.37)(50) = 18.5$

Finish: $.25x + .6(50 - x) = (.37)(50) \Rightarrow x = 32.857143$ L

(15) Let x = # of hours John works.

(5pts) Then, since John starts 3 hours after Bob, Bob works $x+3$ hours.

SETUP:

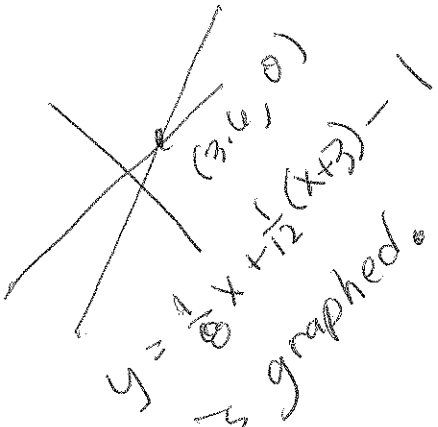
$$\frac{1}{8}x + \frac{1}{12}(x+3) = 1$$

John can do it in 8 hrs

Bob takes 12 hrs.

$x = 3.6$ hrs John

$\Rightarrow$ 6.6 hrs Bob



$\Rightarrow$ graphed.

121 TEST 1

BONUS $x^2 + y^2 - 10x + 22y = -130$

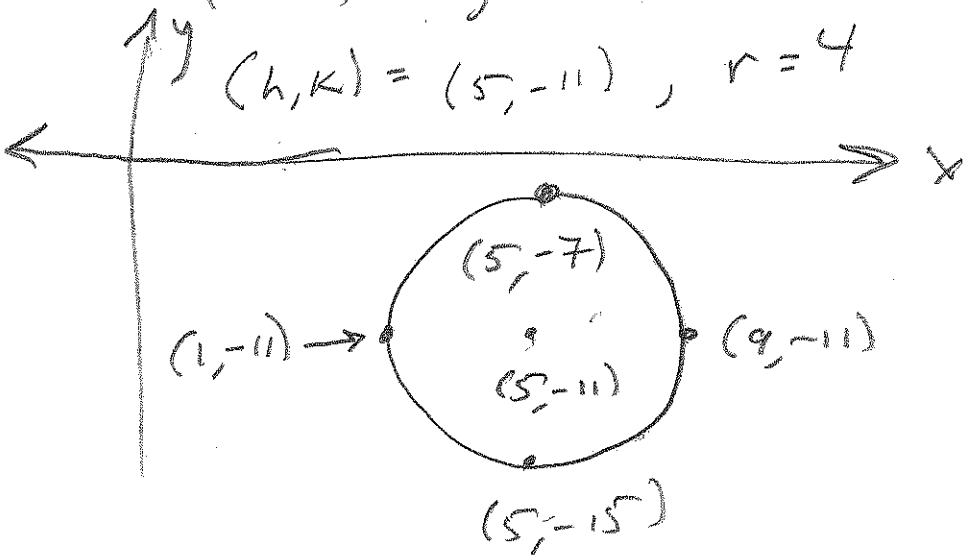
$x^2 - 10x + y^2 + 22y = -130$

$x^2 - 10x + 5^2 + y^2 + 22y + 11^2 = -130 + 25 + 121$

$(x-5)^2 + (y+11)^2 = 16$

$(h,k) = (5,-11)$, $r = 4$

10 pts



BONUS $(h,k) = (9,10)$, $(13,4)$ is on it

10 pts

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

$= \sqrt{(13-9)^2 + (4-10)^2}$

$= \sqrt{4^2 + (-6)^2}$

$= \sqrt{16+36}$

$= \sqrt{52} = r$

$= 2\sqrt{13}$

$\boxed{(x-9)^2 + (y-10)^2 = 52}$

$(x-h)^2 + (y-k)^2 = r^2$