Test-taking –
First Pass – Quick! Most points from your 1st moves, anyway

$|x+1| < 7$

$x+2 < 7$ AND $x+2 > -7$

$|x+2| - 3 > 5$

$|x+2| > 8$

$x+2 > 8$ OR $x+2 < -8$

$|A| \geq -5$

Always

$|A| \leq -5$

Nevah

$|A| \leq 0$

$\Rightarrow A = 0$

$|A| \geq 0$

$A \geq 0$ OR $A \leq 0$

A just gots ta be real.

Sep 15-7:48 AM

MAT 121 Test 1 - Fall, 2013 (5 pts) Name_____
100 Points Covers Chapter 1

Find all real or imaginary solutions in #s 1 – 5..

1. (5 pts) $3x+2=-x-5$

$+x \quad -2 = +x \quad -2$

$4x = -7$

$x = -\frac{7}{4}$

2. (5 pts) $\frac{2}{3}x-\frac{1}{4}=\frac{5}{6}$

LCD : 12
$= 2 \cdot 2 \cdot 3$

$\frac{2x}{3}\cdot\frac{4}{4}-\frac{1}{4}\cdot\frac{3}{3}=\frac{5}{6}\cdot\frac{2}{2}$

$\frac{8x-3}{12}=\frac{10}{12}$

$8x-3=10$

$8x=13$

$x=\frac{13}{8}$

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

$x^2=\frac{5}{3}$

$x=\pm\sqrt{\frac{5}{3}}$

4. (5 pts) $3x^2+6x+13=0$

$a=3, b=6, c=13$

$b^2-4ac=6^2-4(3)(13)$

$=36-156$

$=-120$

$\sqrt{-120}=2\sqrt{30}\,i$

$x=\frac{-6\pm 2\sqrt{30}\,i}{6}=\boxed{\frac{-3\pm\sqrt{30}\,i}{3}}$

130
26
2 | 120
2 | 60
2 | 30
3 | 15
5

$\sqrt{30}i$

$a+bi$
$=a+ib$

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. $x^2 - 6x - 5 = 0$

$a=1, b=-6, -5$

$b^2-4ac = 36-4(1)(-5)$

$=36+20$

$=56$

2 real solns

(∵ rational)

56 aren't a perfect square.

b. $x^2 + 6x + 17 = 0$

$a=1, b=6, c=17$

$6^2-4(1)(17)$

$36-56 = -20$

$= -2 \cdot 2 \cdot 5$

$\sqrt{b^2-4ac} = -2i\sqrt{5}$

Two Nonreal solns

$2+36i$ nonreal complex.

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

$x^2+6x = 17$

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

$(x+3)^2 = 26$

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

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

7. (5 pts) Find an equation of the line through $(-3,1)$ and $(2,7)$. Point-slope is preferred, but not required.

$y = \frac{7-1}{2+3}(x+3)+1$ $y = m(x-x_1)+y_1$

$= \frac{6}{5}(x+3)+1$

(-3,1) and (2,7)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7-1}{2+3} = \frac{6}{5}$$

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

$$y = \frac{6}{5}(x+3) + 1$$

OR

$$y = \frac{6}{5}(x-2) + 7$$

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

$$\frac{y - y_1}{x - x_1} = m$$

8. (5 pts) Find an equation of the line thru $(3,5)$ that is perpendicular to the line $y=\frac{4}{7}x-11$.

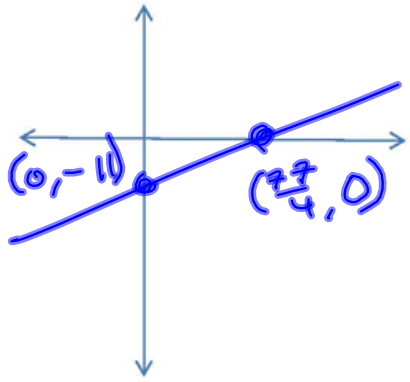
$y=-\frac{7}{4}(x-3)+5$

9. (5 pts) Sketch the graph of the line $y=\frac{4}{7}x-11$.

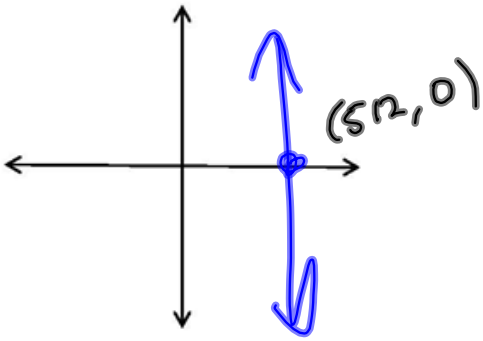
x	y
0	-11
$\frac{77}{4}$	0

$\frac{4}{7}x=11$

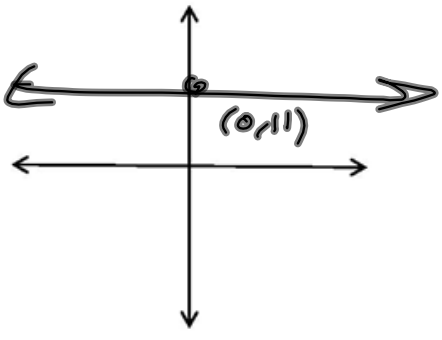
$x=\frac{77}{4}$



10. (5 pts) Sketch the graph of the line $x=512$



11. (5 pts) Sketch the graph of the line $y=11$



Solve the inequalities.

12. (5 pts) $-3x-5 \geq 4$

$-3x \geq 9$

$x \leq -3$

13. (5 pts) $|2x-3| \geq 7$

$2x-3 \geq 7$ OR $2x-3 \leq -7$

14. (5 pts) $|2x-3| < 7$

$2x-3 < 7$ and $2x-3 > -7$

15. (5 pts) $|2x-3| < -7$

16. (5 pts) $|2x-3| \geq -7$

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17. (5 pts) Suppose population growth in a small town is linear (a straight line). Also suppose the population was 10,000 in 1998 and 12,000 in 2011. Model the town's population (in thousands) as a function of time (in years after 1998). Then use your model to predict the population in 2014.

y = population, in thousands, as function of
x = the # of years after 1998.

$(x_1, y_1) = (0, 10)$

$(x_2, y_2) = (13, 12)$

2011 − 1998

2014 − 1998 = 16

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{12-10}{13-0} = \frac{2}{13}$

Scientific calculator: yes

Grapher: NO

$y = \frac{2}{13}(x-0) + 10$ *

$y = \frac{2}{13}x + 10$

$x = 16 \Rightarrow y = \frac{2}{13}(16) + 10$

$= \frac{32}{13} + \frac{130}{13} = \frac{162}{13}$

18. (5 pts) ~~How many liters of 15% alcohol must~~ be added to 90 liters of 47% alcohol to obtain a mixture of 35% alcohol?

Amt of alcohol = Amt of alcohol

Let x = the amount of 15% alcohol used (liters)
= the # of liters of 15% alcohol used.

$.15x + .47(90)$ = 35% mixture

$\frac{.15 \text{ l pure alc.}}{1 \text{ l mix}} \cdot x \text{ l mix}$ (15%)

volume will be $x + 90$

$.35(x+90)$

$\left(\frac{.35 \text{ liters alc.}}{1 \text{ l. mix}}\right)(x+90)(\text{l. mix})$ (35%)

Amt pure alcohol = Amt pure alcohol

$.15x + .47(90) = .35(x+90)$

How much 37% alcohol must be mixed with how much 7% alcohol to make 100 liters of 25% alcohol?

Let x = amt of 37% alcohol (ℓ) &
y = " " 7% " "

Pure = Pure

$.37x + .07y = .25(100)$

2 vars. Need 1 to solve.

$x + y = 100 \Rightarrow y = 100 - x$ Auxiliary Equation.

$.37x + .07(100 - x) = .25(100)$

y in place of y.

BONUS Page. Work *one* of the following. Expect one or all three types on the next test.

BONUS (10 pts) Suppose I take 5 hours to do a job that Kelli can do in 4 hours. Then on top of that, I start work one hour late! How many hours does Kelli end up spending on the job, until it's finished? Hint: If you take the average of our times, you're doing it wrong.

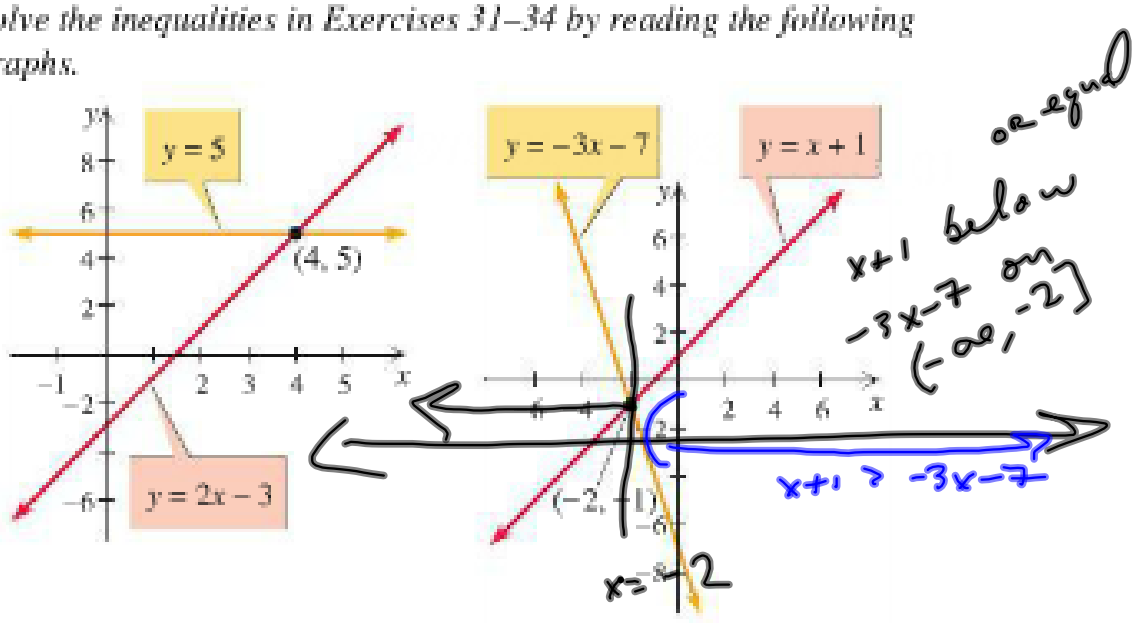
BONUS (10 pts) Re-write the function $f(x)=x^2+6x+17$ in the form $f(x)=a(x-h)^2+k$. State the vertex of this parabola.

BONUS (10 pts) Re-write the function $g(x)=3x^2+6x-13$ in the form $g(x)=a(x-h)^2+k$. State the vertex of this parabola.

31. $2x - 3 > 5$ **32.** $5 \geq 2x - 3$

33. $x + 1 \leq -3x - 7$ **34.** $x + 1 > -3x - 7$ $(-2, \infty)$

Solve the inequalities in Exercises 31–34 by reading the following graphs.



$\frac{-2x-3}{-5} \geq 0 \longrightarrow \frac{-(2x+3)}{-5} = \frac{2x+3}{5} \geq 0$

Times -5

$-2x-3 \leq 0$

Times -1

$2x+3 \geq 0$

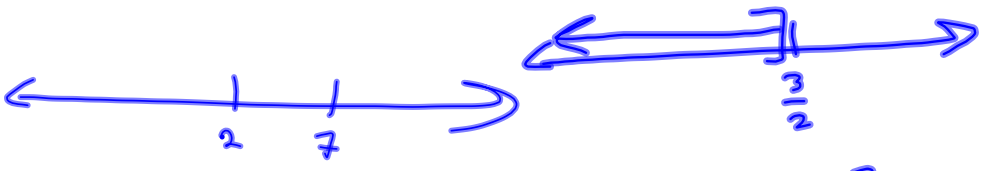
#23 $\frac{2x-3}{-5} \geq 0$

$(-5)\left(\frac{2x-3}{-5}\right) \leq (-5)(0)$

$2x-3 \leq 0$

$2x \leq 3$

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



$2 < 7$

$= (-\infty, 3/2]$

$-2 > -7$

$(1, \infty)$

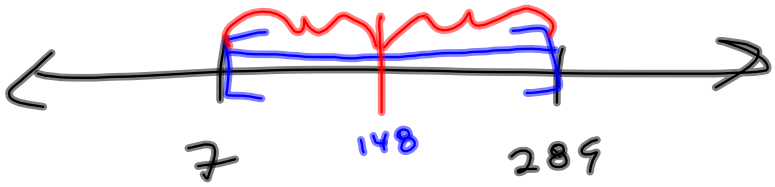
$= \{x \mid x > 1\}$

$\{x \mid x \leq 3\}$

$= (-\infty, 3]$

Absolute Value Inequalities Describing Intervals or union of intervals.

MID: $\frac{7+289}{2} = 148$



$\frac{289-7}{2} = \frac{282}{2} = 141$ = Radius

$|x-5|$ is the distance from x to 5.

$|x-mid| \le Radius$

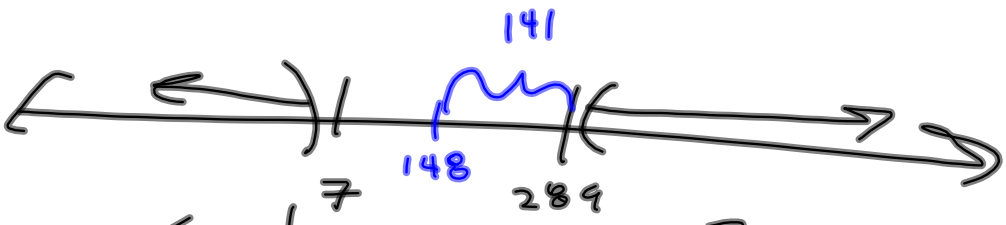
$|x-148| \le 141$

$\frac{296}{2} = 148$

$\{x \mid |x-148| \le 141\}$ → Book answer for §1.7 #s 77-84

$= \{x \mid 7 \le x \le 289\}$

$= [7, 289]$



$\{x \mid |x-148| > 141\}$

$= \{x \mid x < 7 \text{ OR } x > 289\}$

$= (-\infty, 7) \cup (289, \infty)$

On test, only tested on completing the square to solve an equation. The bonus problems are "manipulating the expression into the form $a(x-h)^2+k$

Cheat for CTS.

$$f(x)=ax^2+bx+c = a(x-h)^2+k$$
$$= a\left(x+\frac{b}{2a}\right)^2 + f\left(-\frac{b}{2a}\right)$$

$f(x)= x^2+4x-7$

$= x^2+4x+2^2-4-7$

$=(x+2)^2-11$

$a=1, b=4, c=-7$

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

$f(-2) = (-2)^2+4(-2)-7$

$= 4-8-7$

$= -11$

Vertex:

$(h,k) = \left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$

$f(x) = (x+2)^2-11$

x^2+5x+6

$a=1, b=5, c=6$

$b^2-4ac = 25-24=1 \rightsquigarrow \sqrt{1}=1$

$x = \frac{-5\pm 1}{2(1)} = \frac{-5\pm 1}{2}$ $\begin{matrix}-2\\-3\end{matrix}$

$(x+2)(x+3)$

$x = \frac{3\pm\sqrt{7}}{2}$ is a zero $\Longrightarrow$

$(x-\frac{3+\sqrt{7}}{2})(x-\frac{3-\sqrt{7}}{2})$ is how it factors!