Algebra and Trigonometry — Joysheet 5
MAT 150, Fall 2013 — D. Ivanšić

Name: Saul Ocean

Show all your work!

Solve the inequalities. Write your solution in interval notation.

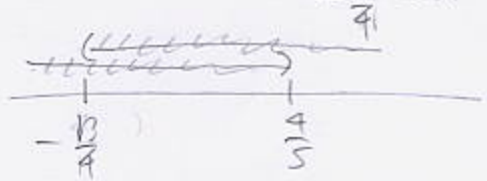
1. (7pts) $2x < 4 - 3x < x + 17$ (do as two inequalities)

$2x < 4-3x$ AND $4-3x < x+17$

$5x < 4$ $\qquad 4 < 4x+17$

$x < \frac{4}{5}$ AND $-13 < 4x$

$-\frac{13}{4} < x$



Overlap is $(-\frac{13}{4}, \frac{4}{5})$

2. (7pts) $3x + 2 \leq 4$ or $4x - 1 \geq 5$

$3x+2 \leq 4$ OR $4x-1 \geq 5$

$3x \leq 2$ $\qquad 4x \geq 6$

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

Everything is $(-\infty, \frac{2}{3}] \cup [\frac{3}{2}, \infty)$

3. (6pts) Find the domain of the function $f(x) = \dfrac{\sqrt{9-2x}}{x+3}$ (in interval notation).

Must have $9-2x \geq 0$

$9 \geq 2x$

$\frac{9}{2} \geq x$

$x \leq \frac{9}{2}$

Can't have $x+3=0$

$x=-3$

$(-\infty, 3) \cup (3, \frac{9}{2}]$

4. (14pts) Michelle is considering two monthly cell-phone plans: plan A costs \$20, includes 100 free minutes and charges 12 cents per minute for additional minutes; plan B costs \$50, includes 400 free minutes and charges 16 cents per minute for additional minutes. Assuming Michelle always uses at least 400 minutes per month, for which number of minutes used is plan B better?

Cost of plans:

$A(x) = 20 + 0.12(x-100)$

$B(x) = 50 + 0.16(x-400)$

B is better when $B \leq A$

$50 + 0.16(x-400) \leq 20 + 0.12(x-100)$

$50 + 0.16x - 64 \leq 20 + 0.12x - 12$

$0.16x - 14 \leq 0.12x + 8$ $\quad | \begin{matrix} -0.12x \\ +14 \end{matrix}$

$0.04x \leq 22$

$x \leq \frac{22}{0.04}$

$x \leq 550$

Plan B is better as long as Michelle uses less than 550 min

5. (14pts) John B. and Harry R. bike to their jobs on Capitol Hill. It takes John 15 minutes and Harry 20 minutes to ride to work since Harry lives 2 miles farther than John. Harry's bike speed is 4mph more than John's.

a) What are their bike speeds?

b) How far is Capitol Hill from Harry's house?

(Hint: convert time to hours)

a) Let r = John's speed, $r+4$ = Harry's speed } in mph

d = John's distance, $d+2$ = Harry's distance } in miles

distance = rate · time for trips:

John	Harry
$d = \frac{1}{4} \cdot r$	$d+2 = \frac{1}{3}(r+4)$

(Substitute)

(15 min $= \frac{1}{4}$ hr) (20 min $= \frac{1}{3}$ hr)

$\frac{1}{4}r + 2 = \frac{1}{3}r + \frac{4}{3} \quad | -\frac{1}{3}r, -2$

$\frac{1}{4}r - \frac{1}{3}r = \frac{4}{3} - 2$

$\frac{3-4}{12}r = -\frac{2}{3}$

$-\frac{1}{12}r = -\frac{2}{3} \quad | \cdot(-12)$

$r = \frac{2}{3} \cdot 12 = 8$ mph

a) John: 8 mph, Harry 12 mph

b) John's distance: $8 \cdot \frac{1}{4} = 2$ miles

Harry's distance $2+2=4$

6. (12pts) How many liters of water must be mixed with 3 liters of a 15% solution of muriatic acid in order to get an 8% solution?

x	3	$x+3$
0%	15%	8%

2.625 liters need to be added.

Let x = amount of water added

$0x + 0.15 \cdot 3 = 0.08(x+3)$

$0.45 = 0.08x + 0.24 \quad | -0.24$

$0.21 = 0.08x \quad | \div 0.08$

$x = \frac{0.21}{0.08} = 2.625$ l