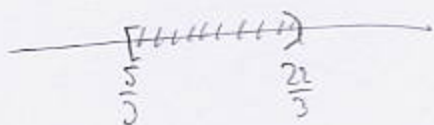Name: Saul Ocean

Show all your work!

Solve the inequalities. Write your solution in interval notation.

1. (6pts) $4 \le 3x - 1 < 21$ $\quad |+1$

$$5 \le 3x < 22 \quad |\div 3$$

$$\frac{5}{3} \le x < \frac{22}{3}$$

$$\left[\frac{5}{3}, \frac{22}{3}\right)$$

2. (7pts) $2x - 1 < 3$ or $2x + 3 \ge 10$

$$2x - 1 < 3 \,|+1 \quad \text{or} \quad 2x + 3 \ge 10 \,|-3$$
$$2x < 4 \,|\div 2 \qquad\qquad 2x \ge 7 \,|\div 2$$
$$x < 2 \quad \text{or} \quad x \ge \frac{7}{2}$$

$$(-\infty, 2) \cup \left[\frac{7}{2}, \infty\right)$$

3. (5pts) Find the domain of the function $f(x) = \dfrac{7-x}{\sqrt{5x-3}}$ (in interval notation).

Must have $5x - 3 > 0$ $\quad |+3$

$$5x > 3 \quad |\div 5 \qquad \text{Domain: } \left(\frac{3}{5}, \infty\right)$$

$$x > \frac{3}{5}$$

4. (14pts) You inherit \$20,000 and can invest it in two different investments, one paying 3% simple interest, and the other paying 4% simple interest. If you wish to have 20,500 after 10 months, what is the least amount you must invest at 4%?

x = amount invested at 4% $\quad I = Prt$, $\quad t = \frac{10}{12}$

$$x \cdot 0.04 \cdot \frac{10}{12} + (20,000 - x) \cdot 0.03 \cdot \frac{10}{12} \ge 500 \quad \left(\begin{array}{l} 500 = 20,500 - 20,000 \text{ is} \\ \text{the interest} \end{array}\right)$$

$$x \cdot 0.04 \cdot \frac{5}{6} + (20,000 - x) \cdot 0.03 \cdot \frac{5}{6} \ge 500 \quad |\cdot 6$$
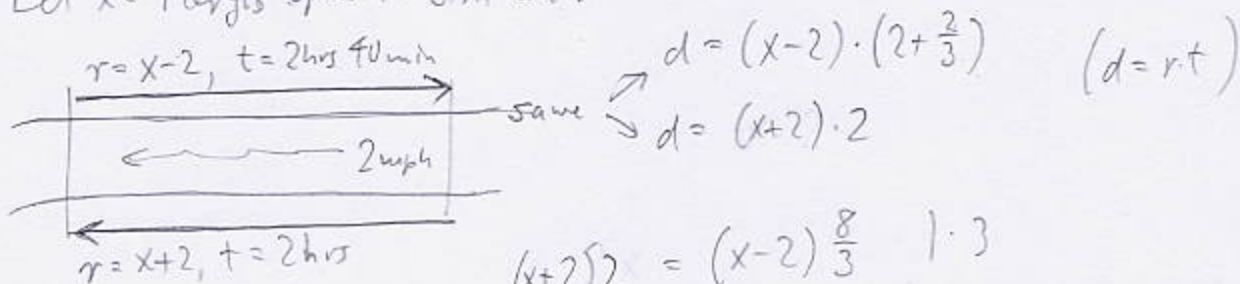
$$0.2x + 3000 - 0.15x \ge 3000 \quad |-3000$$

$$0.05x \ge 0 \qquad |\div 0.05$$

$$x \ge 0$$

Need to invest at least \$0 to get desired interest (\$500 in interest can be achieved with just a 3% account.)

5. (14pts) In 2 hours and 40 minutes. Meryl rows her kayak upstream to a point on a river. Then she rows downstream to the starting point in 2 hours. If the river flows at 2mph, what is Meryl's rowing speed in still water?

Let x = Meryl's speed in still water

$r = x-2$, $t = 2$ hrs 40 min →

$d = (x-2) \cdot (2 + \frac{2}{3})$ $(d = r \cdot t)$

same

$d = (x+2) \cdot 2$

← 2 mph

$r = x+2$, $t = 2$ hrs ←

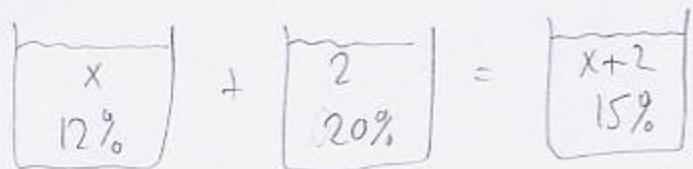$(x+2)2 = (x-2)\frac{8}{3}$ $| \cdot 3$

$6x + 12 = 8x - 16$ $| + 16 - 6x$

$28 = 2x$

$14 = x$

Rows at 14 mph.

6. (14pts) How many liters of a 12% solutions of hydrochloric acid must be mixed with 2 liters of a 20% solution of hydrochloric acid in order to get a 15% solution?

x = liters of 12% solution

$$\boxed{\begin{array}{c} x \\ 12\% \end{array}} + \boxed{\begin{array}{c} 2 \\ 20\% \end{array}} = \boxed{\begin{array}{c} x+2 \\ 15\% \end{array}}$$

Amt of
pure acid
in each vessel:

$0.12x + 0.2 \cdot 2 = 0.15(x+2)$

$0.12x + 0.4 = 0.15x + 0.3$ $| - 0.3 - 0.12x$

$0.1 = 0.03x$ $| \div 0.03$

$x = \frac{0.1}{0.03} \cdot \frac{100}{100} = \frac{10}{3} = 3.333333$ liters

Need $\frac{10}{3}$ liters of a 12% solution