

Solve the inequalities. Write your solution in interval notation.

1. (5pts)  $1 \leq 3 - 4x < 8$   $[-3$

$$-2 \leq -4x < 5 \quad | \div (-4)$$

$$\frac{-2}{-4} \geq x > -\frac{5}{4}$$

$$\frac{1}{2} \geq x > -\frac{5}{4}$$

~~$$-\frac{5}{4} \leq x < \frac{1}{2}$$~~ 
$$\left[-\frac{5}{4}, \frac{1}{2}\right)$$

2. (7pts)  $3x + 1 < 10$  or  $7x - 3 > 25$

$$3x < 9 \quad 7x > 28$$

$$x < 3 \quad \text{or} \quad x > 4$$

~~$$-\infty < x < 3$$~~ ~~$$4 < x < \infty$$~~

$$(-\infty, 3) \cup (4, \infty)$$

3. (6pts) Find the domain of the function in interval notation:  $f(x) = \frac{\sqrt{8-3x}}{4x+2}$

Must have:

$$8 - 3x \geq 0$$

$$8 \geq 3x$$

$$x \leq \frac{8}{3}$$

Can't have:

$$4x + 2 = 0$$

$$4x = -2$$

$$x = -\frac{1}{2}$$

~~$$-\frac{1}{2} < x < \frac{8}{3}$$~~

$$\left(-\infty, -\frac{1}{2}\right) \cup \left(-\frac{1}{2}, \frac{8}{3}\right]$$

4. (14pts) Two computer-maintenance freelancers charge for their services in this way: George charges \$150 for the first three hours and then \$40 per hour for hours after the first three; Yuri charges \$200 for the first five hours and then \$45 per hour for hours after the first five. Assuming at least five hours of work are needed, for which number of hours is it preferable to hire George? Solve as an inequality.

$x =$  number of hours worked

George cost:  $150 + 40(x-3)$

Yuri cost:  $200 + 45(x-5)$

George costs less when  $150 + 40(x-3) \leq 200 + 45(x-5)$

$$150 + 40x - 120 \leq 200 + 45x - 225$$

$$40x + 30 \leq 45x - 25 \quad | -40x + 25$$

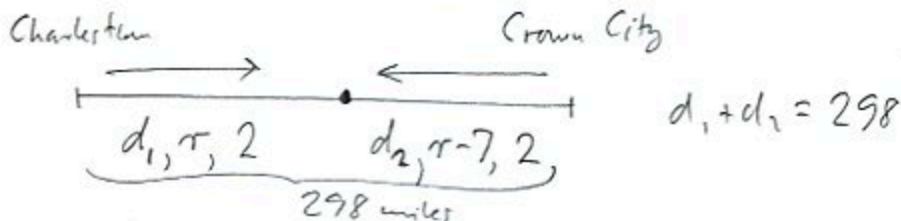
$$55 \leq 5x \quad | \div 5$$

$$11 \leq x$$

George costs less when  $x \geq 11$

5. (14pts) A 298-mile-long road joins cities Charlestown and Crown City. At the same time, one car leaves Charlestown and drives toward Crown City, and another car, driving 7mph slower than the first car, leaves Crown City and drives toward Charlestown. After 2 hours they meet on the road.

- a) What are the speeds of the cars?  
 b) How far from Charlestown did they meet?



$$\left. \begin{array}{l} d_1 = r \cdot 2 \\ d_2 = (r-7) \cdot 2 \end{array} \right\} \text{put into } d_1 + d_2 = 298$$

$$2r + 2(r-7) = 298$$

a) Car leaving:

$$4r - 14 = 298$$

Charlestown: 78 mph

$$4r = 312 \quad | \div 4$$

Crown City: 71 mph (78-7)

$$r = 78 \text{ mph}$$

b)  $d_1 = 78 \cdot 2 = 156$  miles from Charlestown

6. (14pts) How many liters of a 3% solution of sulphuric acid must be mixed with 2 liters of a 7% solution of sulphuric acid in order to get a 6% solution of sulphuric acid?

$$\boxed{\begin{array}{c} 3\% \\ x \end{array}} + \boxed{\begin{array}{c} 7\% \\ 2 \end{array}} = \boxed{\begin{array}{c} 6\% \\ x+2 \end{array}} \quad x = \text{liters of } 3\% \text{ solution}$$

$$0.03x + 0.07 \cdot 2 = 0.06(x+2) \quad \leftarrow \text{amount of sulphuric acid in each container}$$

$$0.03x + 0.14 = 0.06x + 0.12 \quad | -0.03x - 0.12$$

$$0.02 = 0.03x$$

$$x = \frac{0.02}{0.03} = \frac{2}{3} = 0.666667 \text{ liters}$$