

- C) Repeat part a if Company D charges \$5 per month plus 35¢ per minute.

$$19.99 + .21t < 5 + .35t$$

$$-19.99$$

$$-.21t$$

$$-14.99 + .35t$$

$$-.35t$$

$$-14t < -14.99$$

$$\frac{-14t}{-14} < \frac{-14.99}{-14}$$

$$t > 107.07$$

Therefore, if more than 107 minutes used company C will cost less.

⑥

Consider Theorem 4.11. Describe h when both sides of an inequality  $f(x) < g(x)$  are multiplied by  $-1$ , and give the resulting inequality.

when we multiply both sides of the inequality

$$f(x) < g(x) \text{ by } -1$$

Let  $h(x) = -x$ , then apply it to both sides.

According to Thm 4.11 since  $h(x)$  is negative  $h$  is strictly decreasing

$$\begin{aligned} f(x) < g(x) &\Leftrightarrow h(f(x)) > h(g(x)) \\ &\Leftrightarrow -f(x) > -g(x) \end{aligned}$$

- 10 Give an algebraic solution to  $\frac{1}{x} < 2$  over the set of all real numbers. Justify each algebraic step.

$$x > 0 \quad \frac{1}{x} < 2 \quad \text{multiply by } x$$

$$\times \left(\frac{1}{x}\right) < 2x$$

$$1 < 2x$$

$$\frac{1}{2} < x$$

$$x < 0 \quad \frac{1}{x} < 2 \quad \text{for all } x$$

$\therefore$  the solution is  
 $(-\infty, 0) \cup (\frac{1}{2}, \infty)$

13a

Solve each inequality in R.

$$f(y) = \frac{(3y+6)(2y-3)}{(1-y)^2} > 0$$

$$(1-y)^2$$

$$\begin{aligned} \text{• Find zeros: } & 3y+6=0 & 2y-3=0 \\ & y=-2 & y=\frac{3}{2} \\ & \boxed{y=-2} & \boxed{y=\frac{3}{2}} \end{aligned}$$

• Intervals:

$(-\infty, -2), (-2, 1), (1, \frac{3}{2}),$  and  $(\frac{3}{2}, \infty)$

$$\text{• let } y = -3 \quad f(-3) = \frac{(3(-3)+6)(2(-3)-3)}{(-(-3))^2} = \boxed{\frac{27}{16}}$$

$$\text{let } y = 0 \quad f(0) = -18$$

$$\text{let } y = 1.2 \quad f(1.2) = -5.76 / .04 = -144$$

$$\text{let } y = 3 \quad f(3) = \boxed{45/4}$$

Real Range  $(-\infty, -2), (\frac{3}{2}, \infty)$

$$t^3(4t+1) \leq 4t + 1$$

Simplify:  $t^3(4t+1) - (4t+1) \leq 0$   
 $t^3(4t+1) - (4t+1) \leq 0$   
 $(t^3-1)(4t+1) \leq 0$

Zeros:  $t^3 - 1 = 0$        $4t + 1 = 0$   
 $t = 1$        $t = -\frac{1}{4}$

Intervals:  $(-\infty, -\frac{1}{4})$ ,  $[-\frac{1}{4}, 1]$ , and  $(1, \infty)$

Let  $t = -1$        $f(-1) = (-1)^3(4(-1)+1) - (4(-1)+1) = 4$  True

Let  $t = .50$        $f(.50) = -2.425$  True

Let  $t = 3$        $f(3) = 338$  True

Real Range  
 $(-\frac{1}{4}, 1)$

3C  $(x-1)^3 \leq 8$

Simplify:  $(x-1)^3 - 8 \leq 0$   
 $(x-1)^3 - 2^3 \leq 0$   
 $(x-3)(x^2+3x+9) \leq 0$   
 $x^3 - x^2 - 2x^2 + 2x + x - 1 - 8$   
 $x^3 - 3x^2 + 3x - 9$   
 $x = 3$

Intervals:  $(-\infty, 3)$  and  $[3, \infty)$

Let  $t = -4$        $f(-4) = (-4-1)^3 - 8 = -133$  True

Let  $t = 4$        $f(4) = (4-1)^3 - 8 = 19$

Real Range  $(-\infty, 3)$

4.3.3

2a) Consider cell-phone companies with the following rates.

Company C: \$19.99 per month plus 21¢ per minute.

Company D: \$19.99 per month plus 19¢ per minute.

Set up an inequality to be solved to determine the amount of usage for which company C is preferred over Company D. Solve the inequality & interpret the mathematical solution.

Let  $t$  be the minutes used in a month.

Let  $C(t)$  be the cost for  $t$  minutes with company C,

$$\text{then } C(t) = 19.99 + .21t.$$

Let  $D(t)$  be the cost for  $t$  minutes with company D.

$$\text{then } D(t) = 19.99 + .19t.$$

$$C(t) < D(t) \text{ that is, } 19.99 + .21t < 19.99 + .19t \\ -19.99 \\ .21t < .19t$$

.21t < .19t, not true  
Therefore, don't prefer company C over company D.

b) Repeat part a if Company D charges \$18.99 per month plus 19¢ per minute.

Let  $t$  be the minutes used in a month.

$$\text{Let } C(t) = 19.99 + .21t$$

$$\text{Let } D(t) = 18.99 + .19t$$

$$19.99 + .21t < 18.99 + .19t \\ -19.99$$

$$.21t < -1 + .19t \\ -.19t$$

$$.02t < -1$$

$t$  can't be negative  
 $\therefore$  don't prefer company D

Company C over company D