Simultaneous Inequalities

$\begin{cases} 6q \geq q-10 \\ 3q-7 < q+10 \end{cases}$, $(x-2)(2x+1) > 0$, $5 \leq 3+2\omega < 9$,

$|3t-5| < 2$, $\frac{5x-3}{x-2} > 2$, $\frac{1}{x} < x < 1$

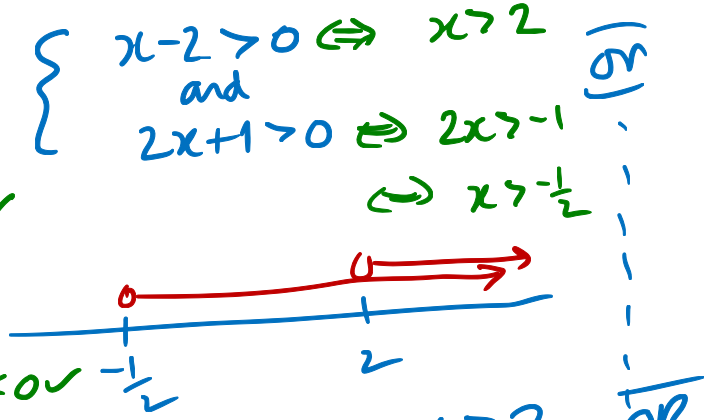
Sketch the region for which $3x+y > 7$ and $x \geq 1$

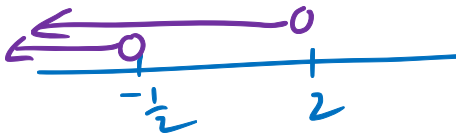
Sketch the region for which $\begin{cases} 4u-2v > 3 \\ 3u-v < 4 \end{cases}$

Simultaneous Inequalities

$(x-2)(2x+1)>0$

either $\begin{cases} x-2>0 \Leftrightarrow x>2 \\ \text{and} \\ 2x+1>0 \Leftrightarrow 2x>-1 \Leftrightarrow x>-\frac{1}{2} \end{cases}$ OR $\begin{cases} x-2<0 \Leftrightarrow x<2 \\ \text{and} \\ 2x+1<0 \Leftrightarrow 2x<-1 \Leftrightarrow x<-\frac{1}{2} \end{cases}$





$x>2$ OR $x<-1/2$

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

$x=-1$, $(-1-2)(-2+1)=(-3)(-1)=3>0$ ✓

$x=3$, $(3-2)(6+1)=1\times 7=7>0$ ✓

$x=0$, $(0-2)(0+1)=(-2)(1)=-2<0$ ✓

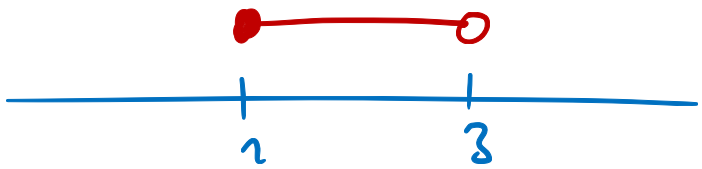
$5 \leq 3+2\omega < 9$

$\Leftrightarrow \begin{cases} 5 \leq 3+2\omega \Leftrightarrow 2 \leq 2\omega \Leftrightarrow 1 \leq \omega \\ \text{and} \\ 3+2\omega < 9 \Leftrightarrow 2\omega < 6 \Leftrightarrow \omega < 3 \end{cases}$

$\Leftrightarrow \begin{cases} 1 \leq \omega \\ \omega < 3 \end{cases}$

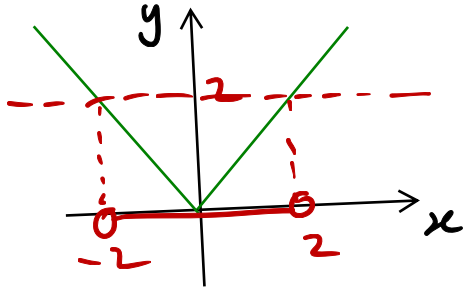
$1 \leq \omega < 3$

ω is in $[1, 3)$



Simultaneous Inequalities

$$y = |x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$$



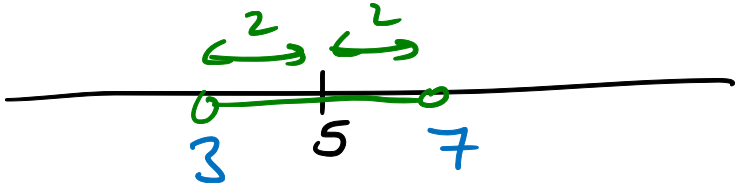
$|3t-5| < 2$

$-2 < 3t-5 < 2$ $\downarrow +5$

$3 < 3t < 7$ $\downarrow \div 3$

$1 < t < 7/3$ $\quad$ t is in $(1, 7/3)$

$|3t-5|$ = distance between $3t$ and 5

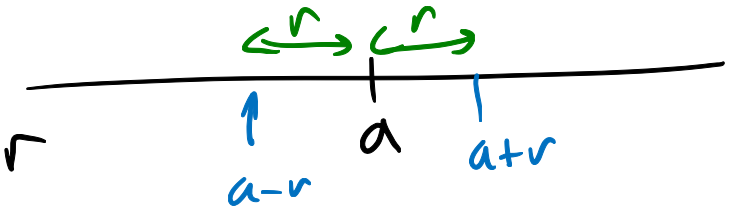


$3 < 3t < 7$

$|x-a| < r$

$\Updownarrow$

$a-r < x < a+r$



Simultaneous Inequalities

$x = 0 \quad (x > -\frac{1}{3})$

$\frac{5x-3}{x-2} = \frac{-3}{-2} = \frac{3}{2} = 1.5 \not> 2$

$$\frac{5x-3}{x-2} > 2$$

$\times (x-2)$ if $x-2>0$ | if $x-2<0$ (if $x<2$)

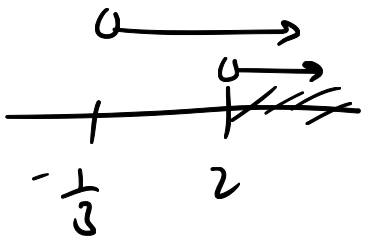
$5x-3 > 2(x-2)$

$5x-3 > 2x-4 \quad \downarrow -2x$

$3x-3 > -4 \quad \downarrow +3$

$3x > -1 \quad \downarrow \div 3$

$x > -\frac{1}{3}$ & $x > 2$



$x > 2$

OR

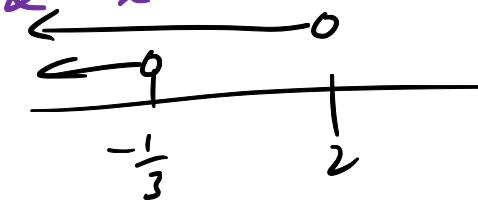
$5x-3 < 2(x-2)$

$5x-3 < 2x-4 \quad \downarrow -2x$

$3x-3 < -4 \quad \downarrow +3$

$3x < -1 \quad \downarrow \div 3$

$x < -\frac{1}{3}$ & $x < 2$



$x < -1/3$

x is in $(-\infty, -\frac{1}{3}) \cup (2, \infty)$

Simultaneous Inequalities

$$\begin{cases} 6q \geq q - 10 & \text{①} \\ 3q - 7 < q + 10 & \text{②} \end{cases}$$

$6q \geq q - 10$

$\Leftrightarrow \quad 5q \geq -10$

$\Leftrightarrow \quad q \geq \frac{-10}{5} = -2$

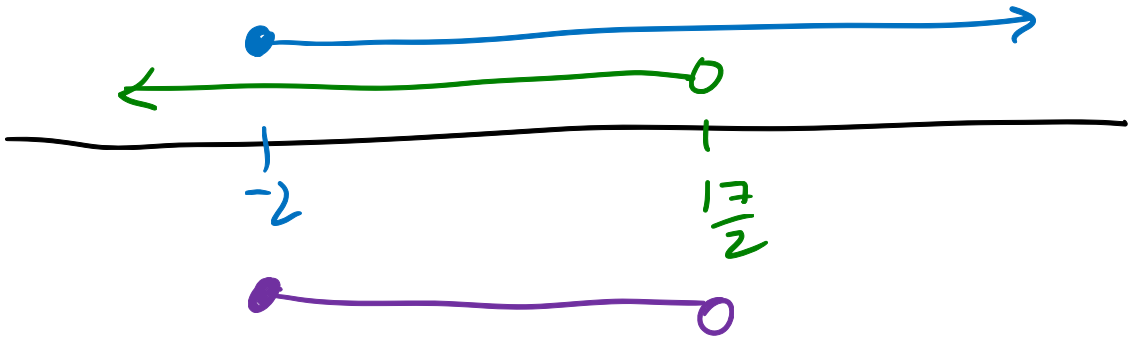
AND

$3q - 7 < q + 10$

$2q - 7 < 10$

$2q < 17$

$q < \frac{17}{2}$



$-2 \leq q < \frac{17}{2}$

q is in $\left[-2, \frac{17}{2}\right)$

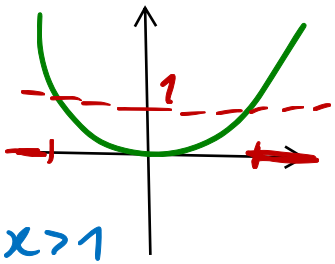
Simultaneous Inequalities

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

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

if $x > 0$

$1 < x^2$



$x < -1$ or $x > 1$

but $x > 0$

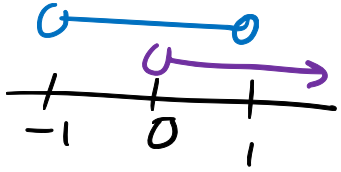
but $x < 1$

So no solutions if $x > 0$

if $x < 0$

$1 > x^2$

$-1 < x < 1$



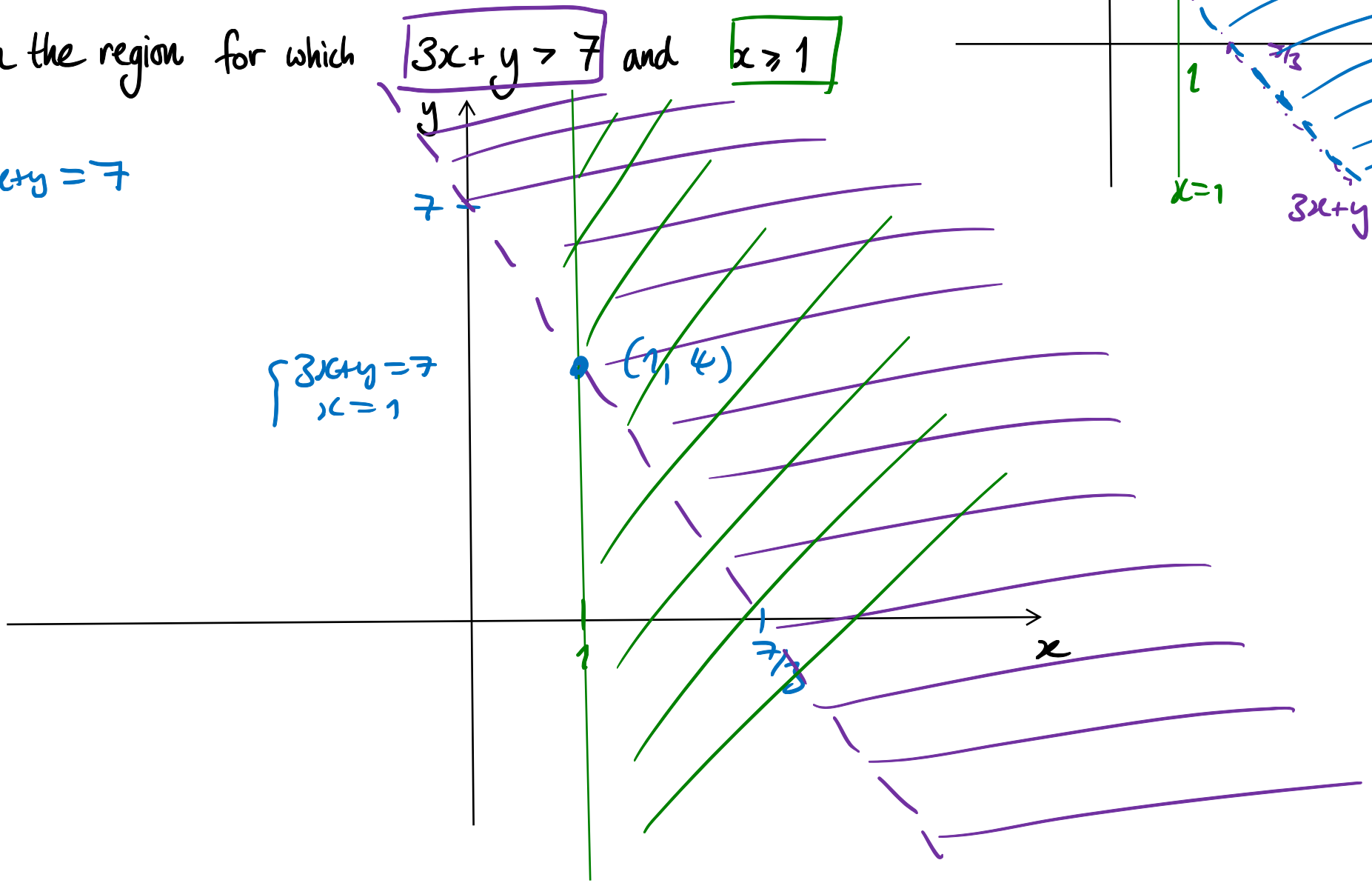
So $0 < x < 1$

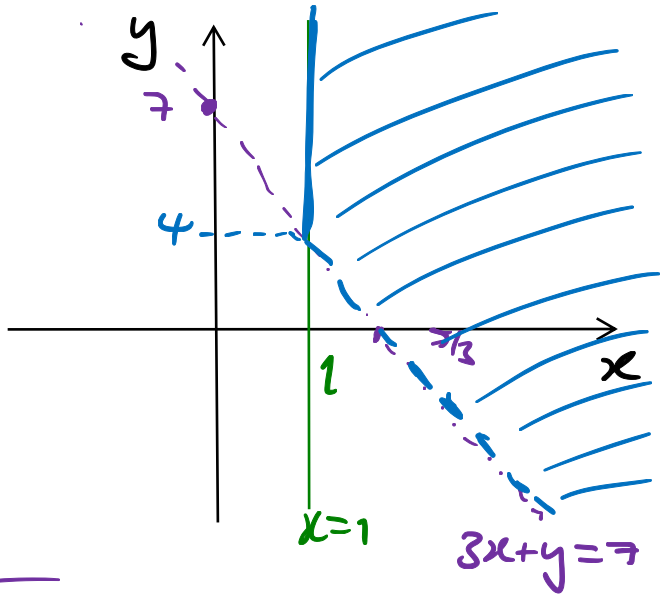
x is in $(0, 1)$

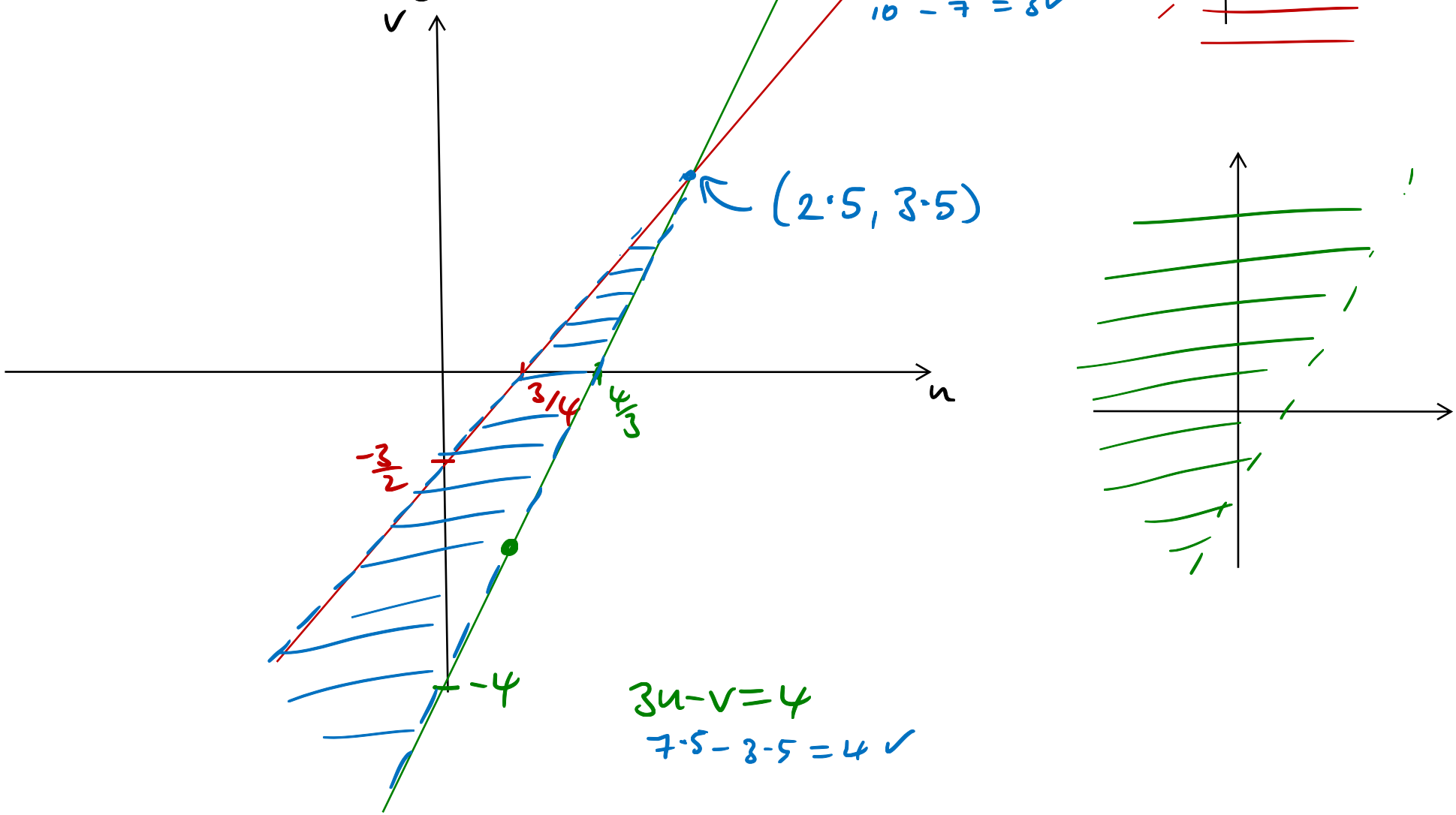
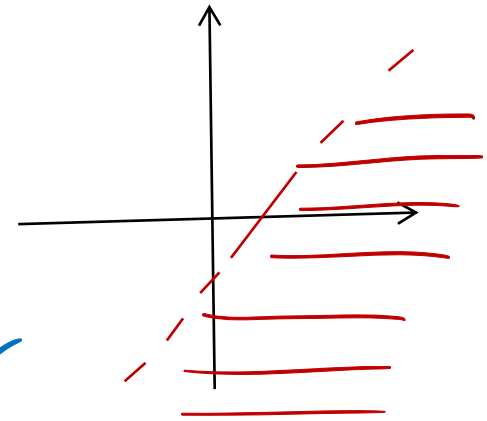
Simultaneous Inequalities

Sketch the region for which $3x + y > 7$ and $x \geq 1$

$3x+y=7$





Simultaneous Inequalities

Sketch the region for which $\begin{cases} 4u - 2v > 3 \\ 3u - v < 4 \end{cases}$