2, 4

6, 4

6

* Graphed on desmos

1. a. Not an equivalence relation due to transitivity

b. Not an equivalence relation due to transitivity

c. Passes, yes an equivalence relation

d. Passes, yes an equivalence relation

2 $\Sigma = \{+, *, a, b\}$

a. Base case : $(a+b) \in \Sigma$

Rec Step : if $x \in \Sigma$ then $x^*(a+b) \in \Sigma$

~~if ends in a+b, concat $(a+b)^*$~~

→ b. Base case : $(a+bsa) + (a+bsb) \in \Sigma$

- Rec Step: if $x \in \Sigma$ then $a+bx$, ends in b concat a
  if $x \in \Sigma$ then $a+bax$, ends in a concat b

3 b. $Pr(s(n)) = n$ You must add first to n because Pr can not be negative because we use monus.

$Pr(n+1) = n$

$(n+1)-1 = n$

$n+(1-1) = n$

$n+0 = n$

4 Four times plus one : IN → IN function

→ four times plus one $(x) = 4(x)+1$ where we don't get below 0

Basis: 4times+1 $(0) = 1$

~~4times+1 $(s(a)) = 5$ is this one right?~~

~~4times+1 $(Pr(0)) = 0$ etc (idk if this is right)~~

Rec Step: 4times+1 $(X) = s(4x)$

$= s[4.(s(0))]$ ...

5 LT : IN → IN function, don't go below zero

LT(x)

Basis: $LT(0) = 0 < s(0) = 0 < 0+1 = 0 < 1$

~~$Pr(0) < 0 = 0 + 1 < 0 = 1 < 0$~~

Rec Step: $LT(s(0)) = s(0) < s(s(0))$

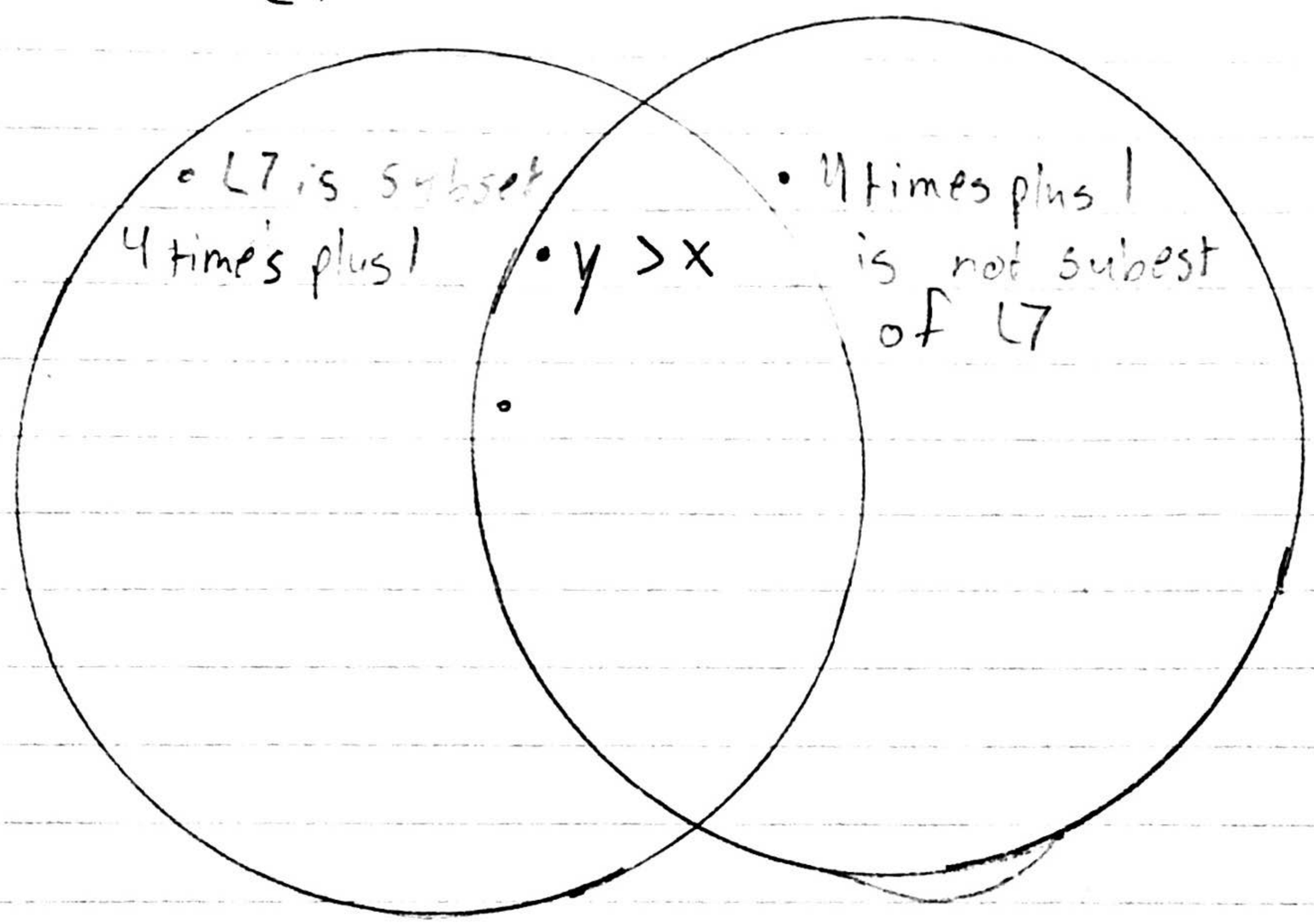
$= 0+1 < s(0+1)$

$= 1 < 0+1+1$

$= 1 < 2$ ✓

or replace 0 with x

6



7 $y = 4x+1$ let $x=1$ $f(1) = 4(1)+1 = 5$ or $f(s(0)) = 4(s(0))+1 = 5$

$f(2) = 4(2)+1 = 9$ or $f(s(s(0))) = 4(s(s(0)))+1 = 9$

Base Case = $f(s(0)) = 5$ or 4timeplus1(1) = 5

let $x = 4$

$f(4) = f(s(s(s(s(0)))))$

$s[4(s(s(s(s(0)))))] = s(16) = 17$

8 $304 + 708 + 1112 + \ldots + (404n - 100) = n(202n + 102)$

$404(1) - 100 = 304$
$404(2) - 100 = 708$

Basis: $n = 1$
$304 = 1(202(1) + 102) = 304$ ✓

Induction Step: $n = k$
Assume true $304 + 708 + 1112 + \ldots + (404k - 100) = k($
Show True based from → $n = k+1$
$304 + 708 + 1112 + \ldots (404k - 100) + (404(k+1) - 100) = (k+1)(202($

$k(202k + 102) + (404(k+1) - 100) = (k+1)(202(k+1) + 102)$
$202k^2 + 102k + (404k + 404 - 100) = (k+1)(202k + 202 + 102)$
$202k^2 + 506k + 304 = (k+1)(202k + 304)$
$= 202k^2 + 302k + 202k + 302$
$202k^2 + 506k + 304 = 202k^2 + 506k + 304$ ✓

Proven
✓