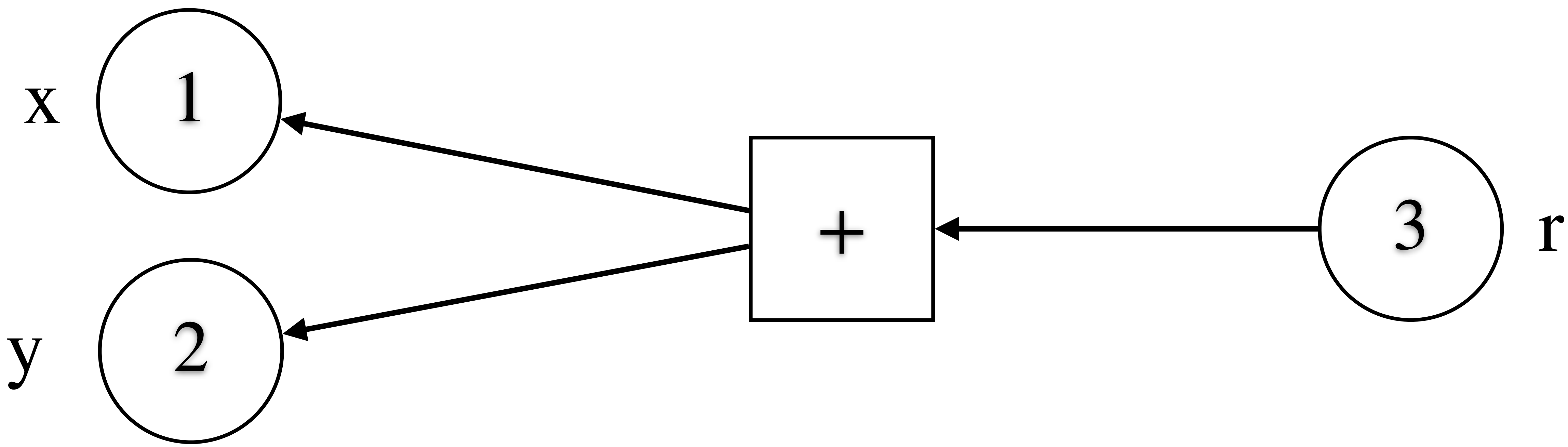
# Provenance and bidirectionality

James Cheney

- Provenance & view update
  - Buneman, Khanna & Tan 2001,2002
- Matching lenses (keys)
  - Barbosa et al. 2008
- XML view update
  - Fegaras 2010
- TLCBX project

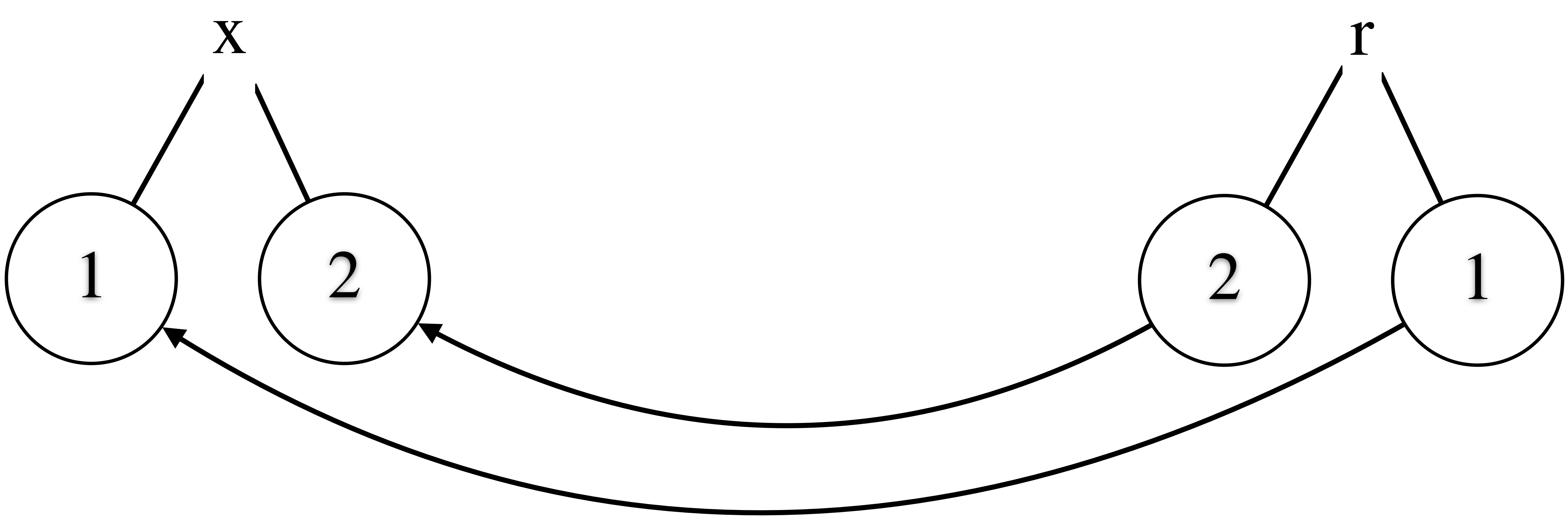
$$
\begin{aligned}
e ::= &\ i \mid e + e' \mid e = e' \\
&\mid \text{if } e \text{ then } e' \text{ else } e'' \\
&\mid (e,e') \mid \text{fst } e \mid \text{snd } e
\end{aligned}
$$

x + y



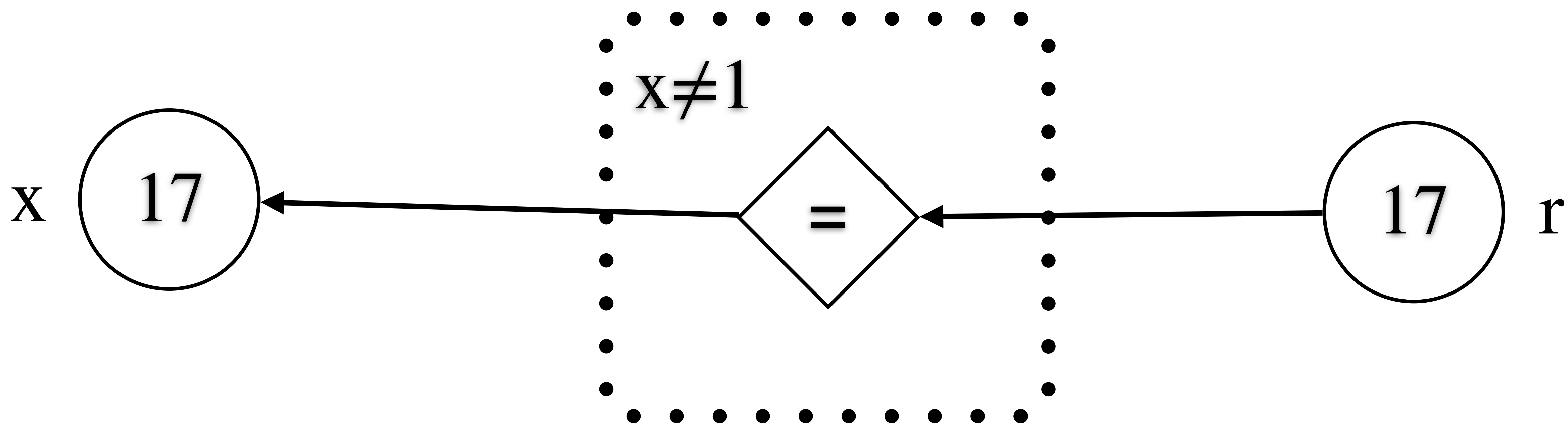

$$R((x,y),r) := r = x+y$$

(snd(x), fst(x))




$$R((x_1,x_2),(y_1,y_2)) := x_1 = y_2 \wedge x_2 = y_1$$

if x = 1 then 1 else x




$R(x,r) := (x = 1 \wedge r = 1) \vee \underline{(x \neq 1 \wedge r = x)}$

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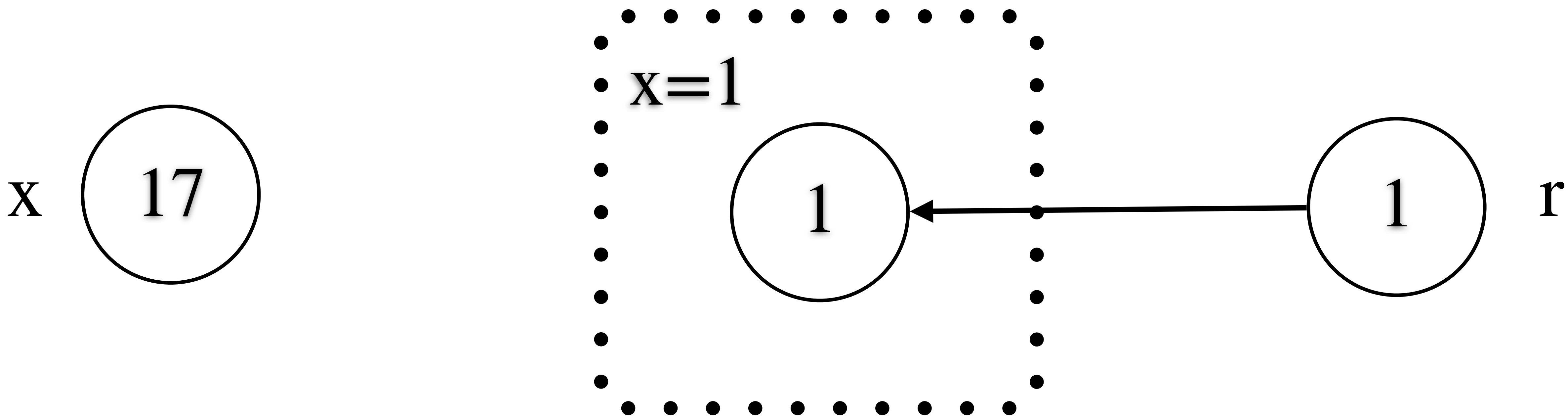
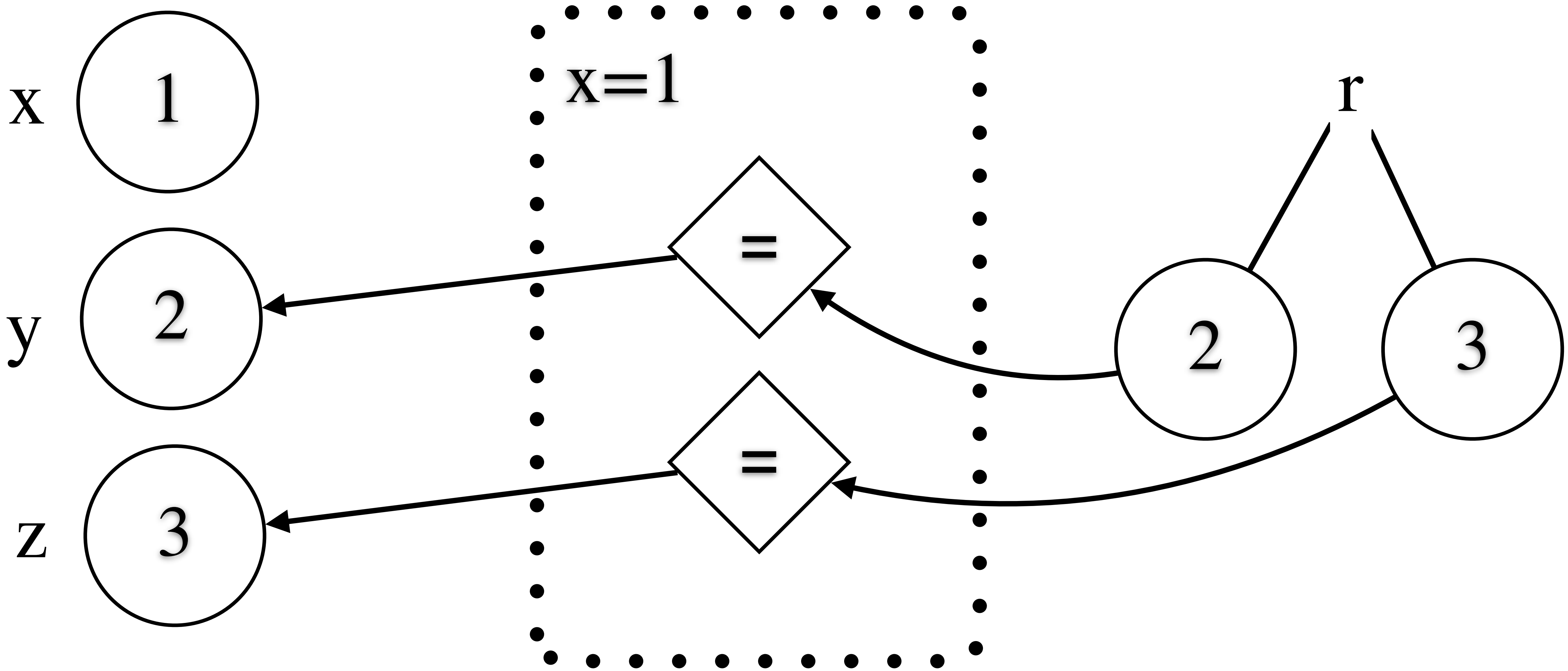



$$R(x,r) := (x = 1 \land r = 1) \lor \underline{(x \neq 1 \land r = x)}$$

if x = 1 then (y,z) else (z,y)




$R((x,y,z),r) := \underline{(x = 1 \wedge r = (y,z))} \vee (x \neq 1 \wedge r = (z,y))$

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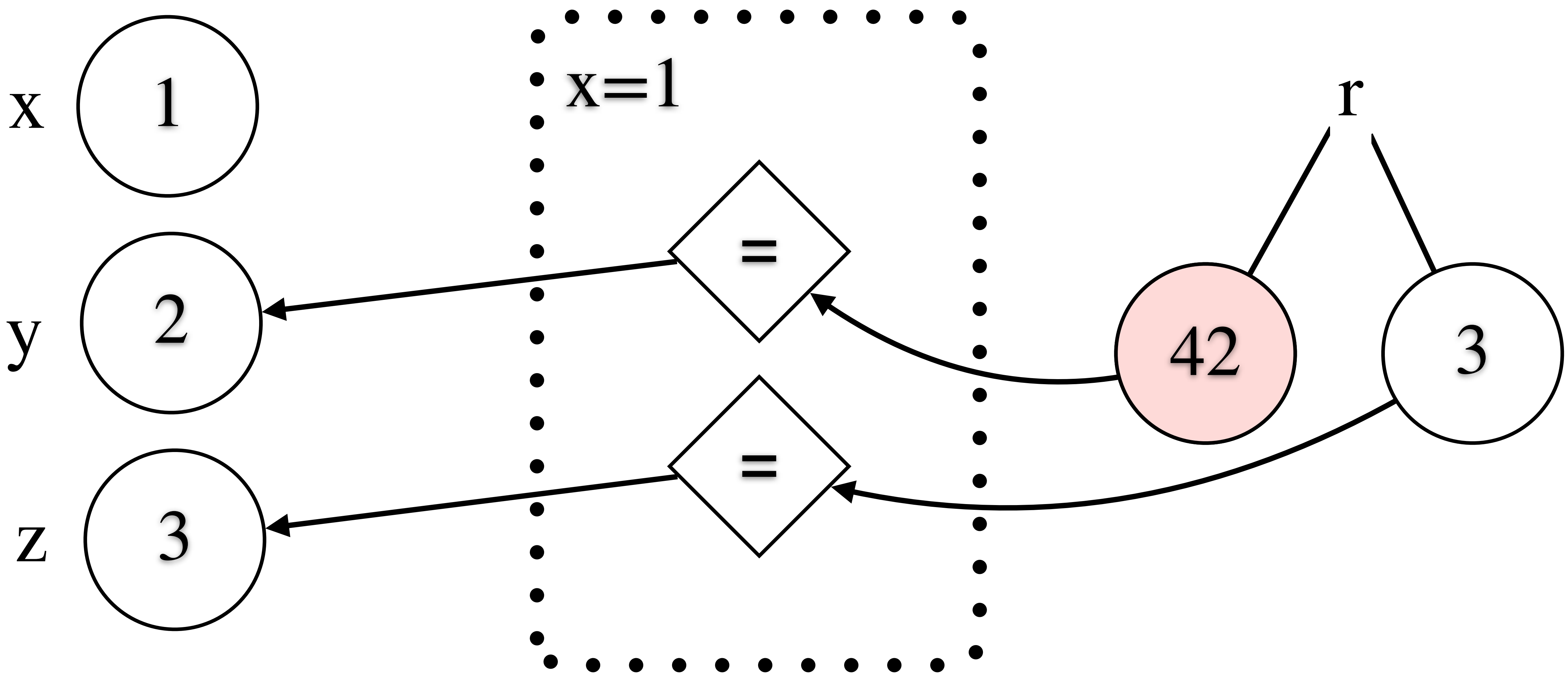


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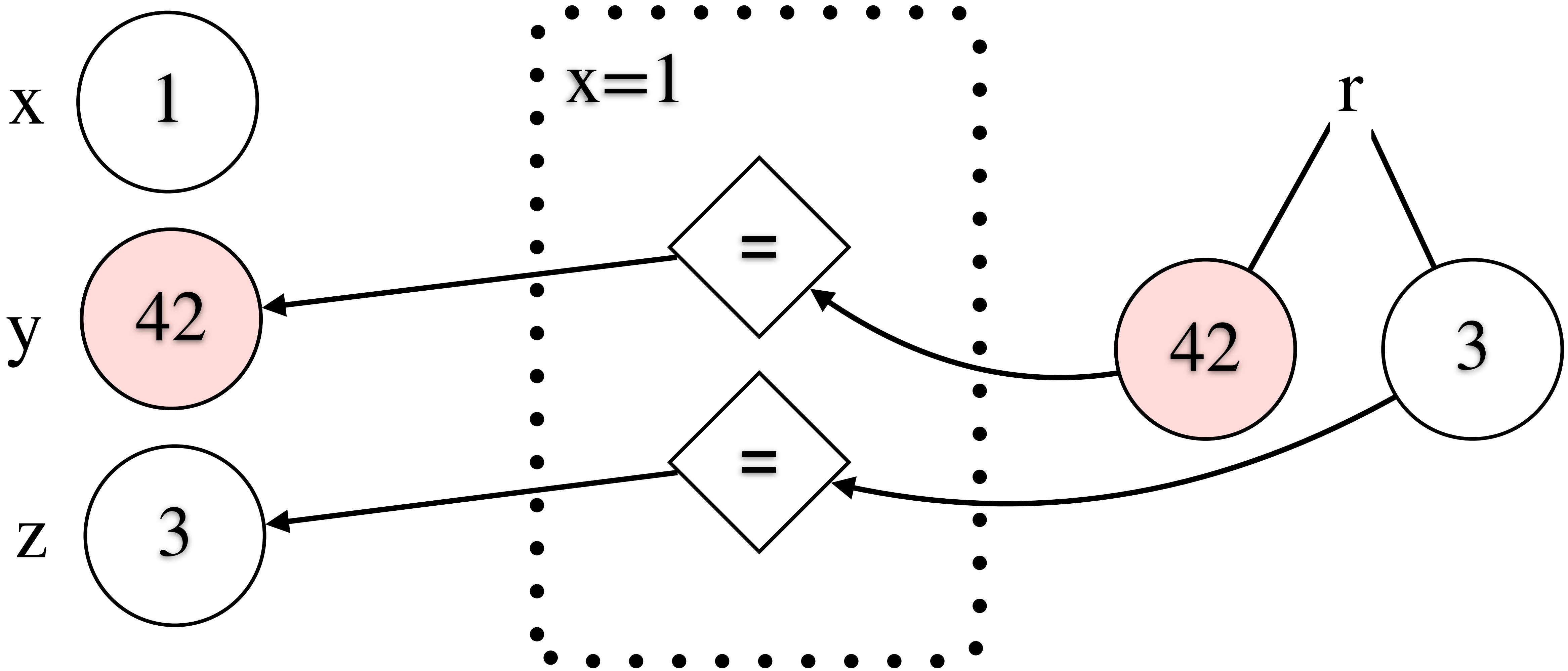


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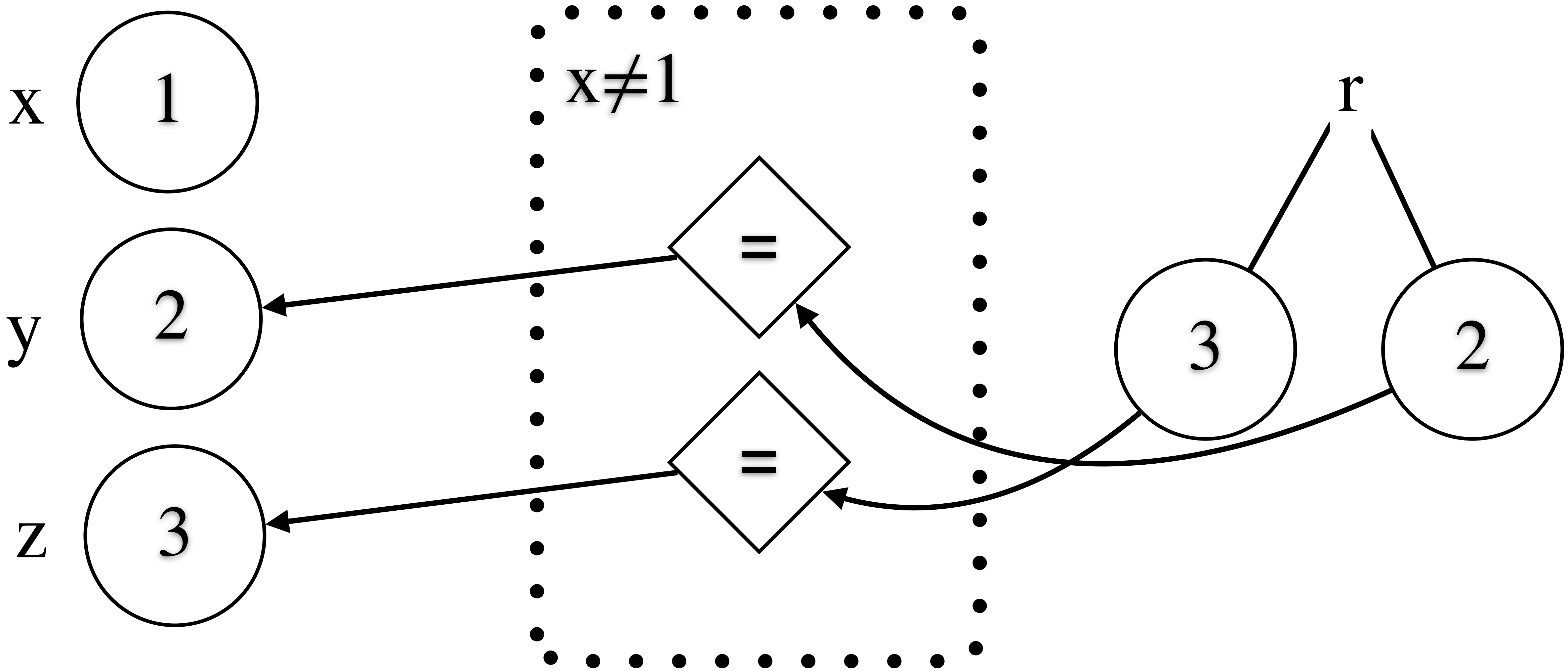


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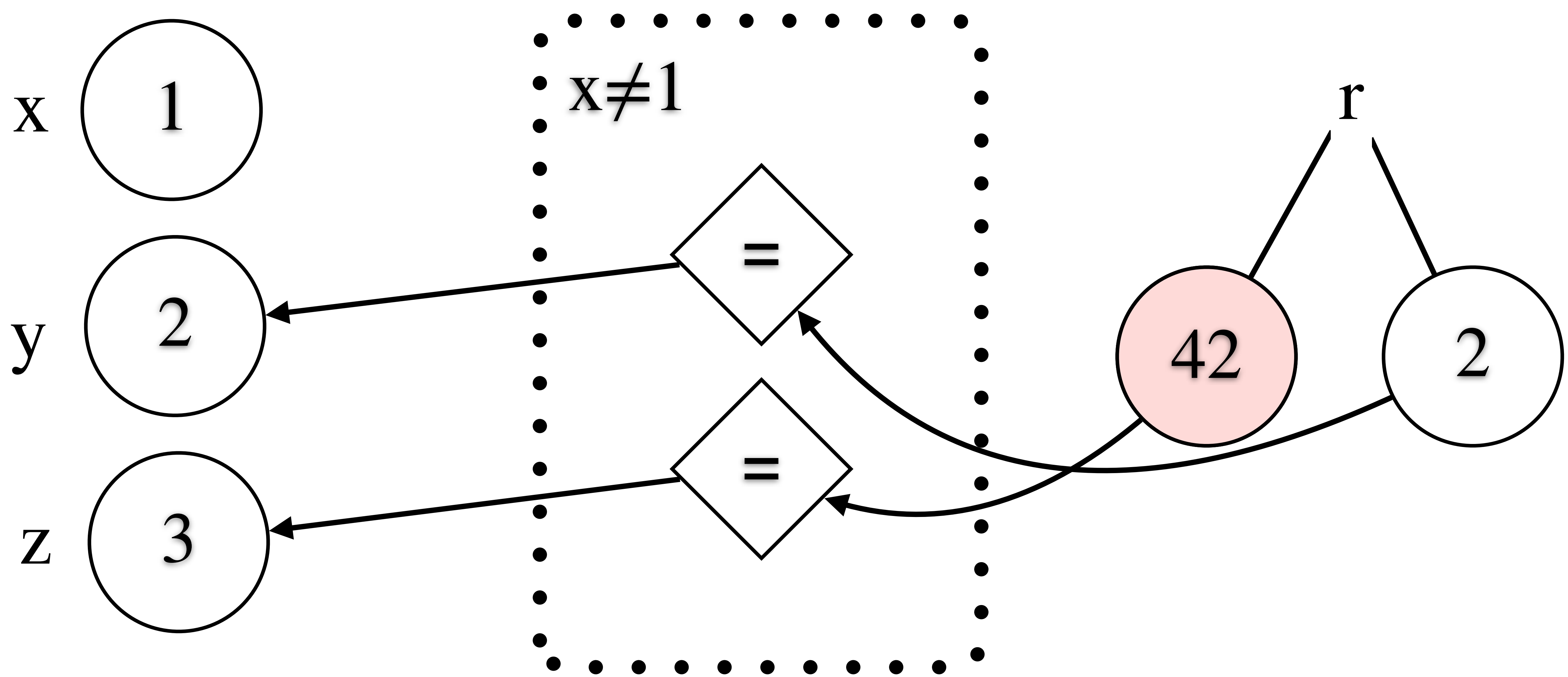


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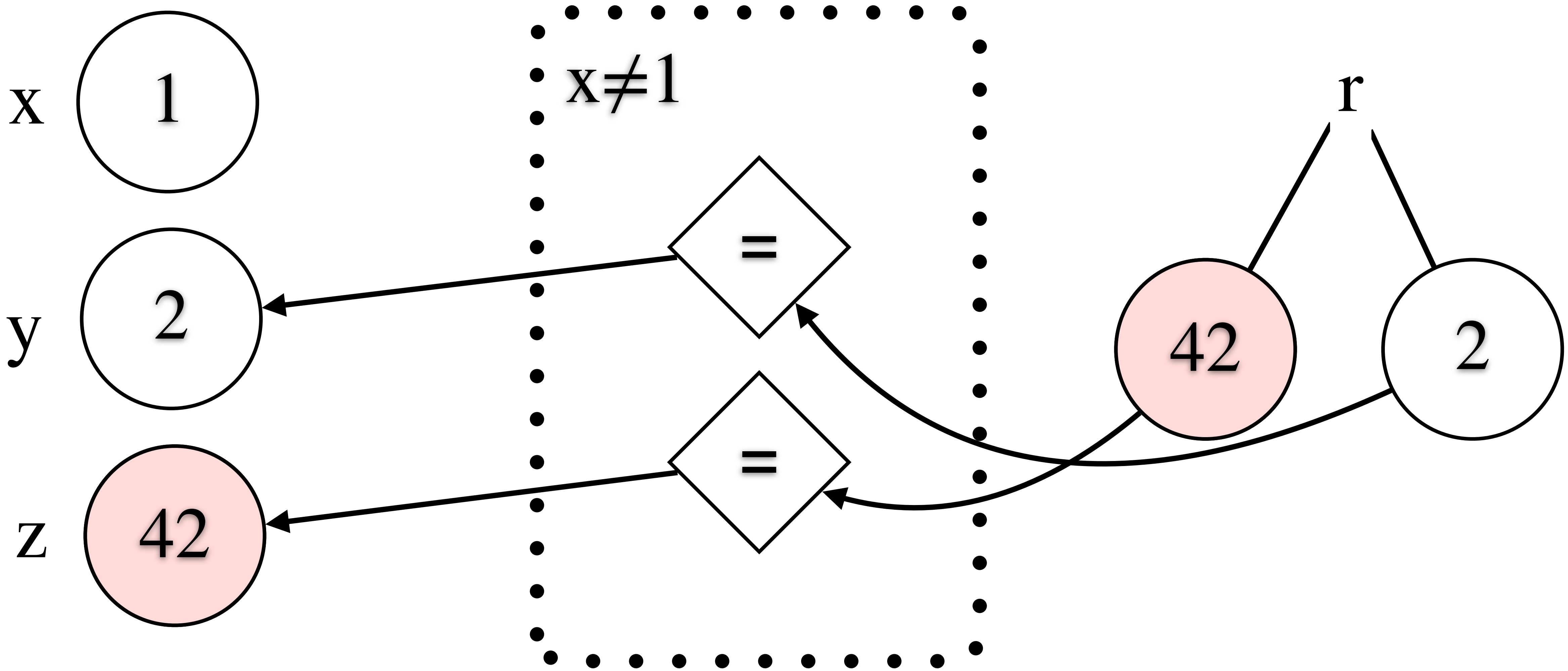


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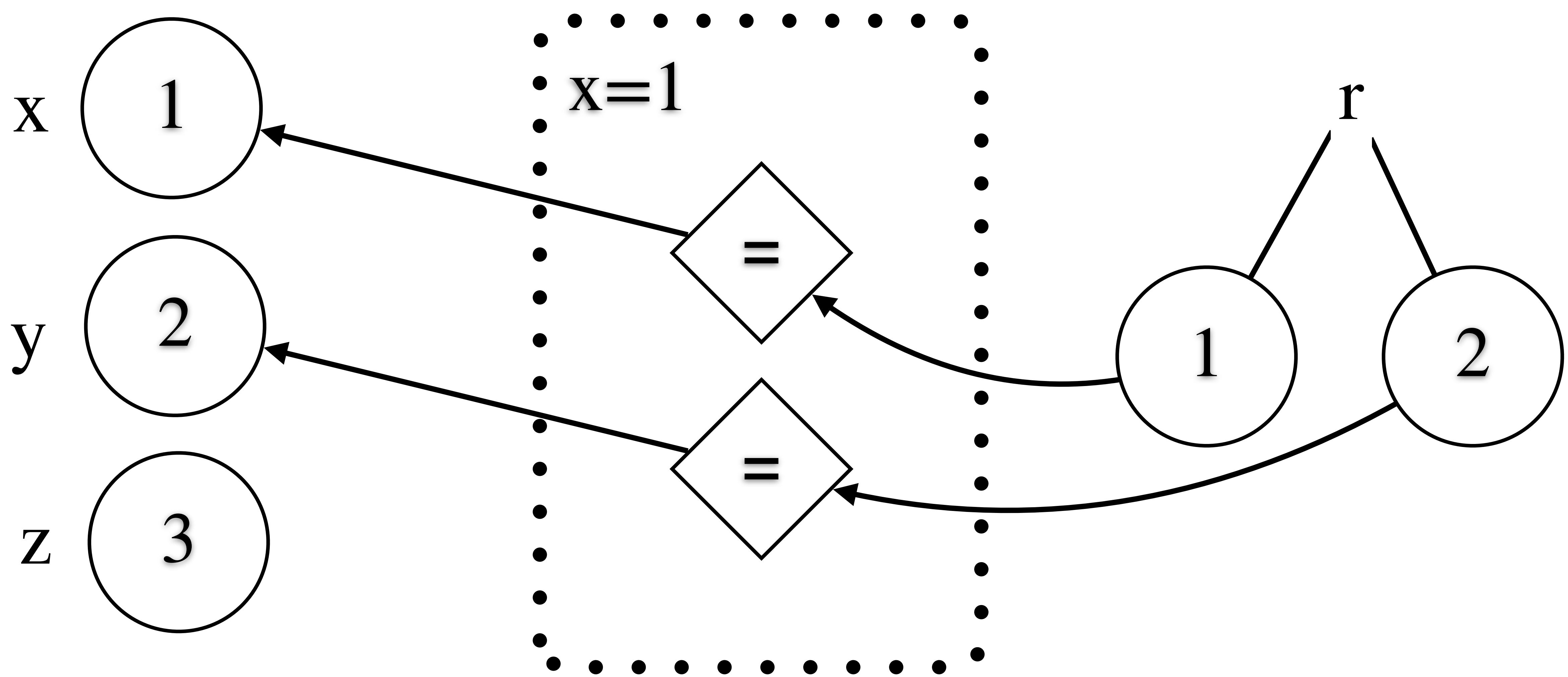


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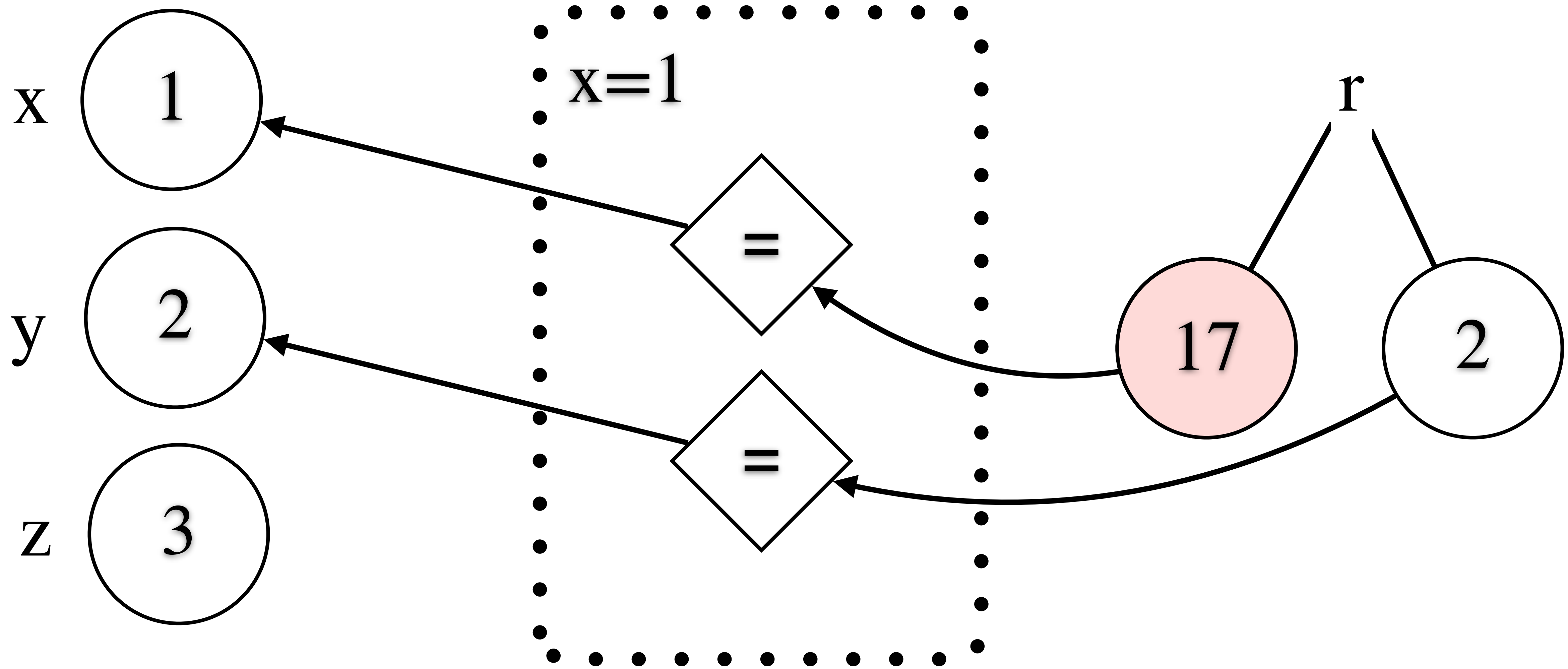


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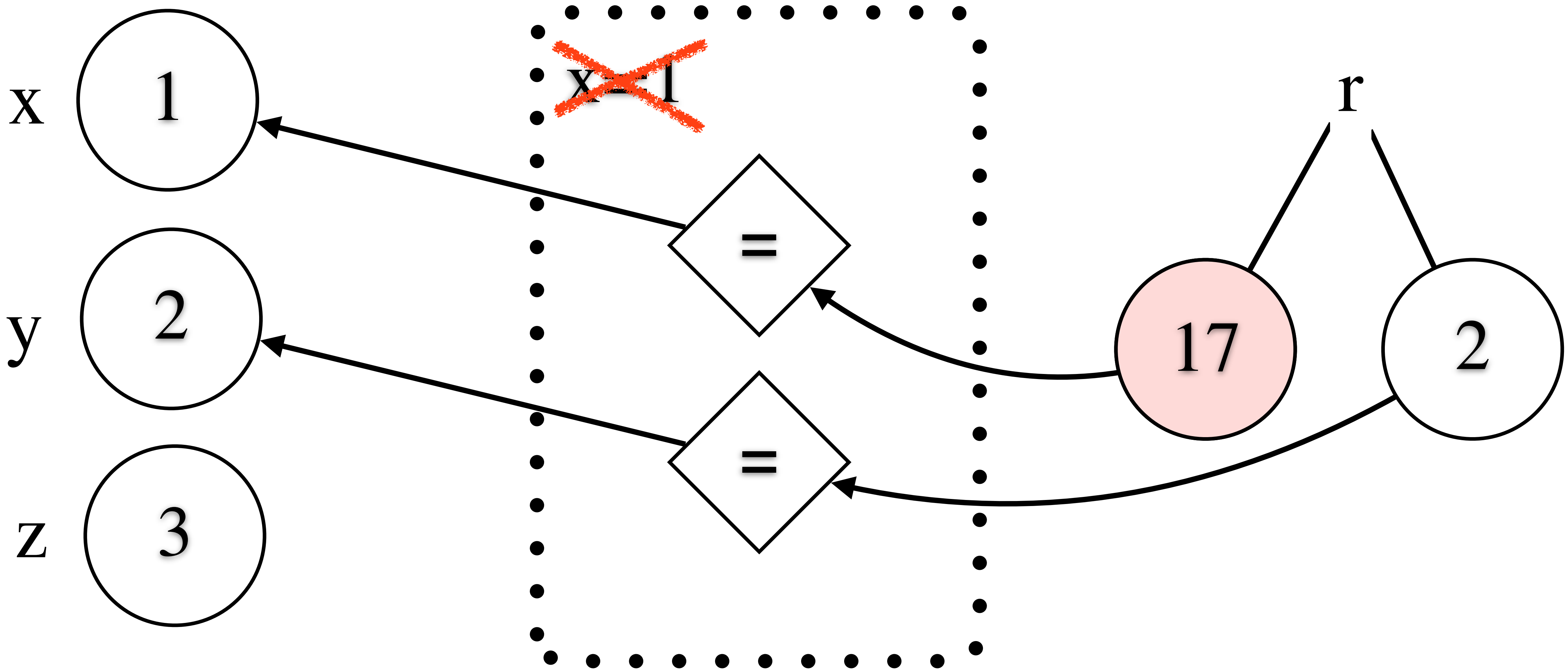


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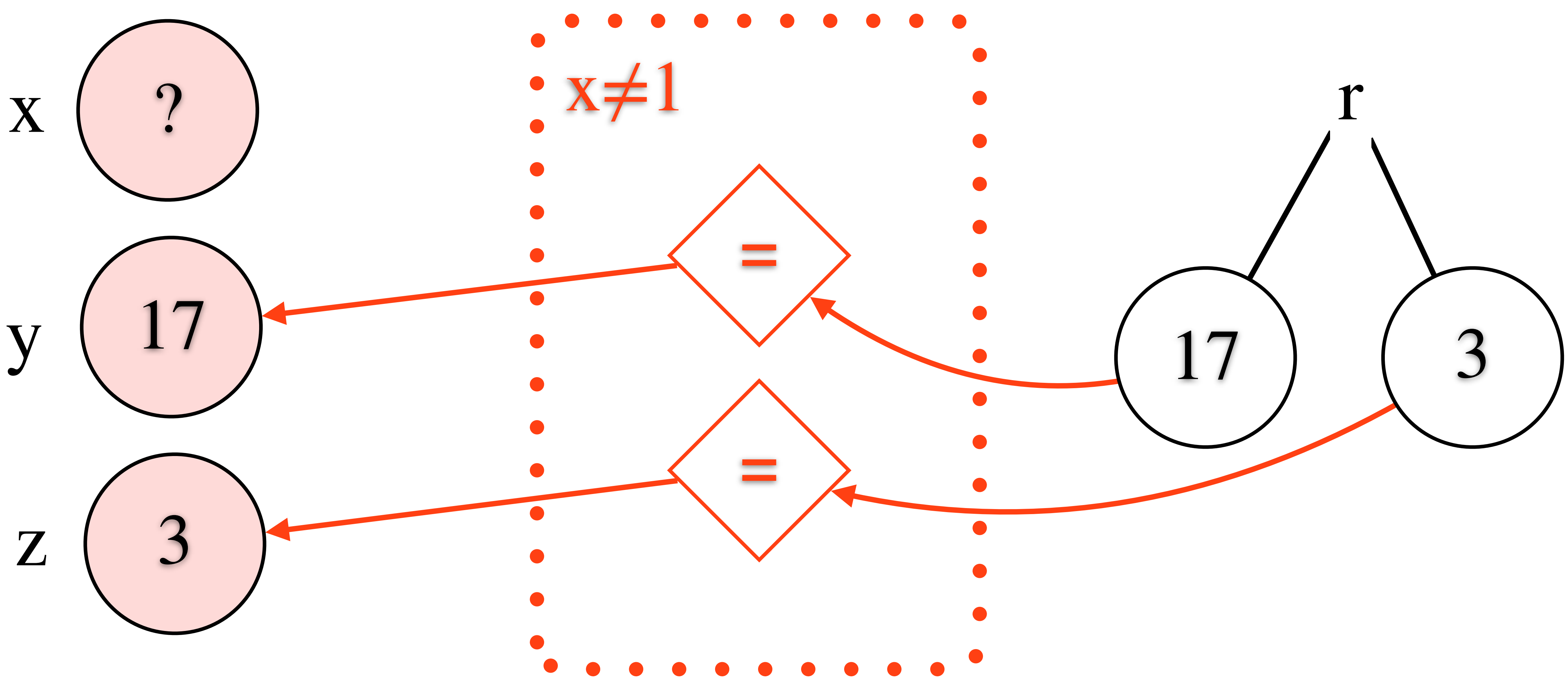


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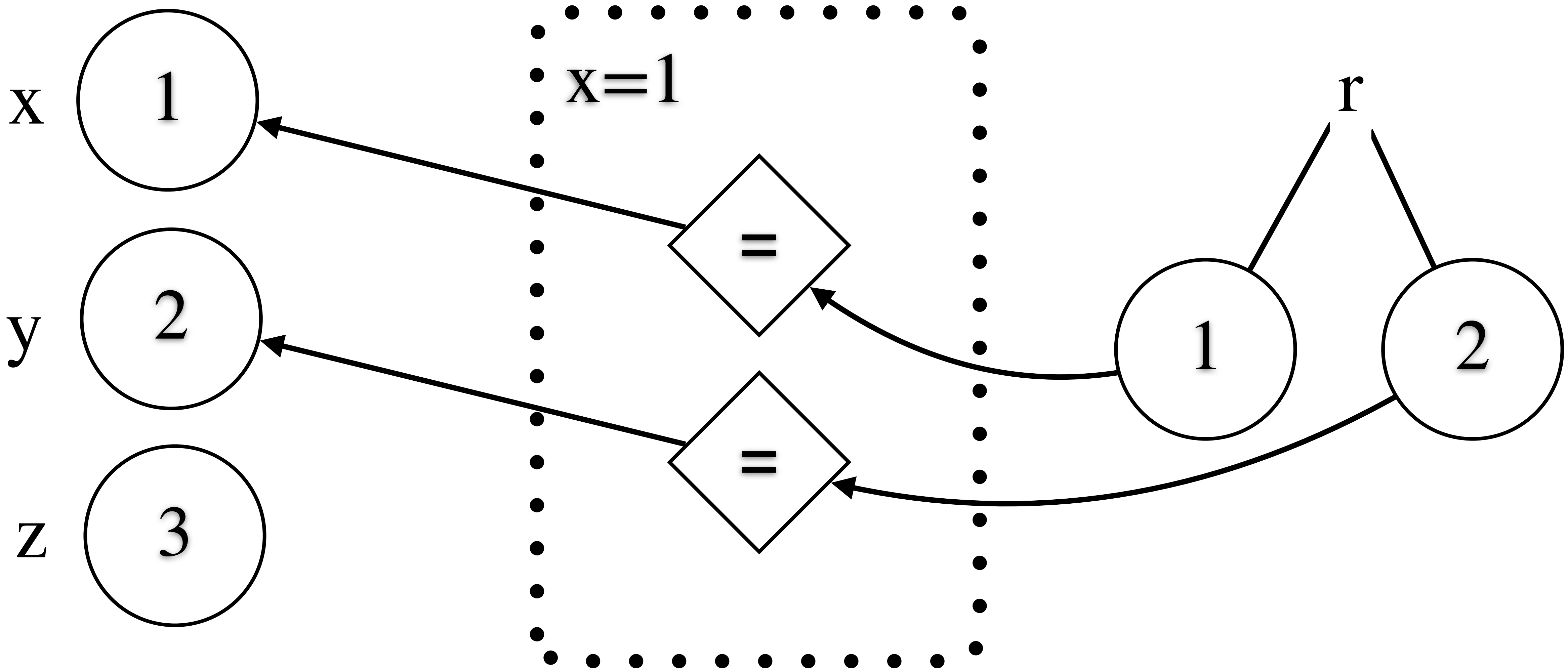


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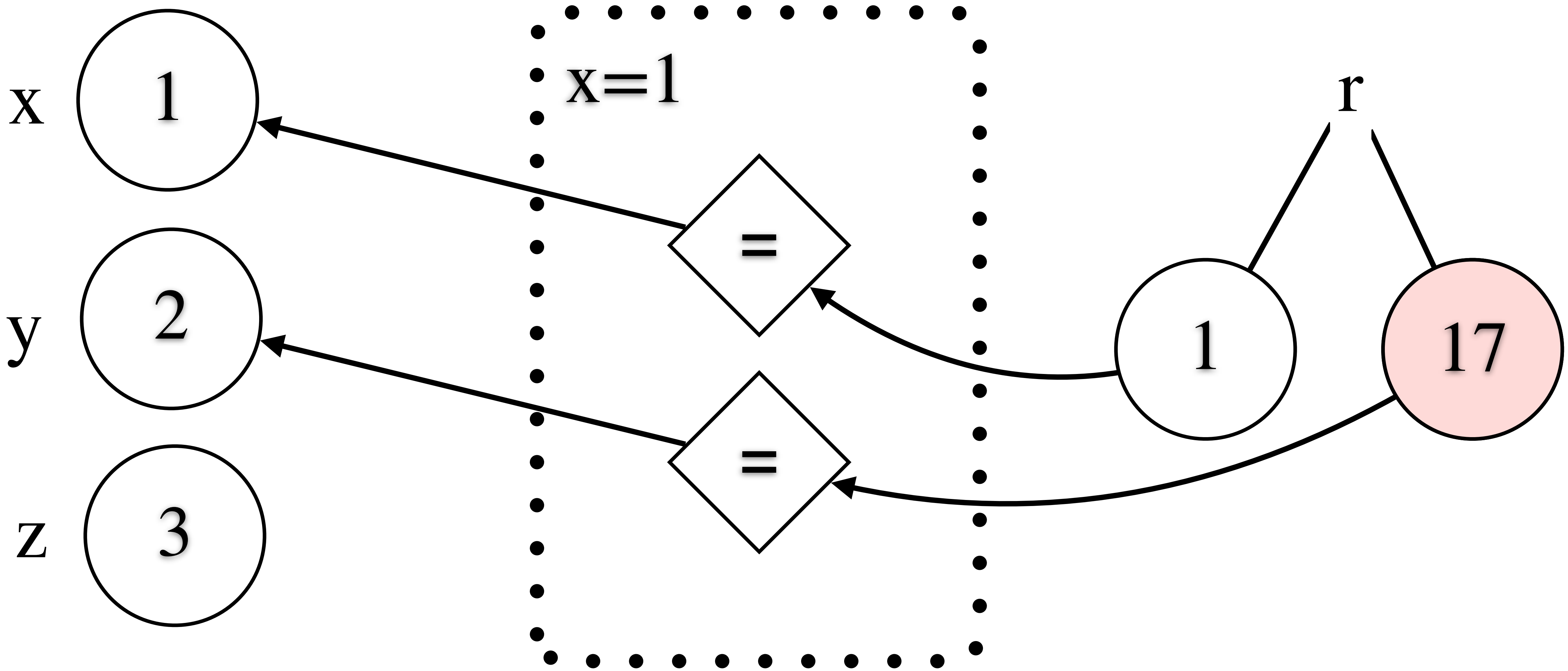


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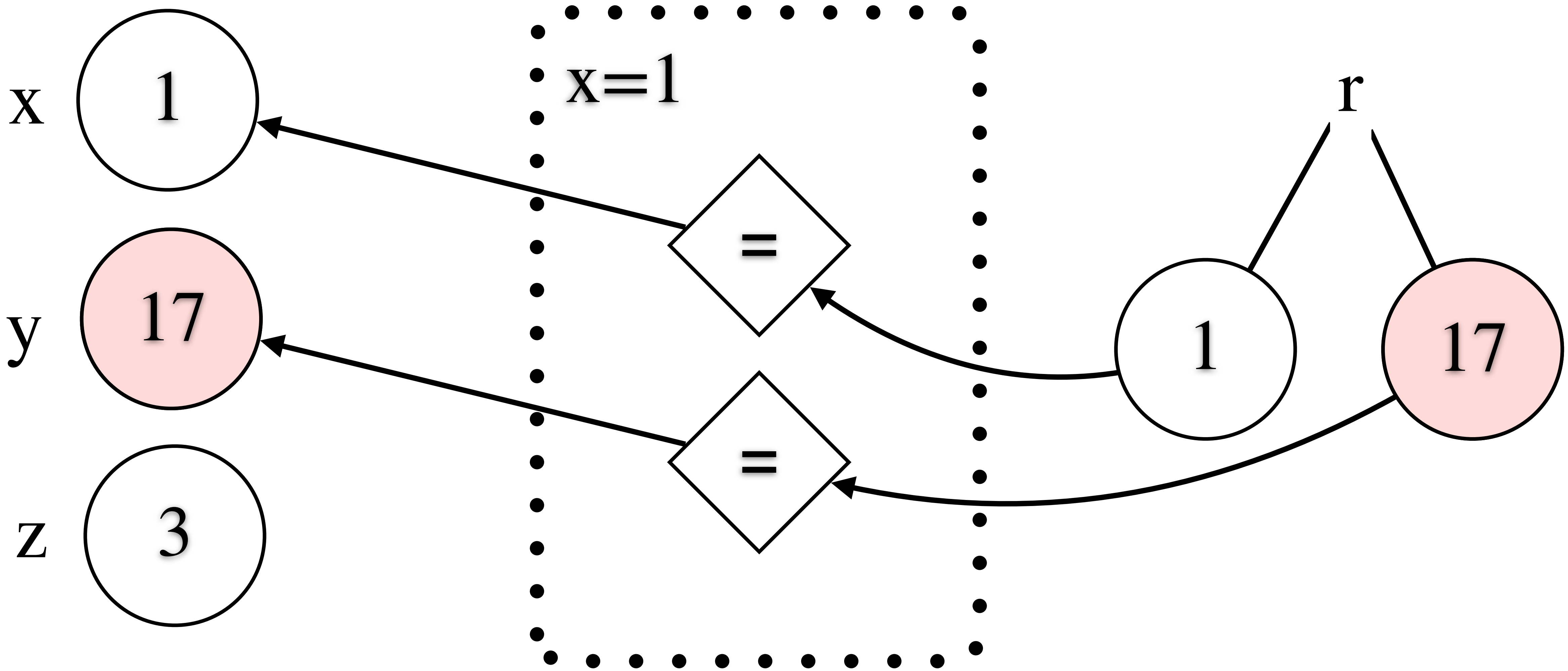


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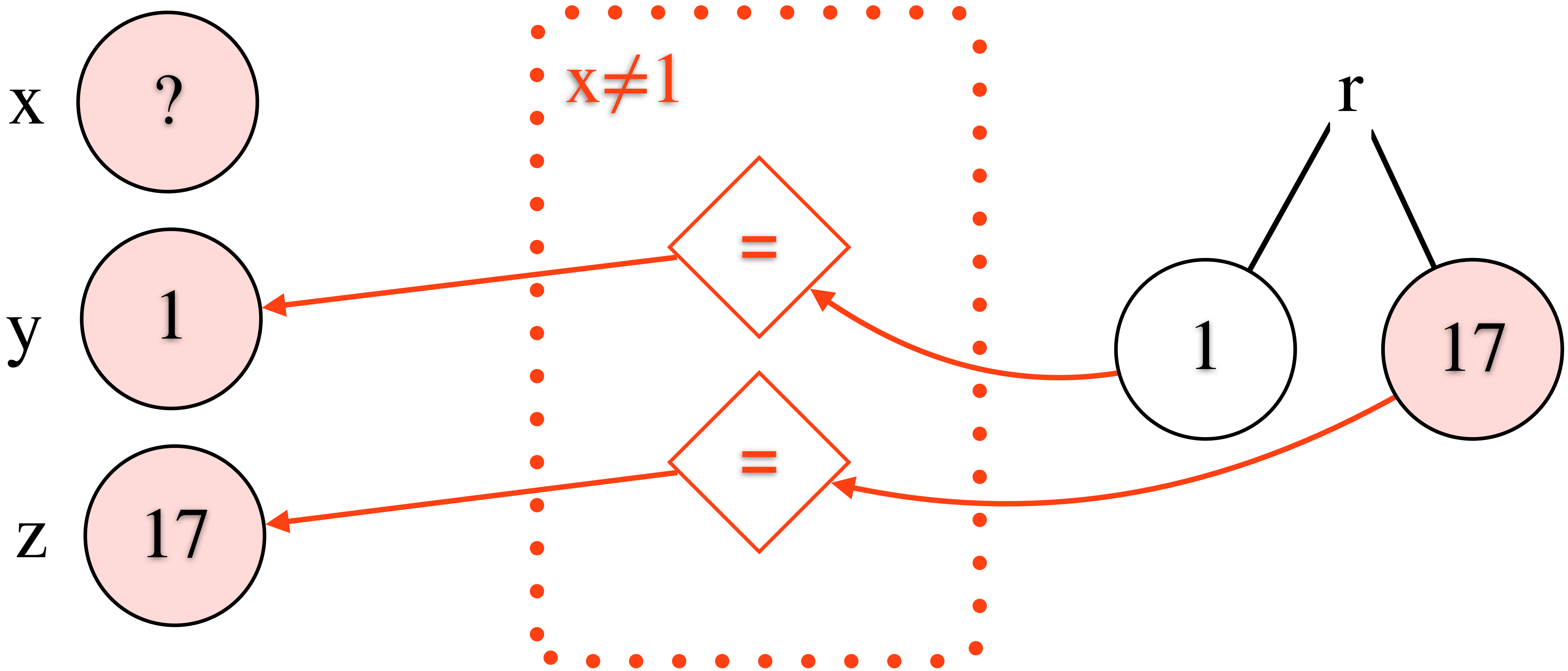


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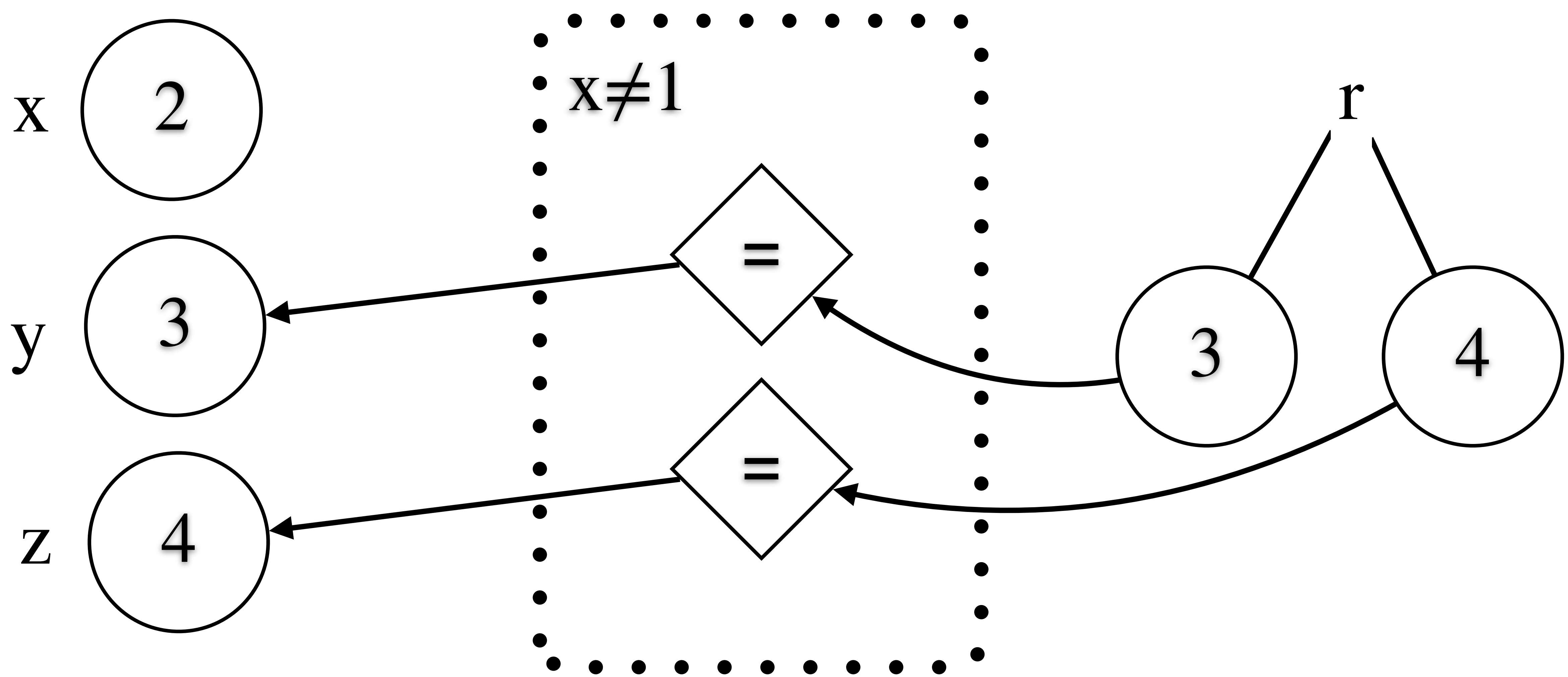


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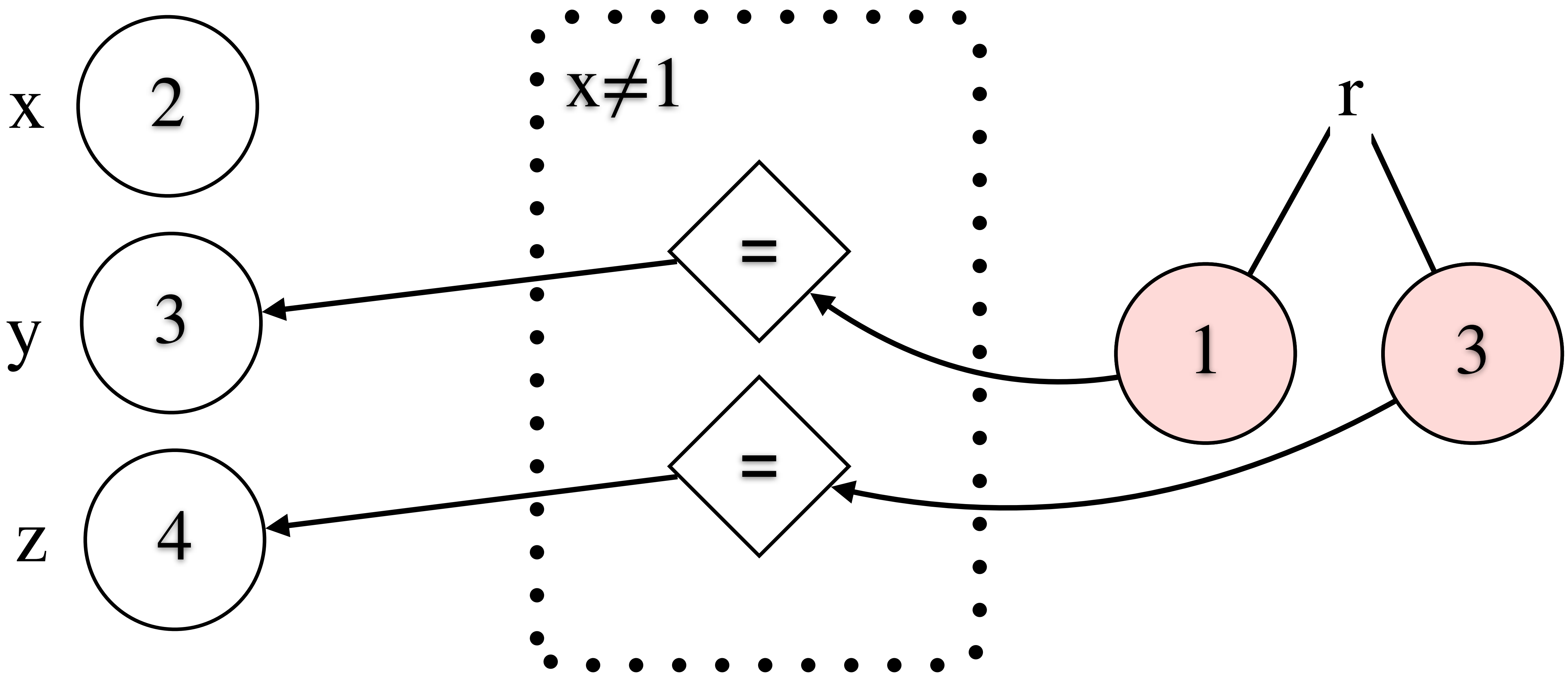


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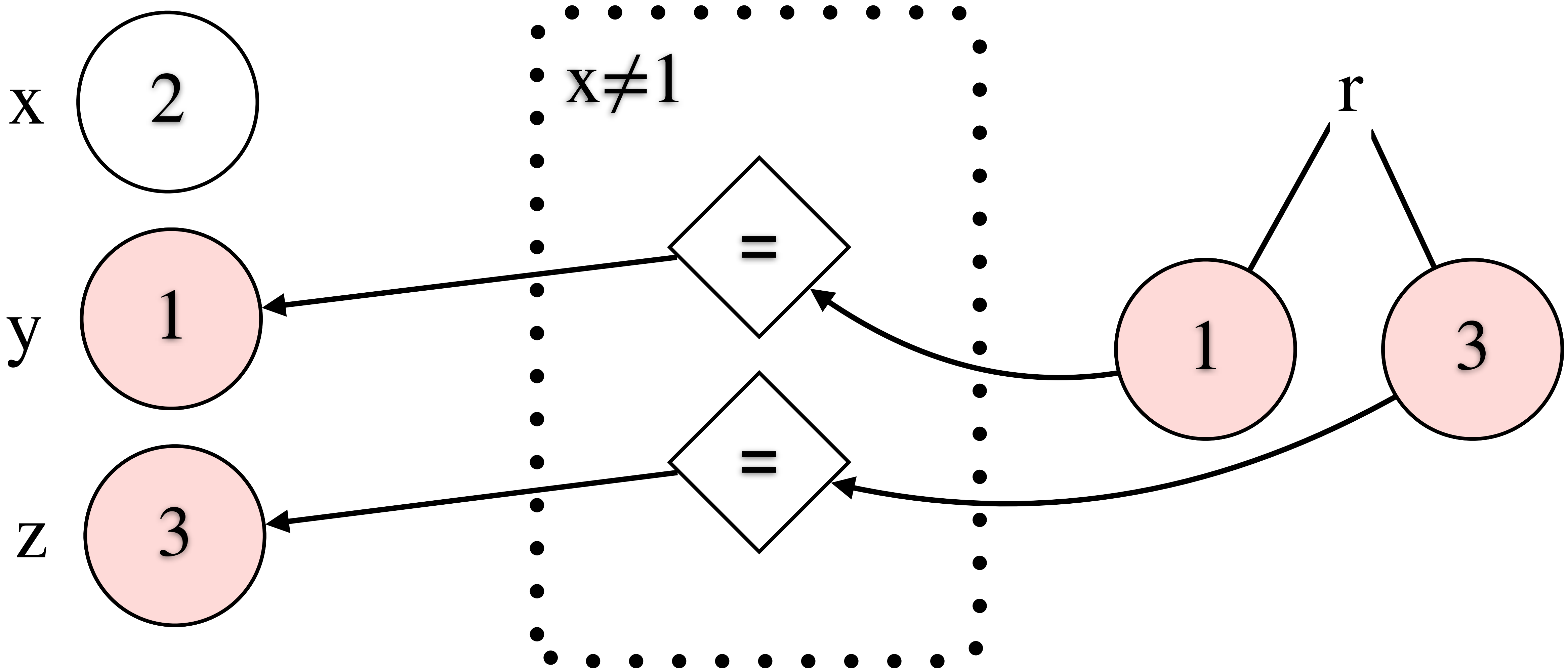


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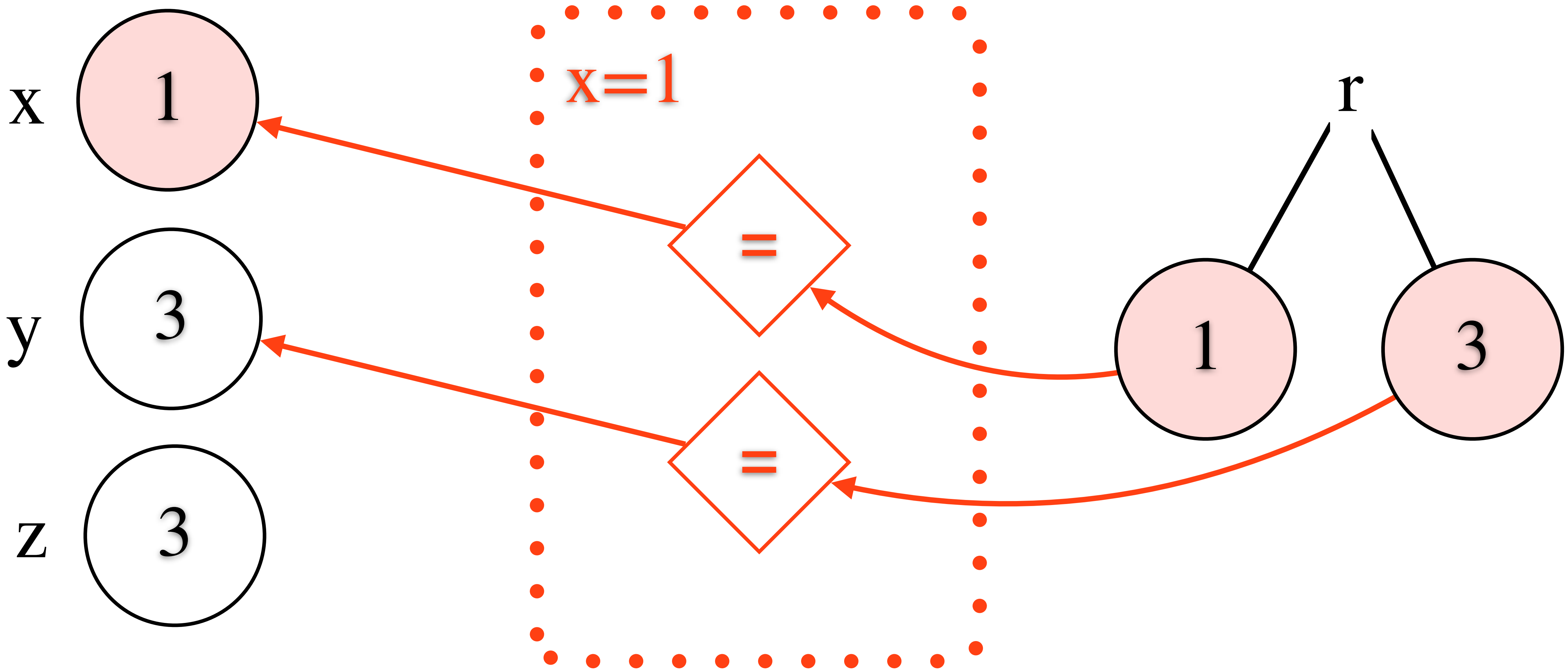


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# Questions

- Is provenance semantics of fixed *e* definable as TGG?
  - for if-then, pairs: probably
  - for richer languages? unclear
- Can we formalize how prov aids bidirectionality (when it does)?
- Can we use formal properties of prov to better understand traceability? Are they the same thing?
- Is "least damage to prov" a good defn of "least change"?
- Is prov a good basis for partial consistency?