NOR:

$(\lambda xy|\ xx(yy))\ (\lambda x|xy)\ (\lambda x|x)$

$\xrightarrow{\alpha}\ (\lambda xw|\ xx(ww))\ (\lambda x|xy)\ (\lambda x|x)$

$\xrightarrow{\beta}\ (\lambda w|(\lambda x|xy)(\lambda x|xy)(ww))\ (\lambda x|x)$

$\xrightarrow{\beta}\ (\lambda x|xy)\ (\lambda x|xy)((\lambda x|x)(\lambda x|x))$

$\xrightarrow{\beta}\ (\lambda x|xy)\ y\ ((\lambda x|x)(\lambda x|x))$

$\xrightarrow{\beta}\ yy\ (\lambda x|x)$

AOR:

$(\lambda xy|\ xx(yy))\ (\lambda x|xy)\ (\lambda x|x)$

$\xrightarrow{\alpha}\ (\lambda xw|\ xx(ww))\ (\lambda x|xy)\ (\lambda x|x)$

$\xrightarrow{\beta}\ (\lambda w|(\lambda x|xy)(\lambda x|xy)(ww))\ (\lambda x|x)$

$\xrightarrow{\beta}\ (\lambda w|(\lambda x|xy)\ y\ (ww))\ (\lambda x|x)$

$\xrightarrow{\beta}\ (\lambda w|\ yy\ (ww))\ (\lambda x|w)$

$\xrightarrow{\beta}\ yy((\lambda x|x)(\lambda x|x))$

$\xrightarrow{\beta}\ yy(\lambda x|x)$

2 a) $(\lambda xy|$ OR y (Not x)$)$

expand:

x FT

$(\lambda xy|((\lambda xy| x \top y) y)((\lambda x| x^{FT}) x))$

$\xrightarrow{\alpha} (\lambda xy|((\lambda xz| x \top z) y)((\lambda x| x^{FT}) x))$

$\xrightarrow{\beta} (\lambda xy|(\lambda z| y \top z)(x^{FT}))$

$\xrightarrow{\beta} (\lambda xy| y \top x^{FT})$

b) $(\lambda xy| y \top x F \top) \top F$

$\xrightarrow{\beta}$ F$\top$ $\top$F$\top$

$\xrightarrow{\beta}$ F

$(\lambda xy| y \top x F \top) F \top$

$\xrightarrow{\beta}$ $\top$ $\top$F F$\top$

$\xrightarrow{\beta}$ F

3 a)

((lambda (z) (if (> 4 5) (+4 z) (+4 5)) 10)

(if (> 4 5) (+4 10) (+4 5))
4≯5, (+4 5)

$\underline{9}$

b) {x → 4, y → 5, z → 10} ∪ ⊂ 10