Short Run vs. Long Run

Cost Curves

Short run

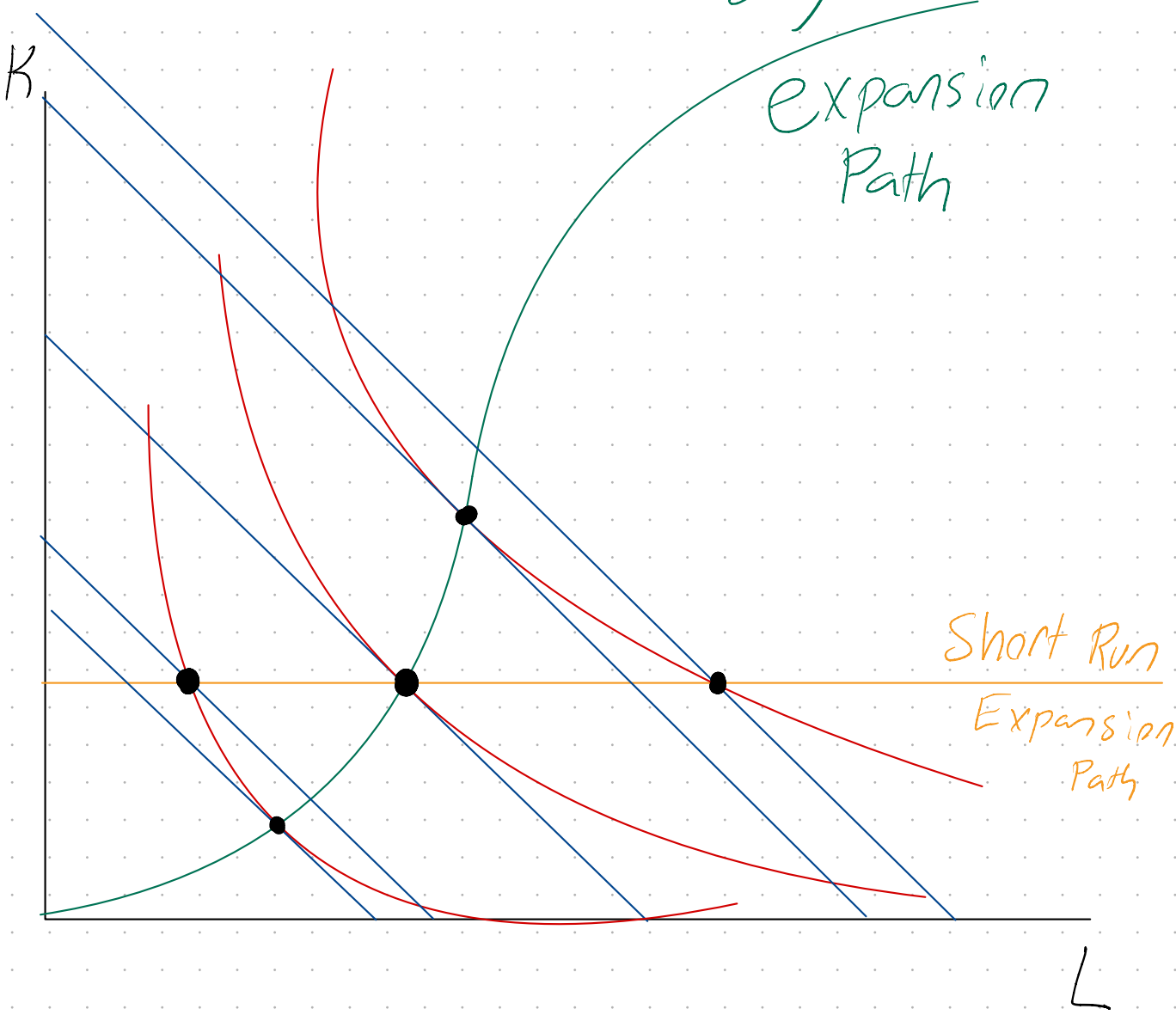
↓

K fixed at $\bar{K}$

long run

↓

no variables fixed



ex: Say you have a production function: $Q = f(K,L) = K^{.5}L^{.5}$

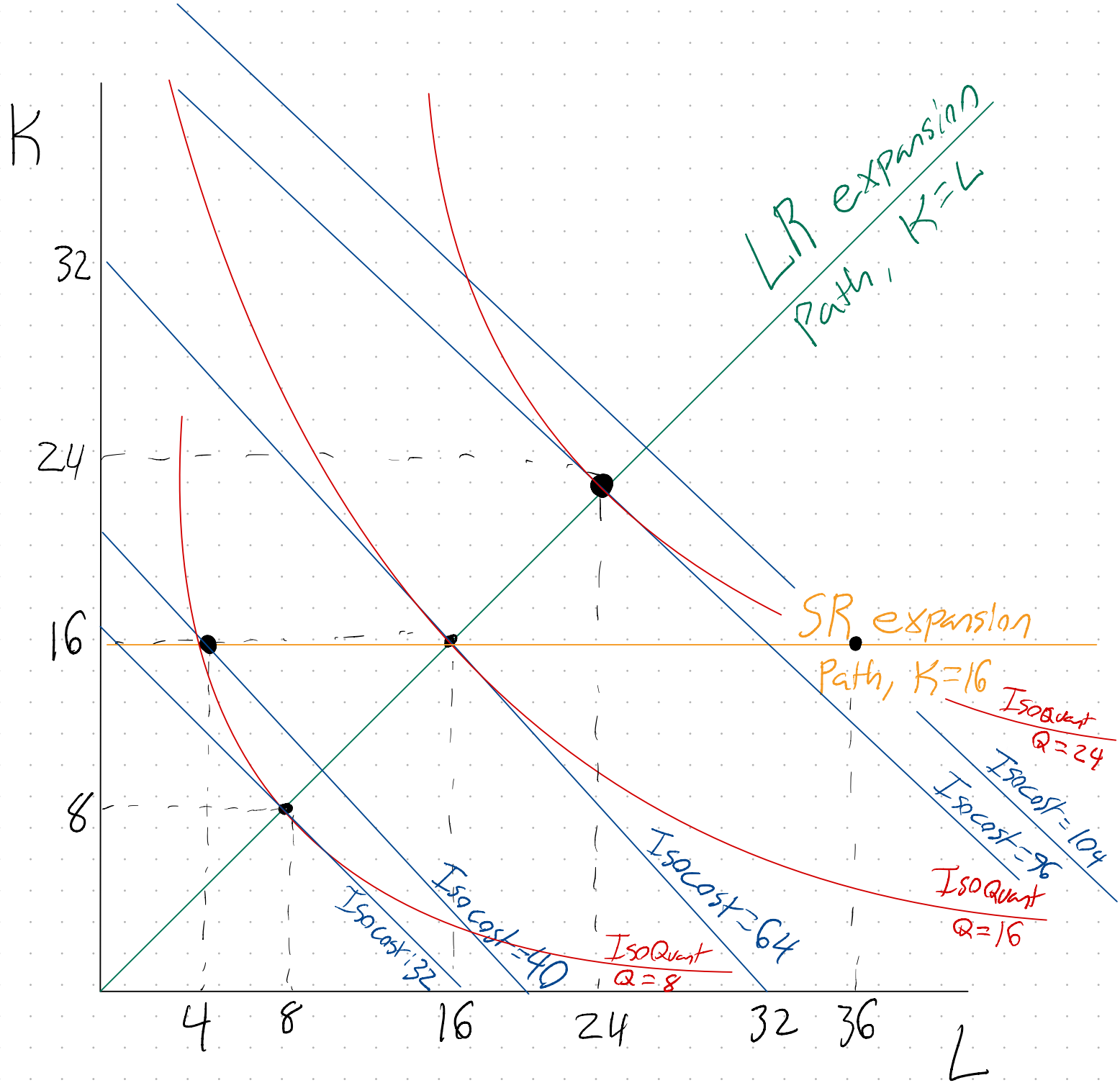
$R = 2 \quad W = 2$

first: Calculate the long run expansion path

$$\frac{MP_K}{R} = \frac{MP_L}{W} \Rightarrow \frac{MP_L}{MP_K} = \frac{W}{R}$$

$$\frac{.5K^{.5}L^{-.5}}{.5K^{-.5}L^{.5}} = \frac{2}{2} \Rightarrow \frac{K}{L} = 1$$

$$\boxed{K = L}$$


K
32
24
16
8
4
8
16
24
32
36
L
LR expansion Path, K=L
SR expansion Path, K=16
IsoQuant Q=24
IsoQuant Q=16
IsoQuant Q=8
Isocost=104
Isocost=96
Isocost=64
Isocost=40
Isocost=32

Say we are currently producing 16 units of Q at min. cost.

Calculate K & L

$$K = L$$

$$16 = K^{.5} L^{.5}$$

$$16 = K^{.5} K^{.5}$$

$$16 = K = L$$

Say we want to change output to 8 units in the SR. What is our K & L?

$$8 = 16^{.5} L^{.5}$$

$$8 = 4 L^{.5}$$

$$2 = L^{.5}$$

$$4 = L \qquad (4, 16)$$

What if we produced 8 units in the LR? What is our K&L?

$$8 = K^{.5}L^{.5}, \quad K = L, \quad 8 = K = L$$

Say we want to change output to 24 units in the SR. What is our K&L?

$$\bar{K} = 16$$

$$24 = L^{.5}\,16^{.5}$$

$$24 = L^{.5} \cdot 4$$

$$6 = L^{.5} \Rightarrow L = 36$$

$(36, 16)$

What if we produced 24 units in the LR? What is our K&L?

$$24 = K^{.5}L^{.5}, \quad K = L, \quad (24, 24)$$

How much can we save by transitioning to LR production?

$$\underbrace{(36 \cdot 2 + 16 \cdot 2)}_{104} - \underbrace{(24 \cdot 2 + 24 \cdot 2)}_{96}$$

$$\boxed{8}$$