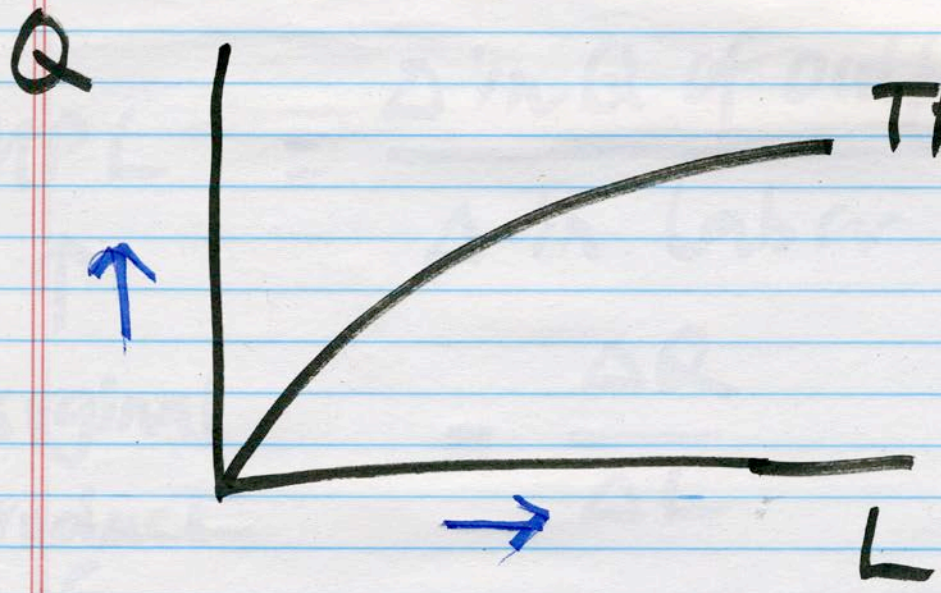


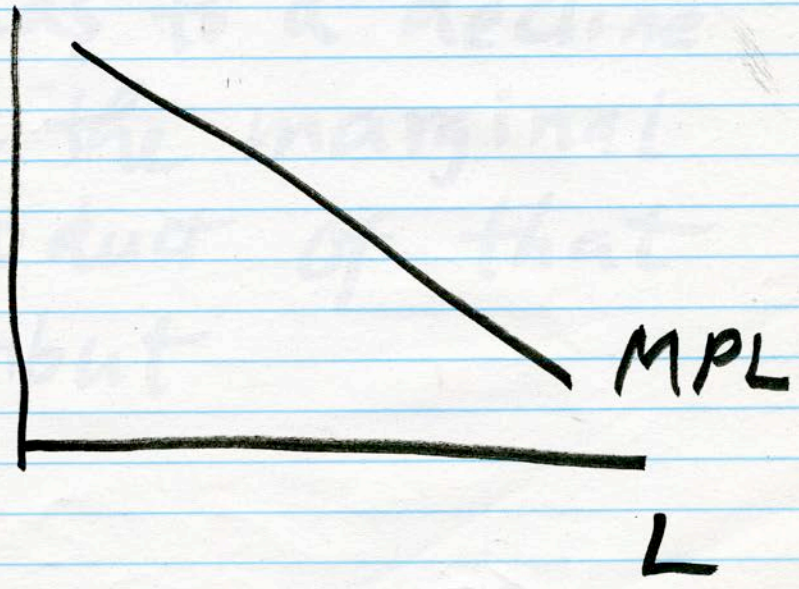
Marginal product of an input is the additional quantity of output that is produced by using one more unit of that input $\frac{\Delta Q}{\Delta L}$

$$MPL = \frac{\Delta \text{ in } Q \text{ of output}}{\Delta \text{ in labor}}$$

$$= \frac{\Delta Q}{\Delta L}$$

↑

marginal product of labor



diminishing return to an input : increase in the quantity of that input, holding other inputs fixed, leads to a decline in the marginal product of that input

Increase in fixed input, total product curve shifts up

Cost Curves

fixed cost: cost of the fixed input; does not depend on quantity of output

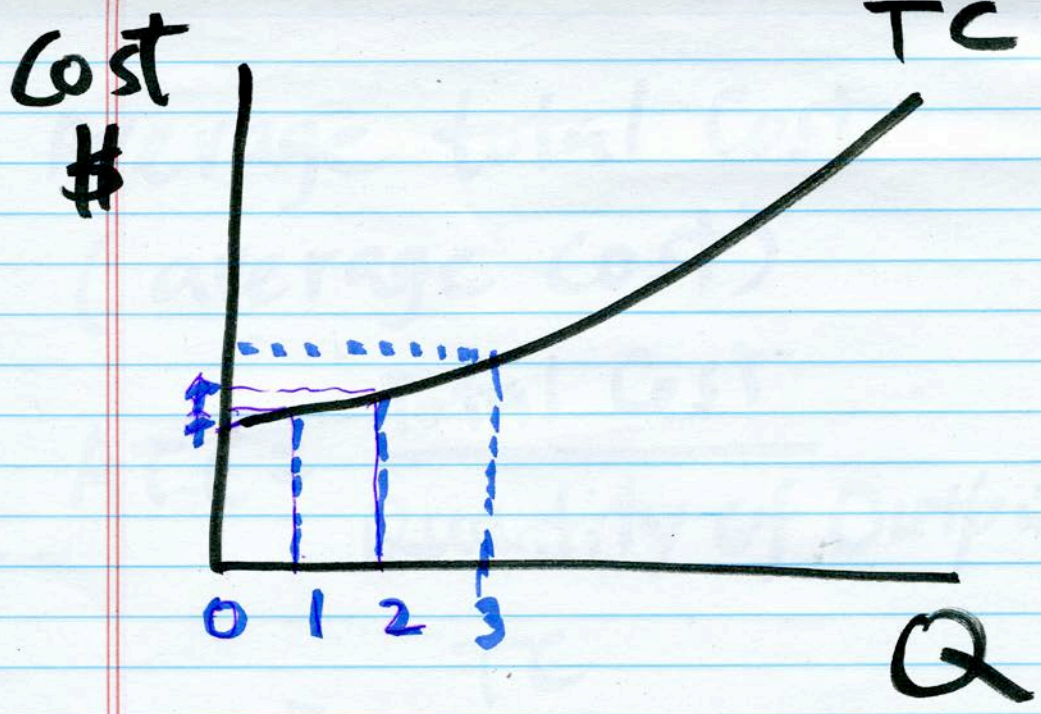
Variable cost: a cost that depends on the quantity of output produced

Total Cost: Sum of fixed cost and variable cost of producing the quantity of output

$$TC = FC + VC$$

Total cost = fixed cost + Variable cost

Total cost curve shows how total cost depends on the quantity of output



Marginal Cost

$$= \frac{\text{Change in total cost}}{\text{Change in quantity of output}}$$

$$MC = \frac{\Delta TC}{\Delta Q}$$

Average total Cost
(average cost)

$$ATC = \frac{\text{Total Cost}}{\text{Quantity of Output}}$$

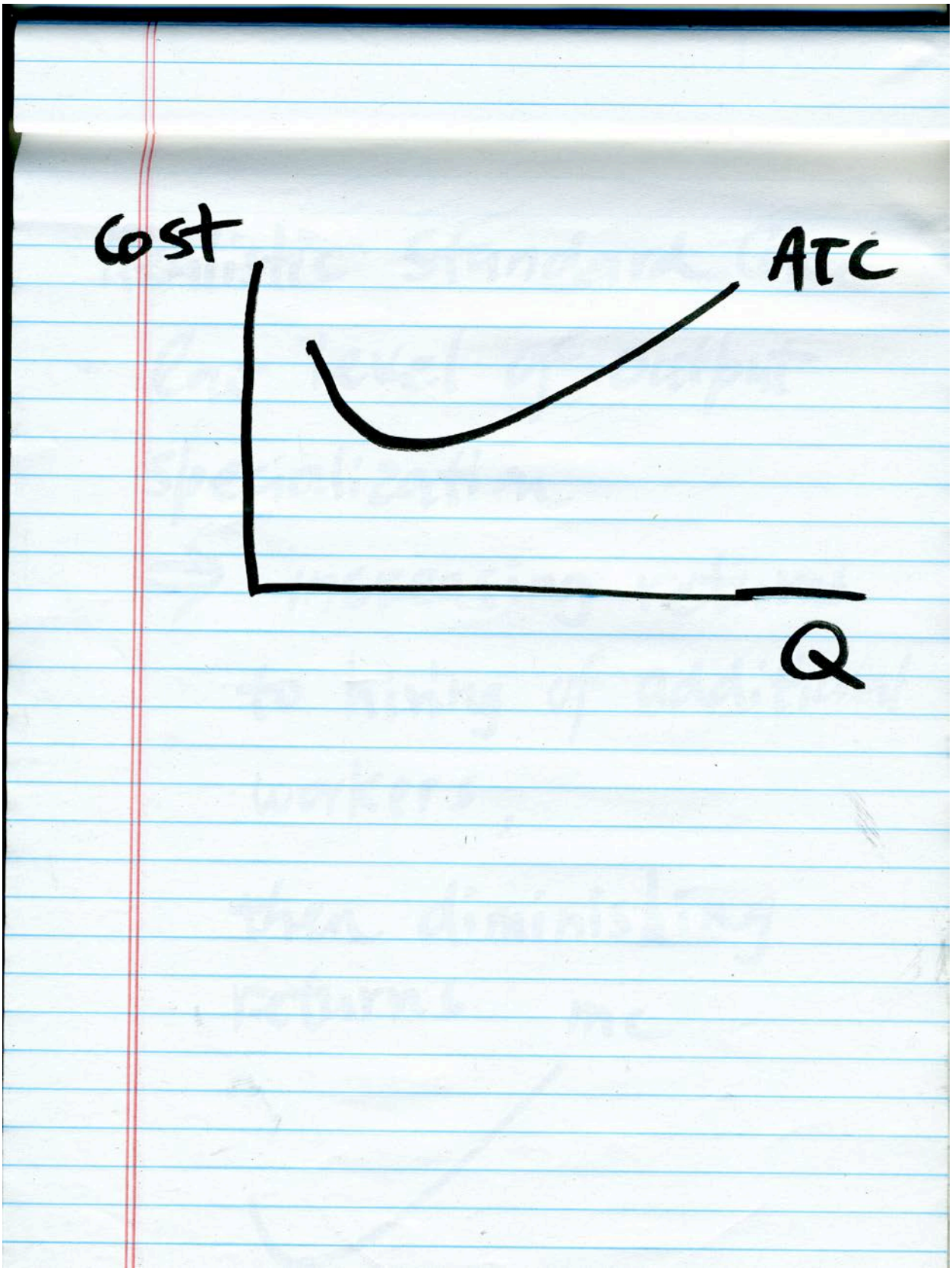
$$= \frac{TC}{Q}$$

$$TC = FC + VC$$

$$ATC = AFC + AVC$$

$$\frac{TC}{Q} = \frac{FC}{Q} + \frac{VC}{Q}$$

10 e.g.


Cost
ATC
Q

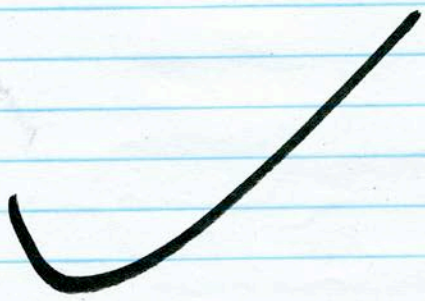
Realistic Standard Case

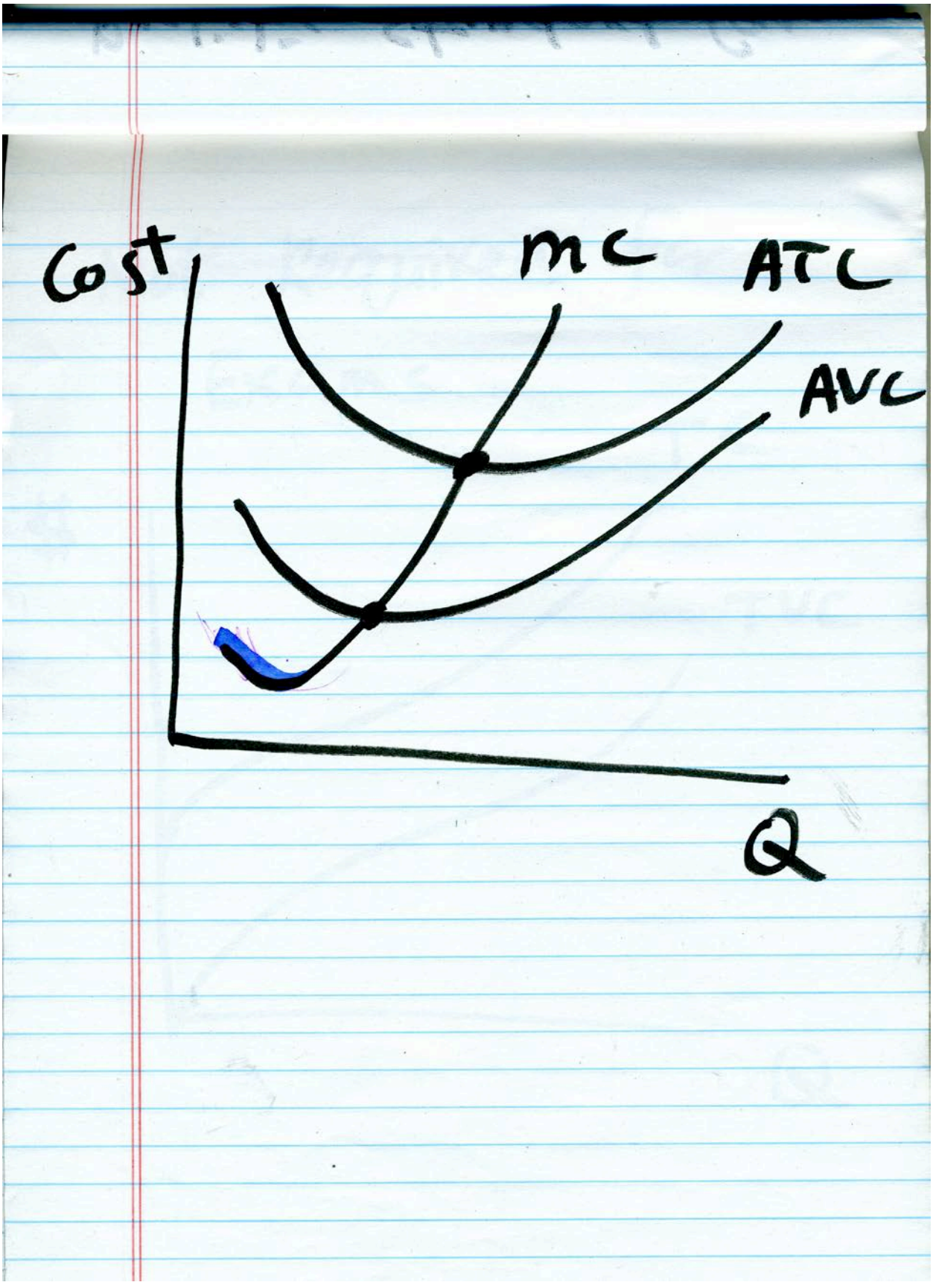
- low level of output

specialization

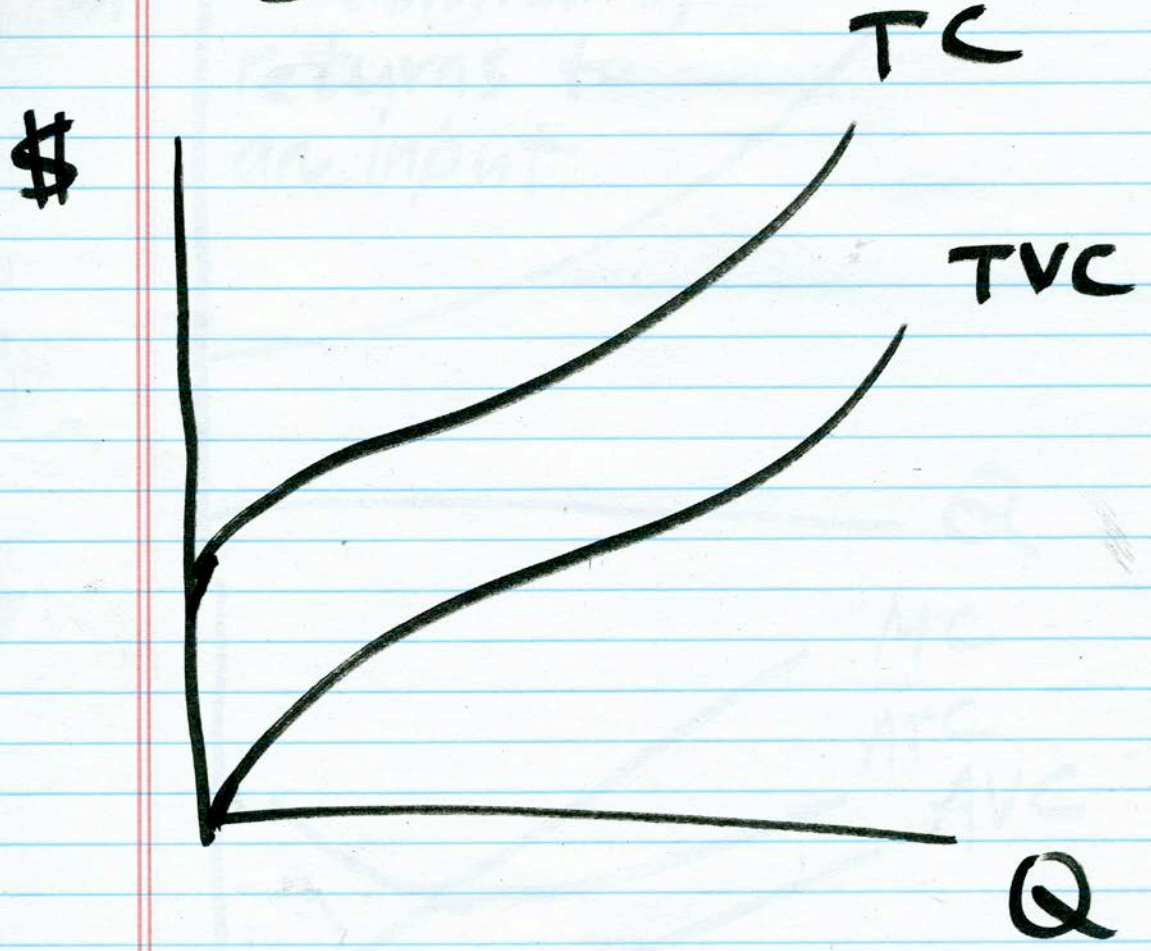
⇒ increasing returns to hiring of additional workers,

then diminishing returns

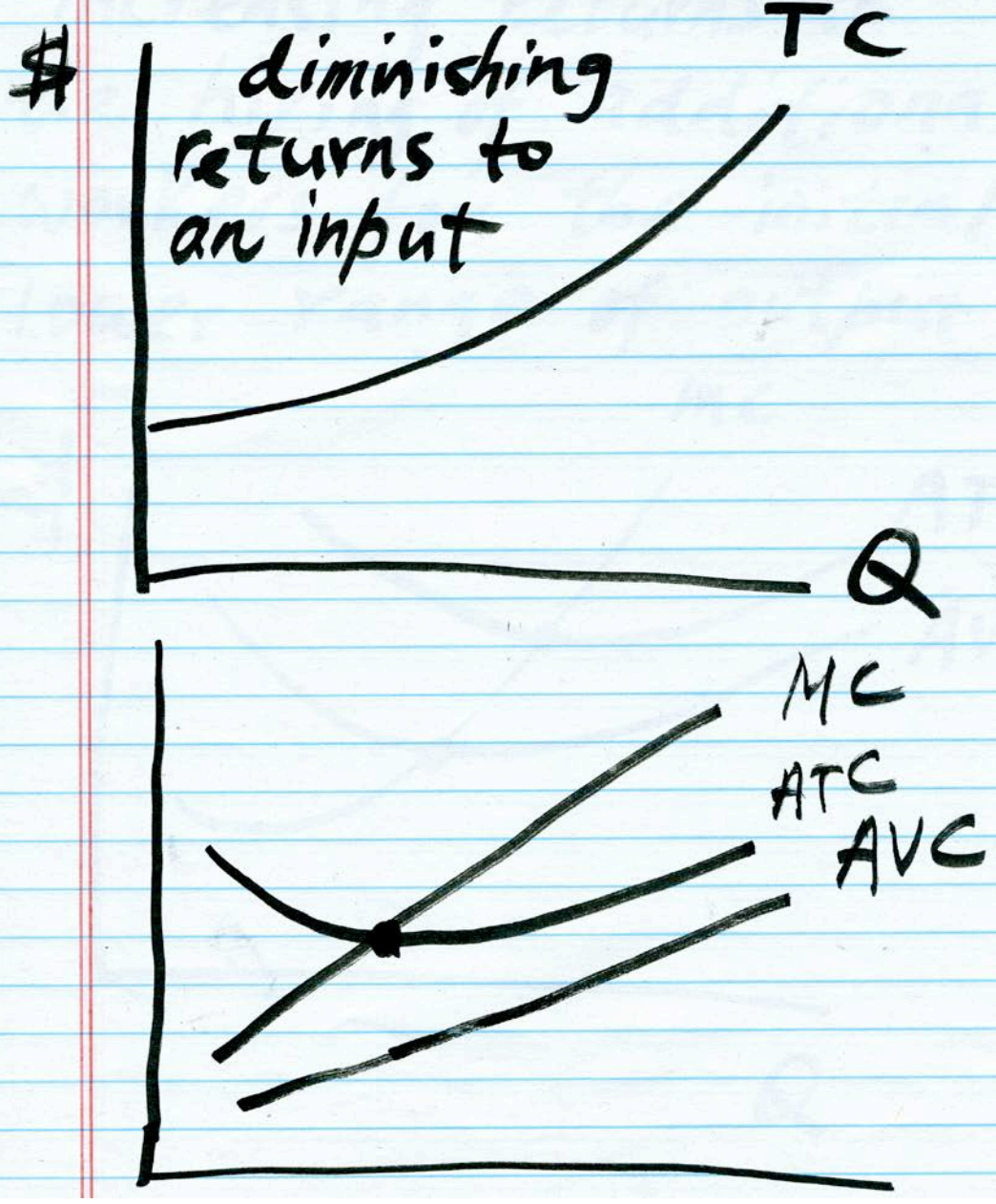



Cost
MC
ATC
AVC
Q

Not Required for Exams

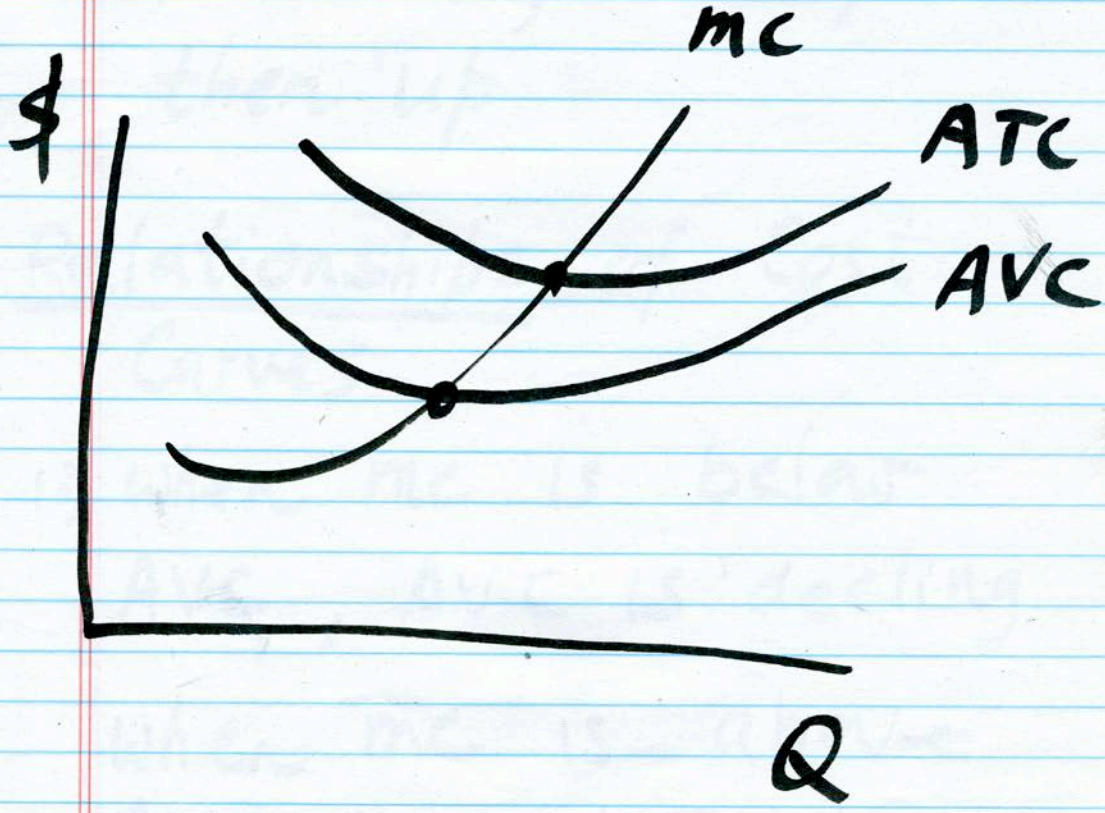


Simplified Case



Realistic Case

Increasing returns to the hiring of additional workers for the initial, lower range of output



- AVC is U-shaped not st. line upward
- there is a declining portion of mc, then up

Relationships of Cost Curves

1) when mc is below AVC, AVC is decling

when mc is above AVC, AUC is rising

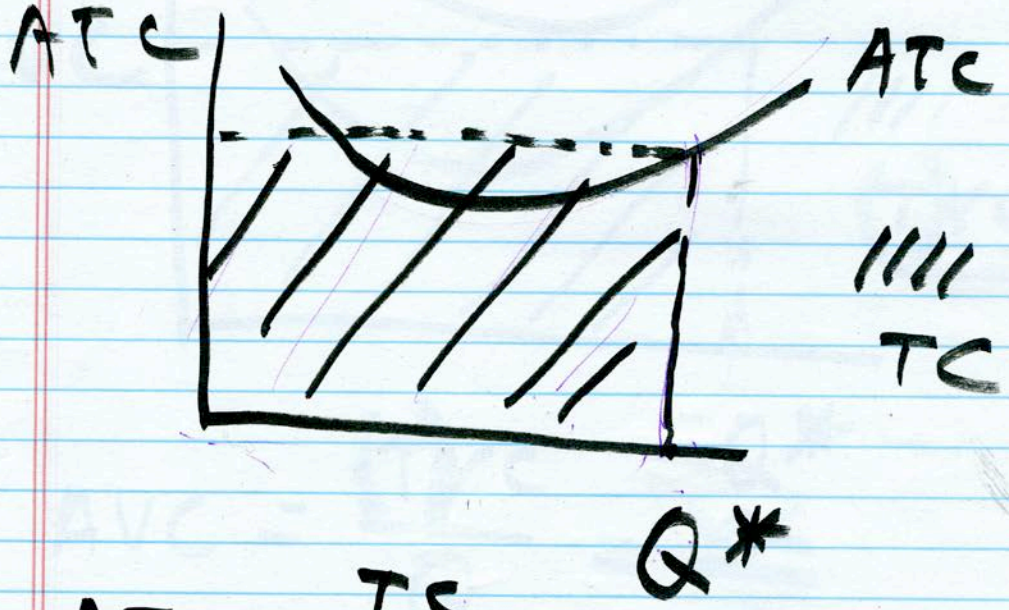
2. When MC is below ATC, ATC is declining; when MC is above ATC, ATC is rising

3. MC crosses AVC and ATC at their respective minimum points

4. Distance between ATC and AVC is AFC

Uses of Cost Curves

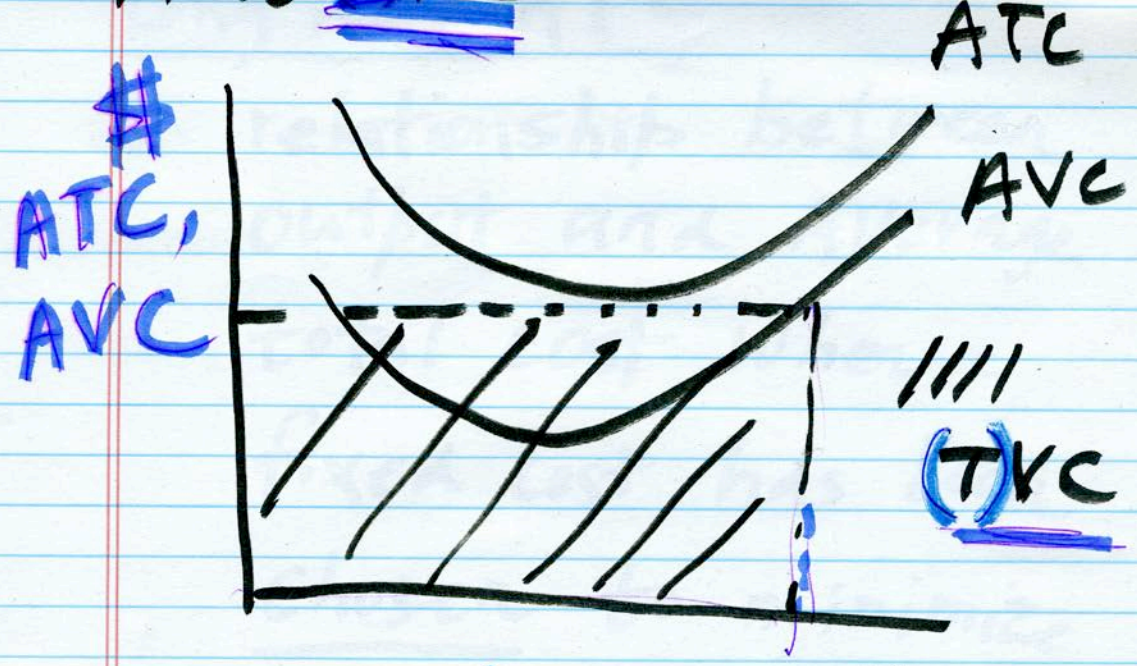
Find Total Cost at Q^*



$$ATC = \frac{TC}{Q}$$

$$ATC \times Q = TC$$

Find (T)VC at Q*



$$AVC = \frac{(T)VC}{Q} = \frac{VC}{Q}$$

$$Q \times AVC = (T)VC = VC$$