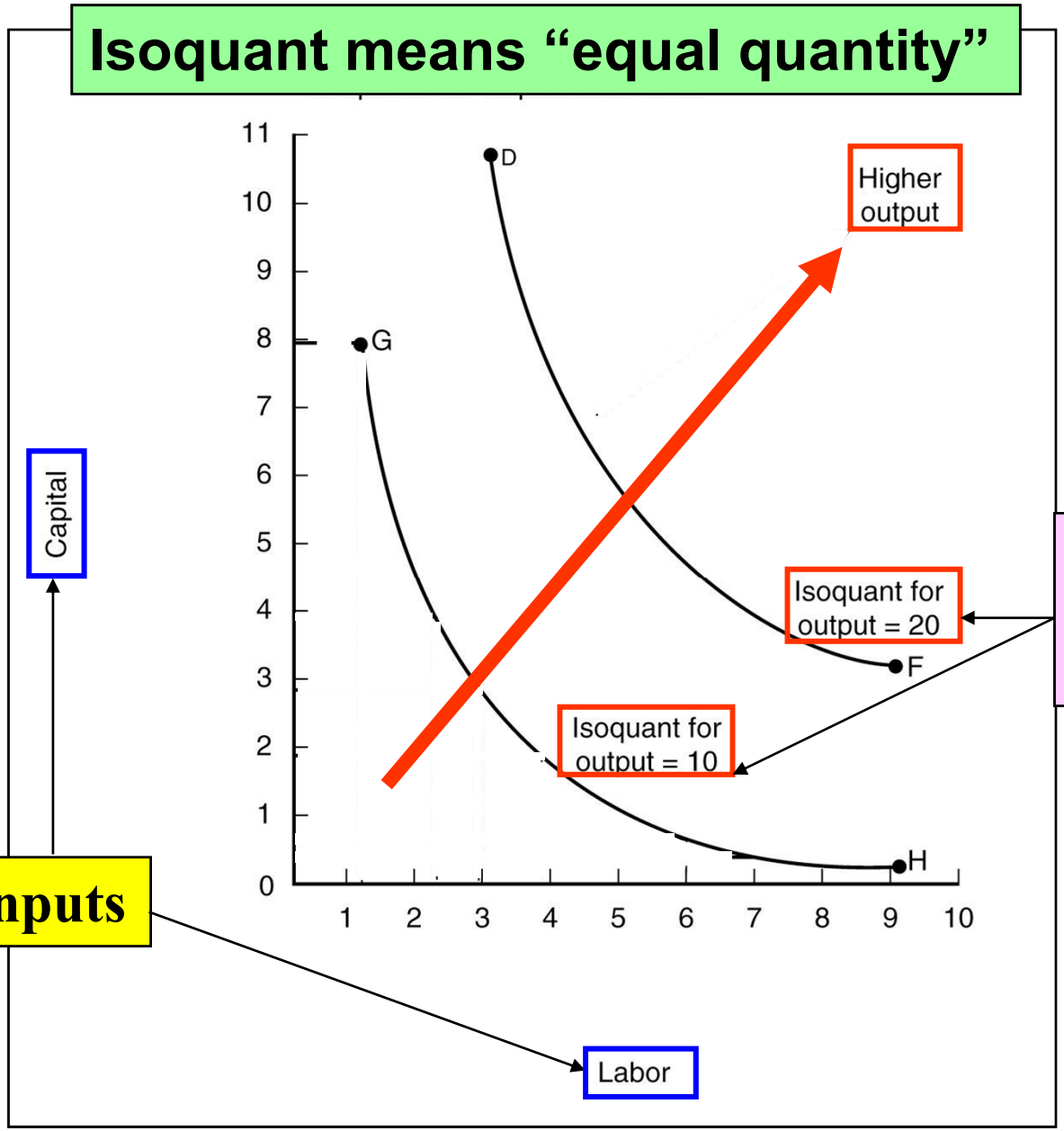
Multiple Input Cost Relationships

Isoquant means “equal quantity”



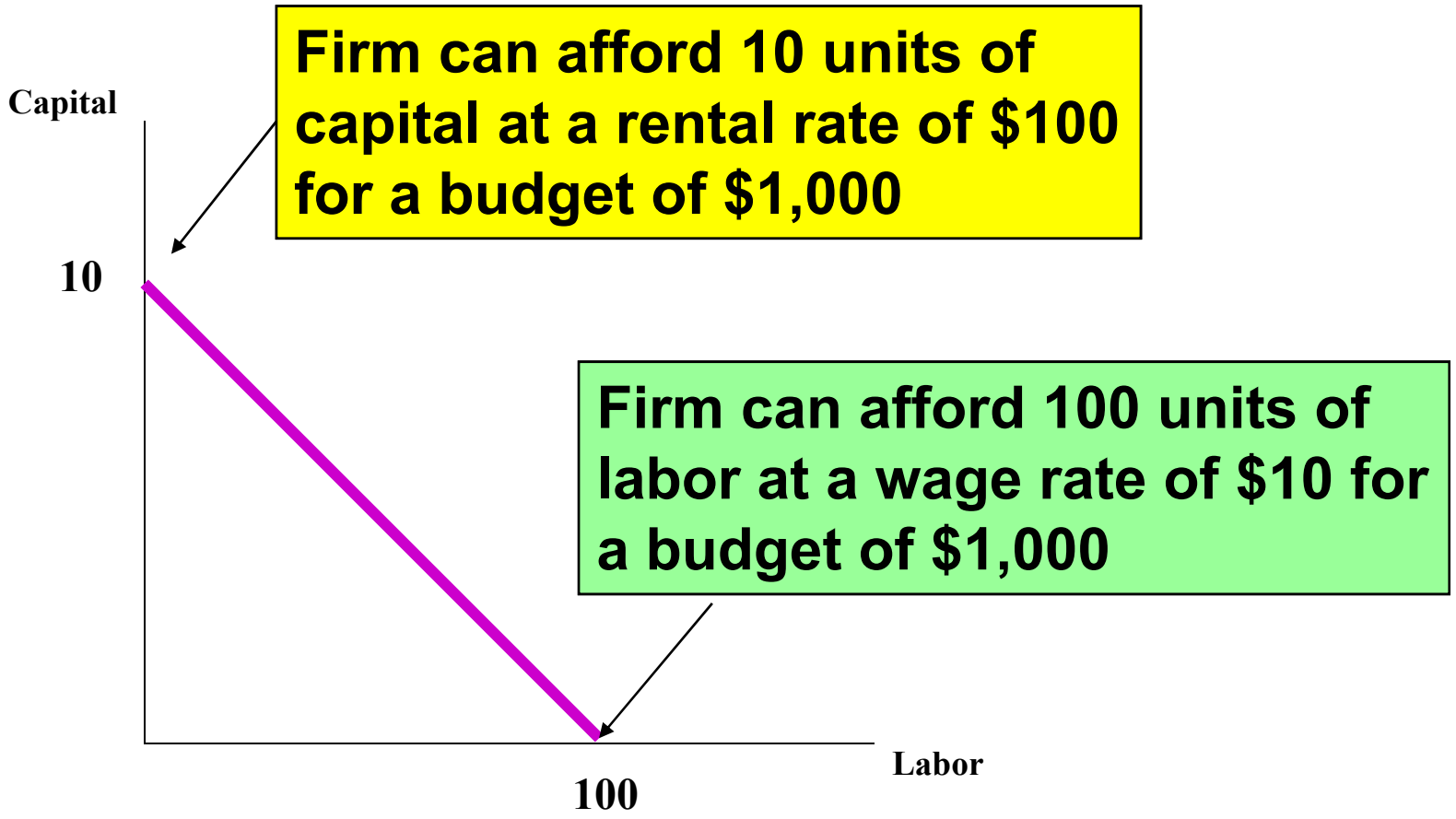
Slope of an Isoquant

The slope of an isoquant is referred to as the Marginal Rate of Technical Substitution, or MRTS. The value of the MRTS in our example is given by:

$$MRTS = \Delta Capital \div \Delta labor$$

If output remains unchanged along an isoquant, the loss in output from decreasing labor must be identical to the gain in output from adding capital.

Plotting the Iso-Cost Line



Slope of an Iso-cost Line

The slope of an iso-cost in our example is given by:

Slope = - (wage rate ÷ rental rate)

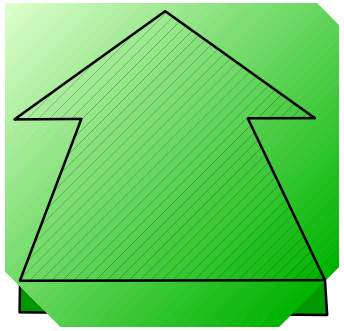
or the negative of the ratio of the price of the two Inputs. The slope is based upon the budget constraint and can be obtained from the following equation:

($10 × use of labor)+($100 × use of capital)

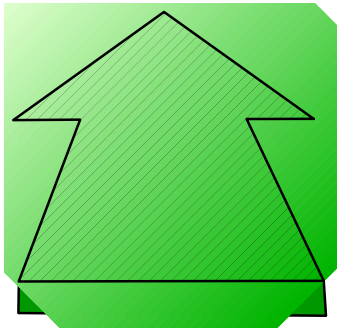
Least Cost Decision Rule

The least cost combination of two inputs (labor and capital in our example) occurs where the slope of the iso-cost line is *tangent* to isoquant:

$$MPP_{LABOR} \div MPP_{CAPITAL} = -(\text{wage rate} \div \text{rental rate})$$



Slope of an isoquant

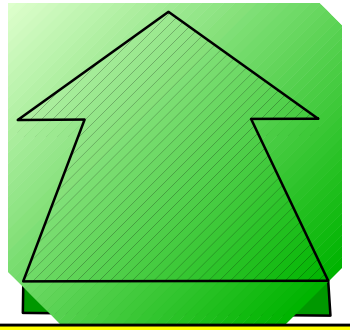


Slope of iso-cost line

Least Cost Decision Rule

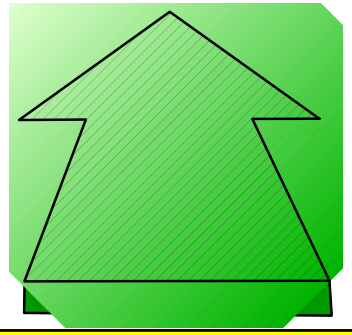
The least cost combination of labor and capital in out example also occurs where:

$$MPP_{LABOR} \div \text{wage rate} = MPP_{CAPITAL} \div \text{rental rate}$$



MPP per dollar spent on labor

=

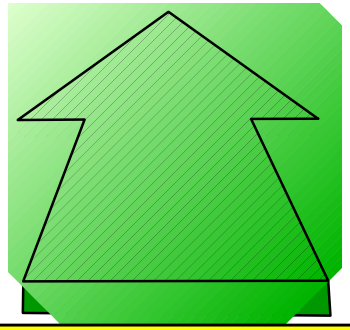


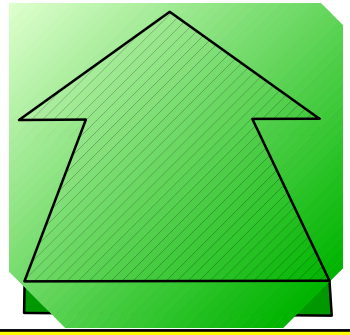
MPP per dollar spent on capital

Least Cost Decision Rule

This decision rule holds for a larger number of inputs as well…

$MPP_{LABOR} \div \text{wage rate} = MPP_{CAPITAL} \div \text{rental rate}$

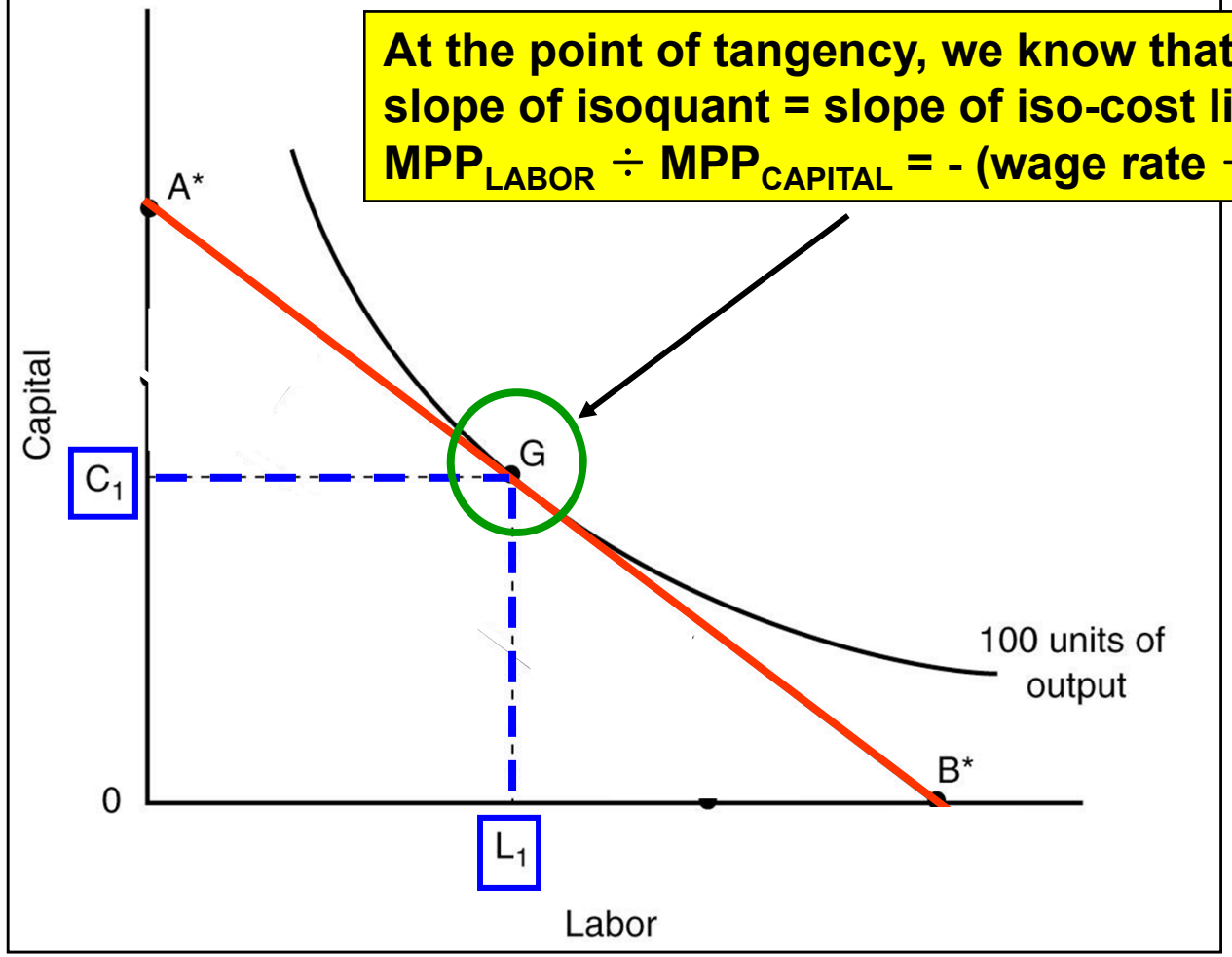




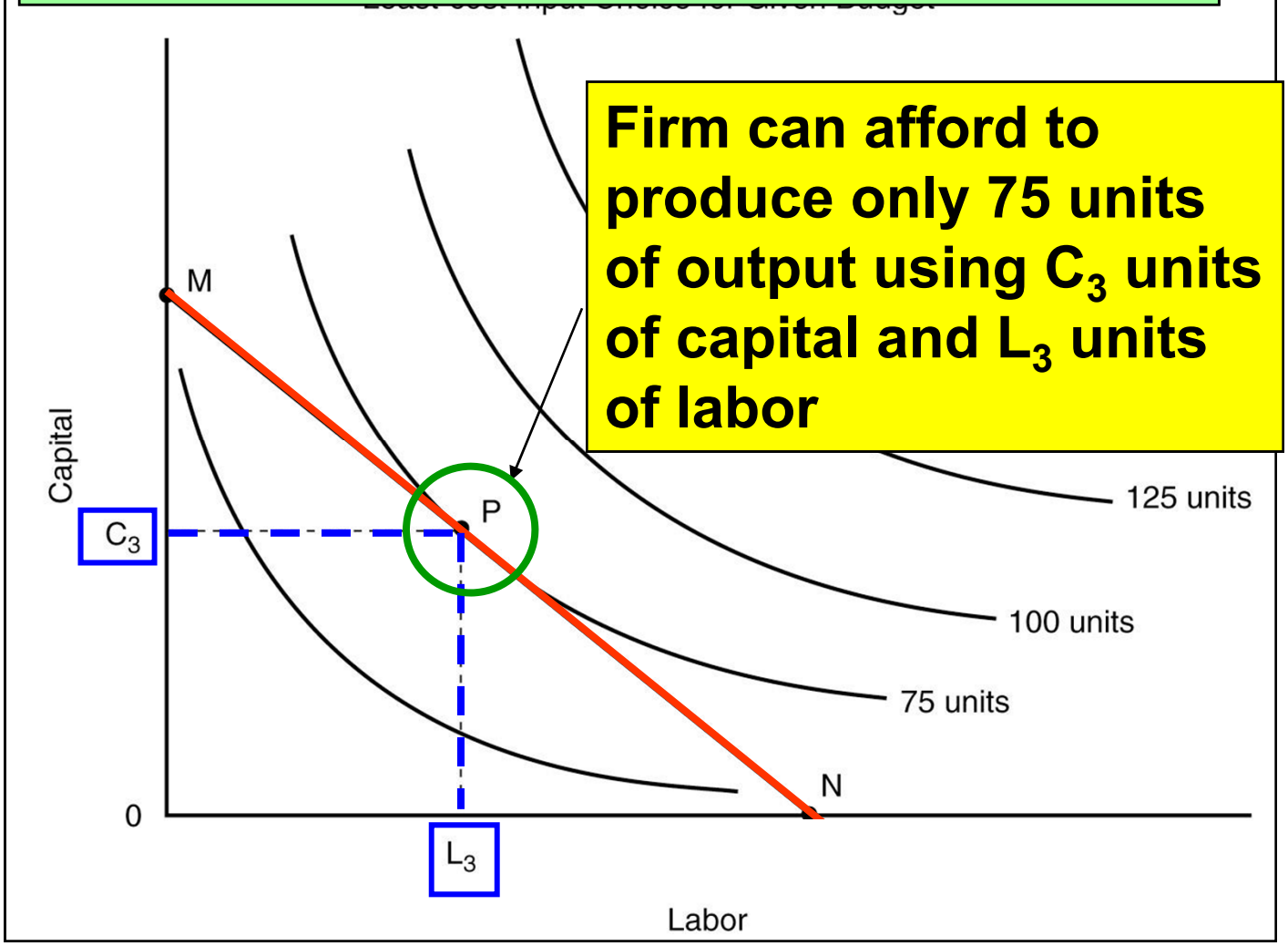
MPP per dollar spent on labor = **MPP per dollar spent on capital**

Least Cost Input Choice for 100 Units

At the point of tangency, we know that:
slope of isoquant = slope of iso-cost line, or…
$MPP_{LABOR} \div MPP_{CAPITAL}$ = - (wage rate ÷ rental rate)



What Inputs to Use for a Specific Budget?



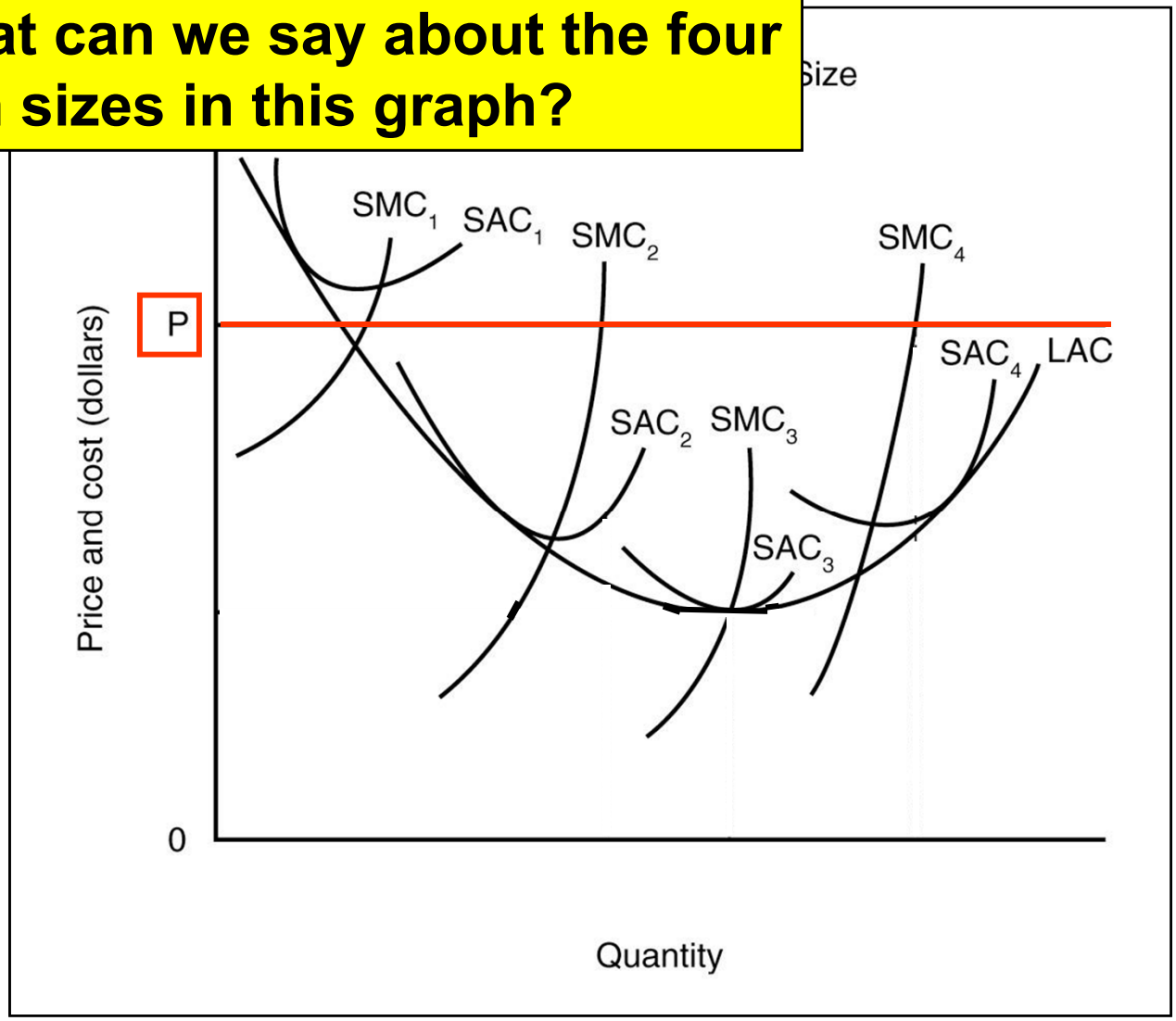
The Planning Curve

The long run average cost (LAC) curve reflects points of tangency with a series of short run average total cost (SAC) curves. The point on the LAC where the following holds is the *long run equilibrium* position (Q_{LR}) of the firm:

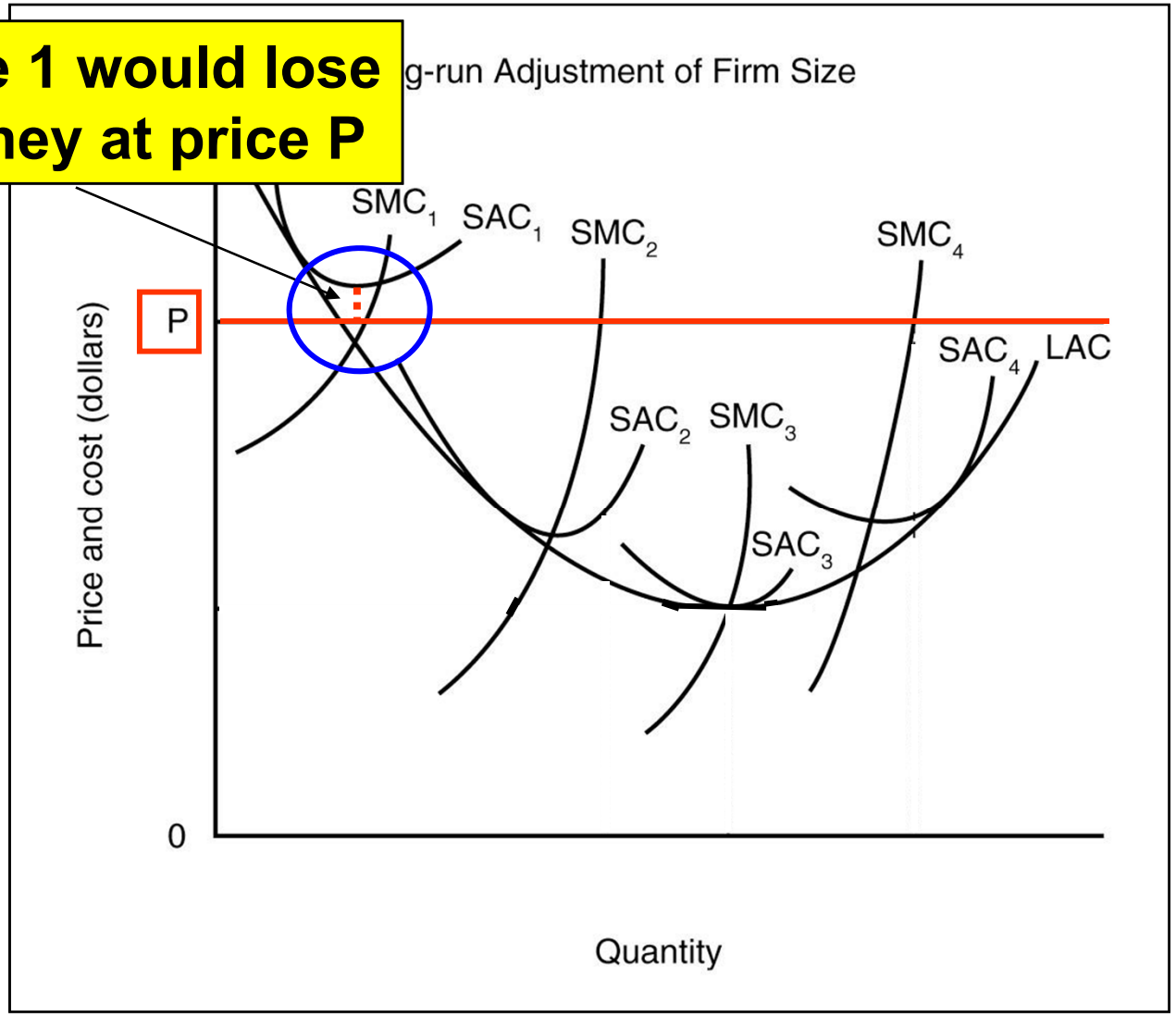
$$SAC = LAC = P_{LR}$$

where MC represents marginal cost and P_{LR} represents the long run price, respectively.

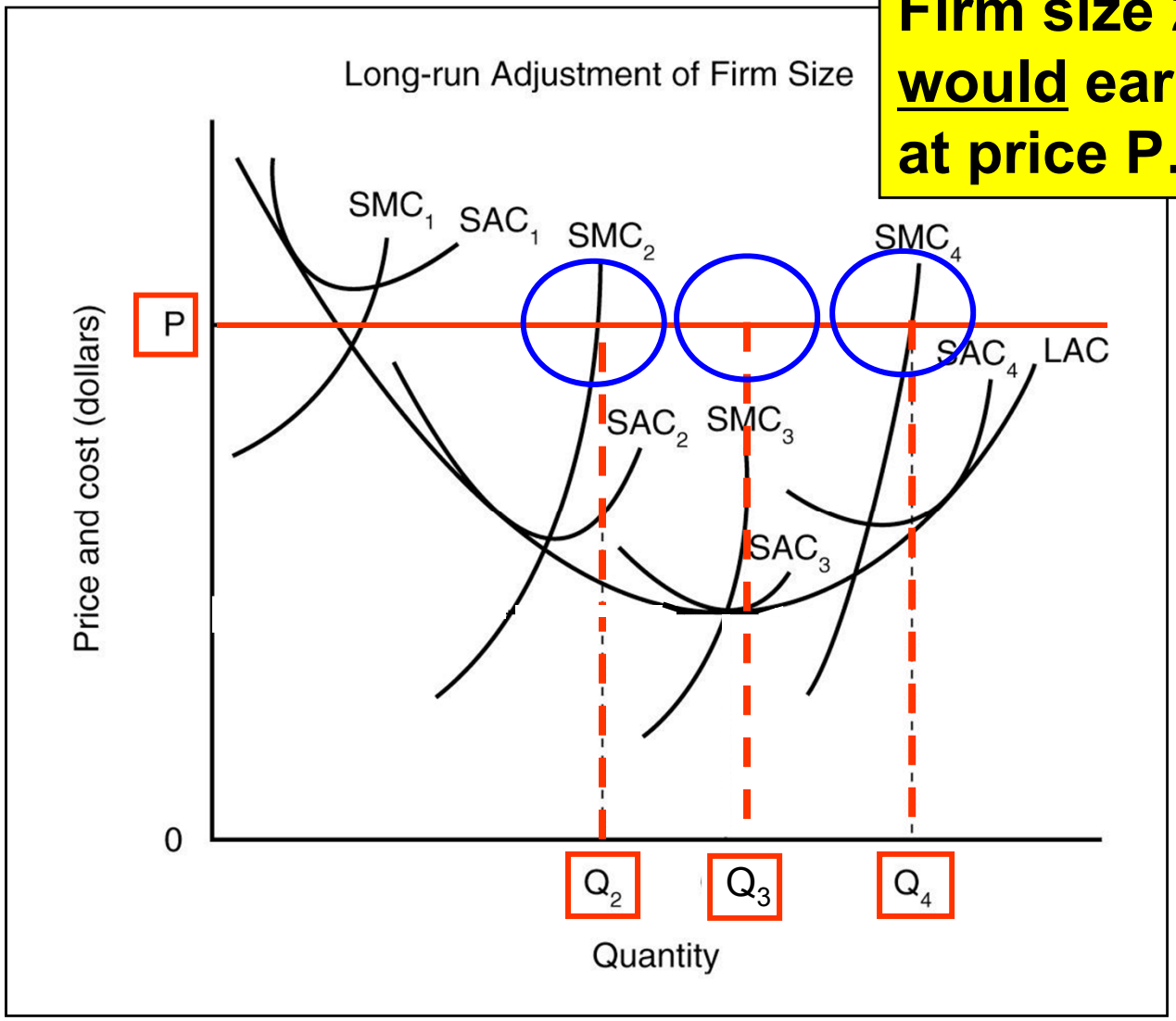
What can we say about the four firm sizes in this graph?



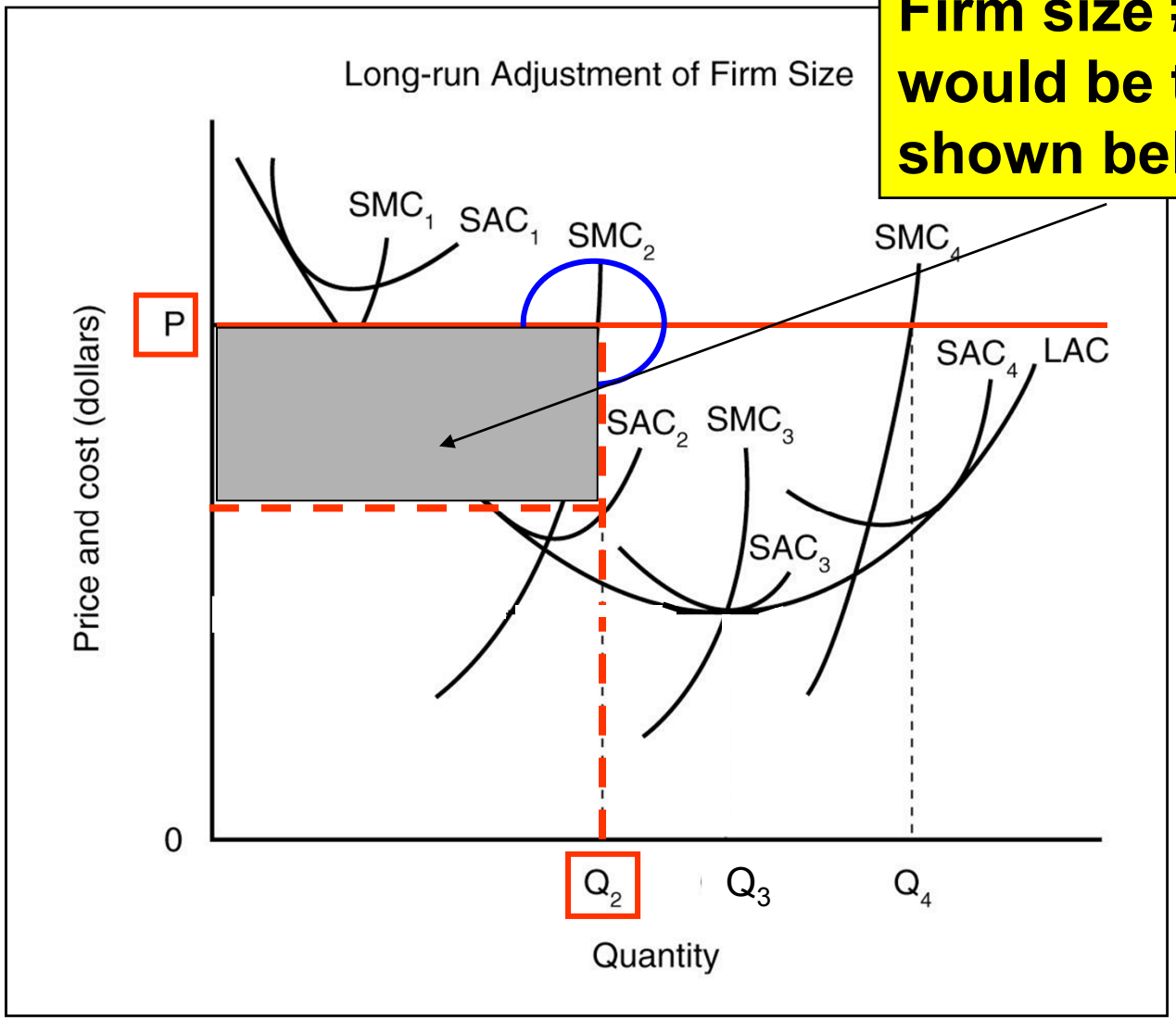
Size 1 would lose money at price P



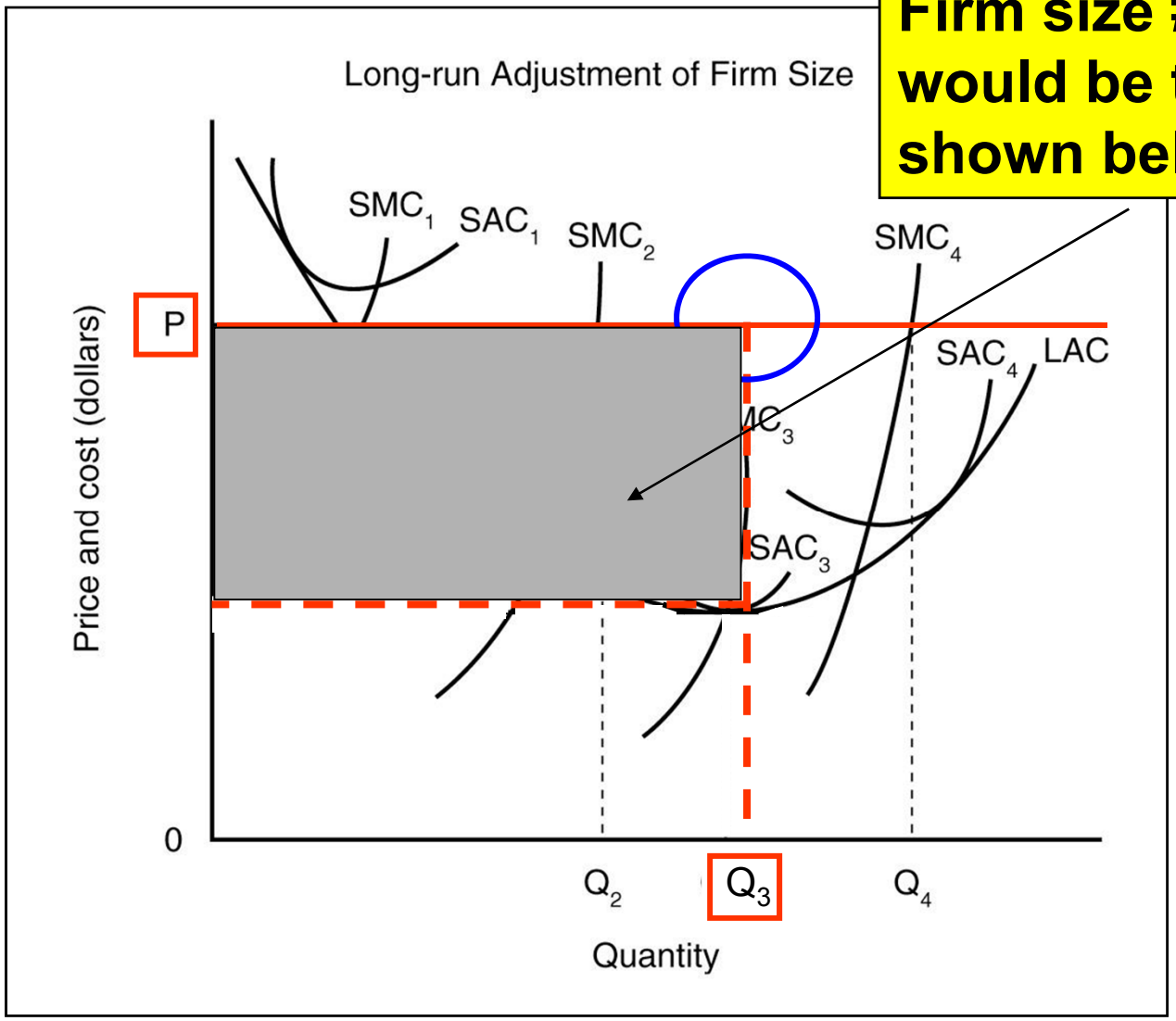
Firm size 2, 3 and 4 <u>would</u> earn a profit at price P….



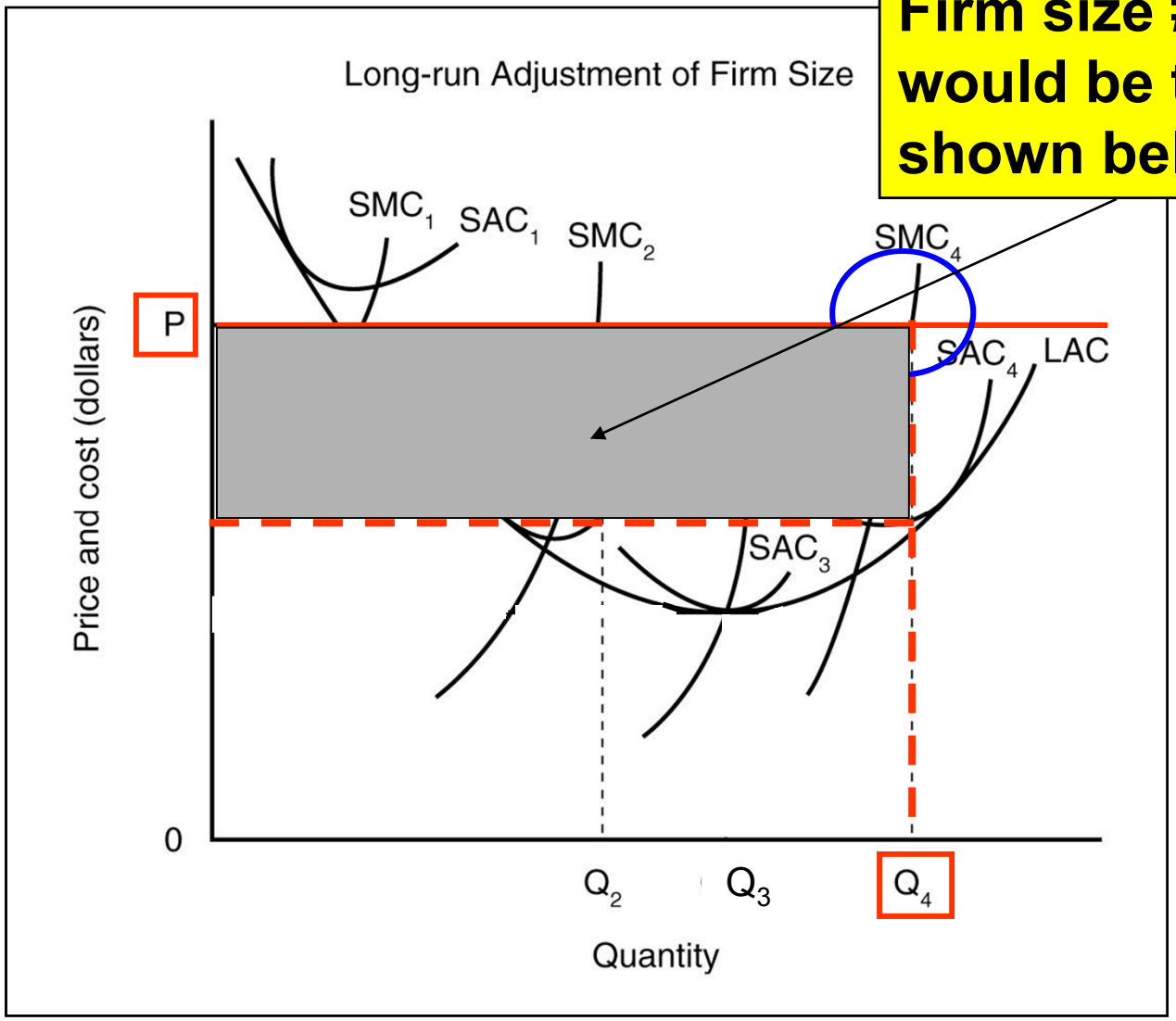
Firm size #2's profit would be the area shown below…

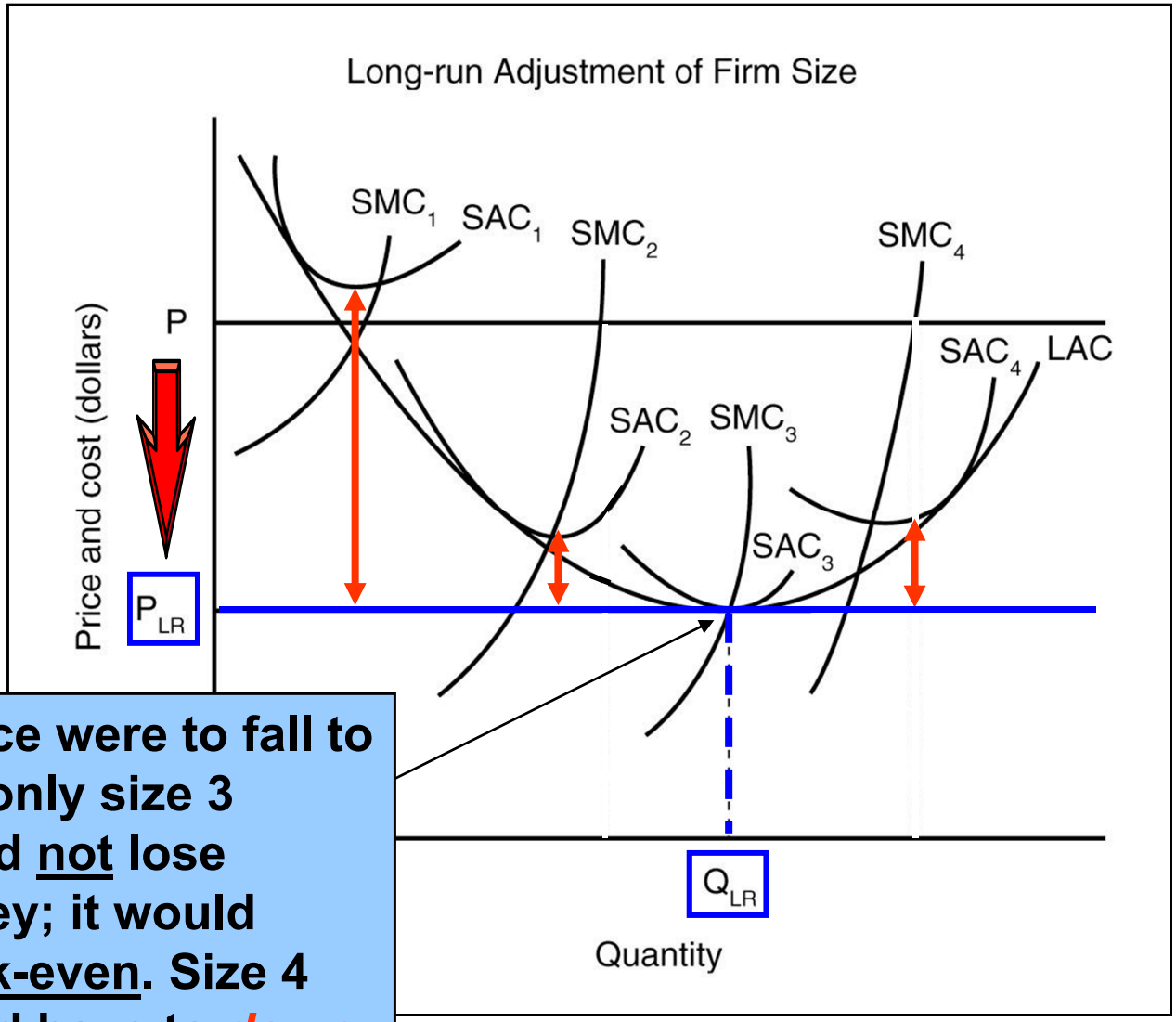


Firm size #3's profit would be the area shown below…



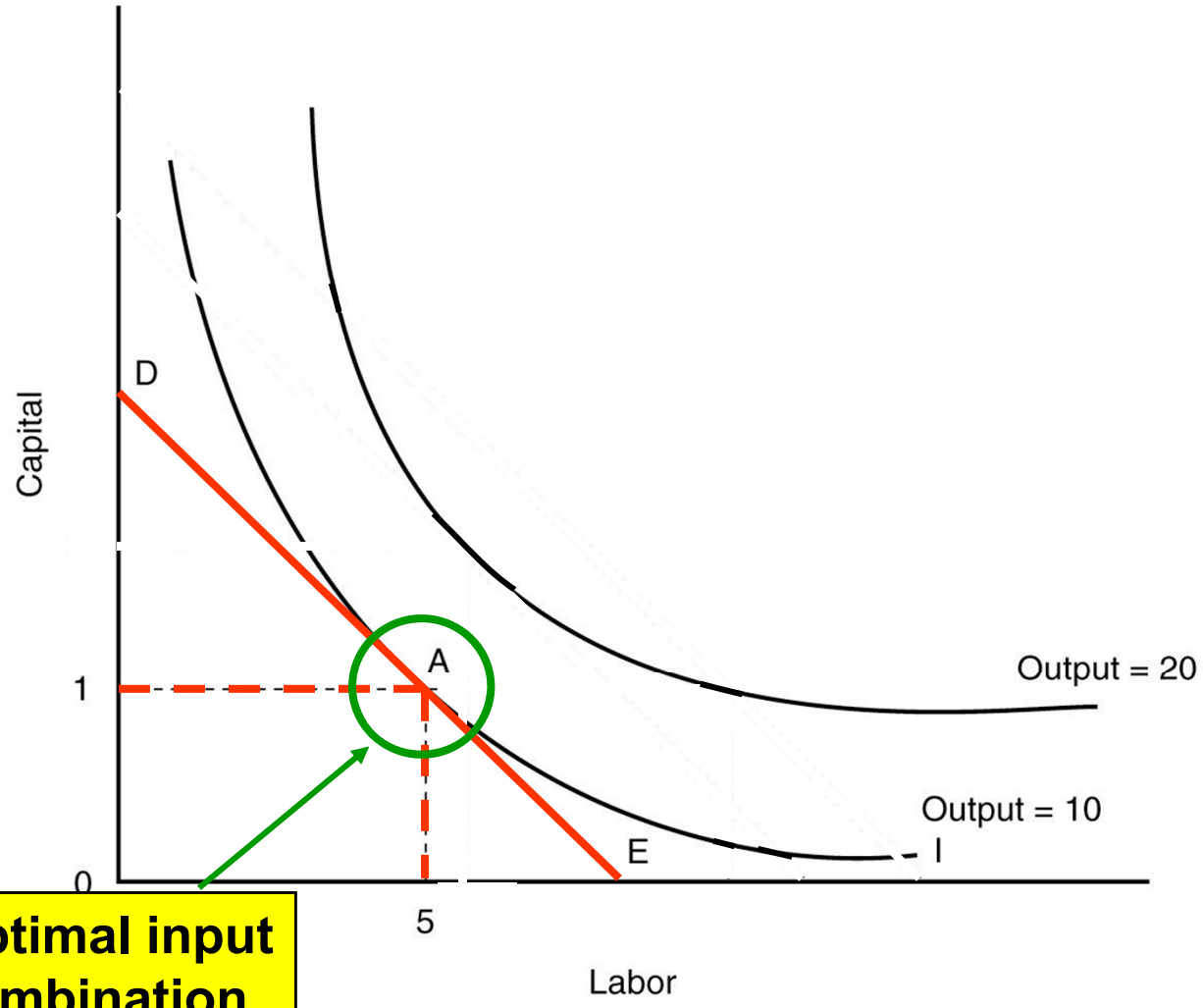
Firm size #4's profit would be the area shown below…





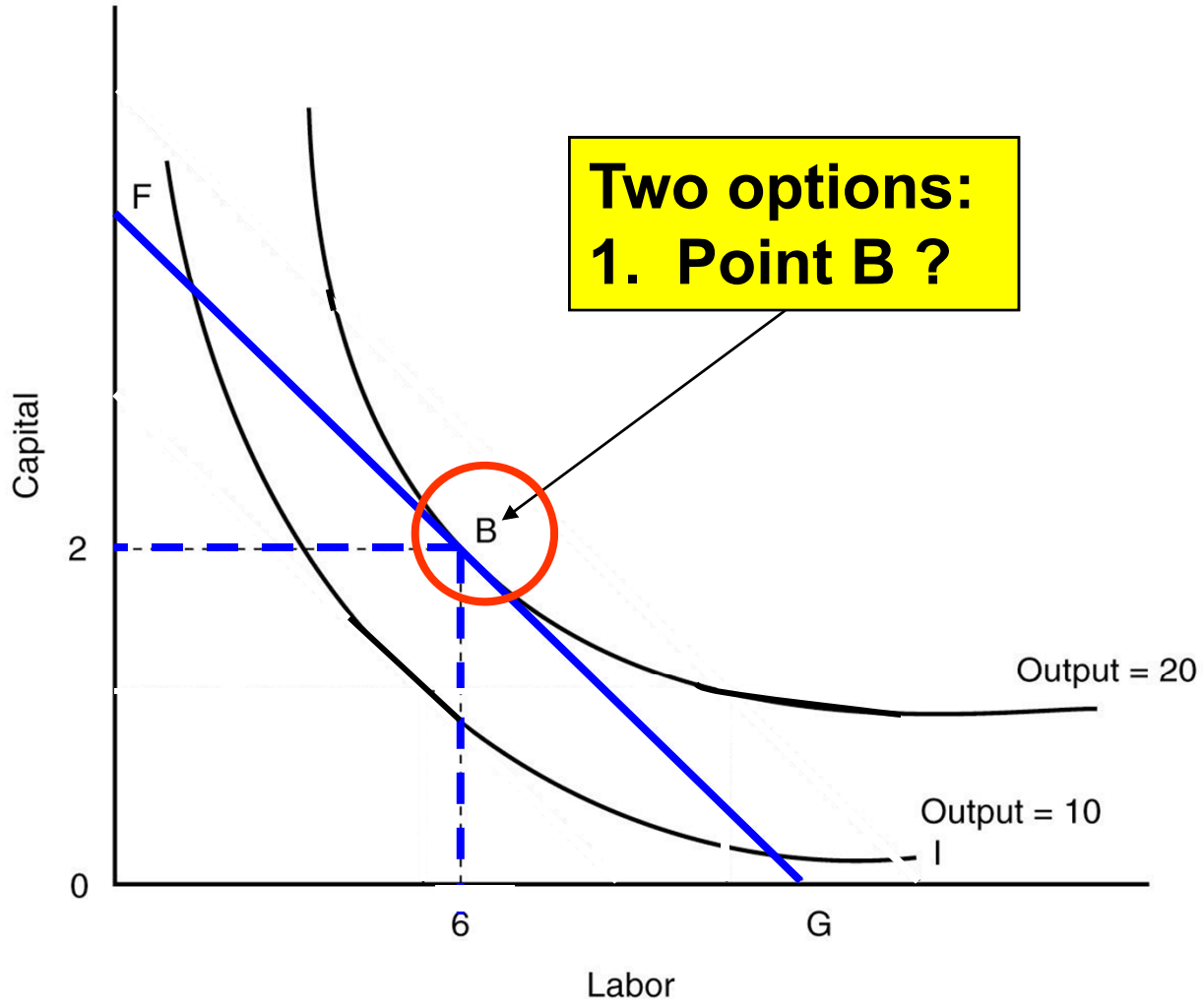
If price were to fall to P_{LR}, only size 3 would <u>not</u> lose money; it would <u>break-even</u>. Size 4 would have to *down size* its operations!

How to Expand Firm's Capacity

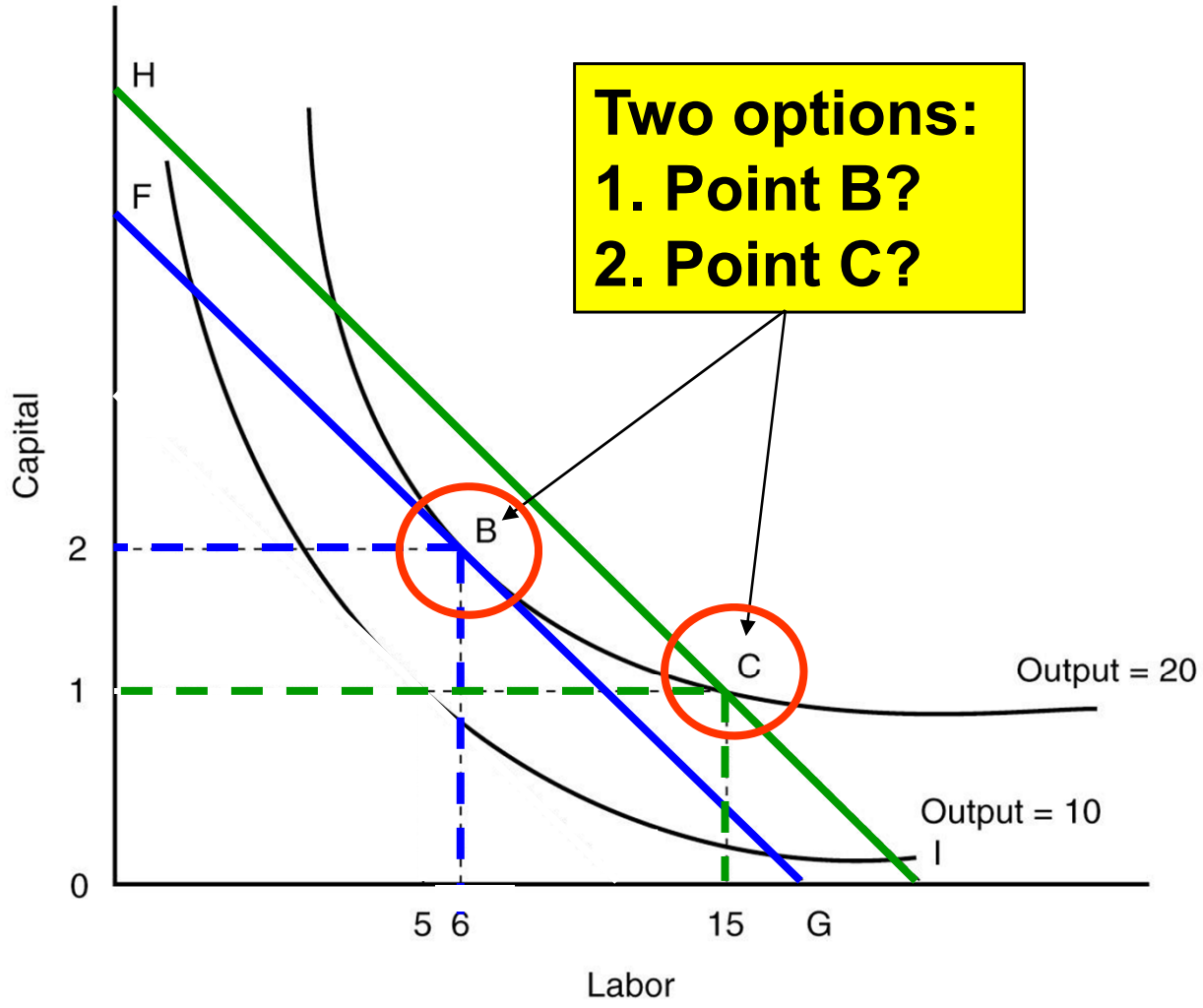


Optimal input combination for output=10

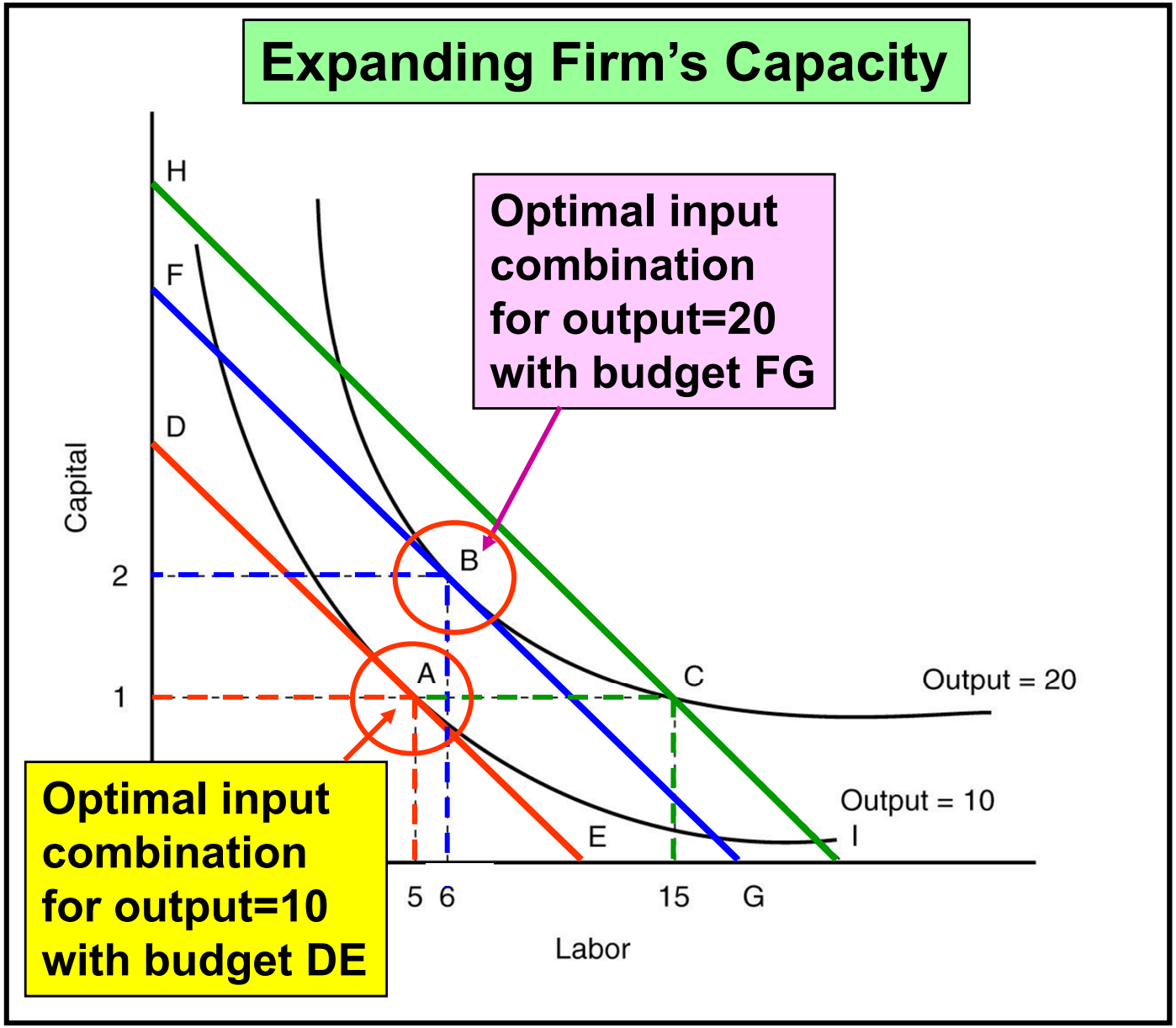
How to Expand Firm's Capacity



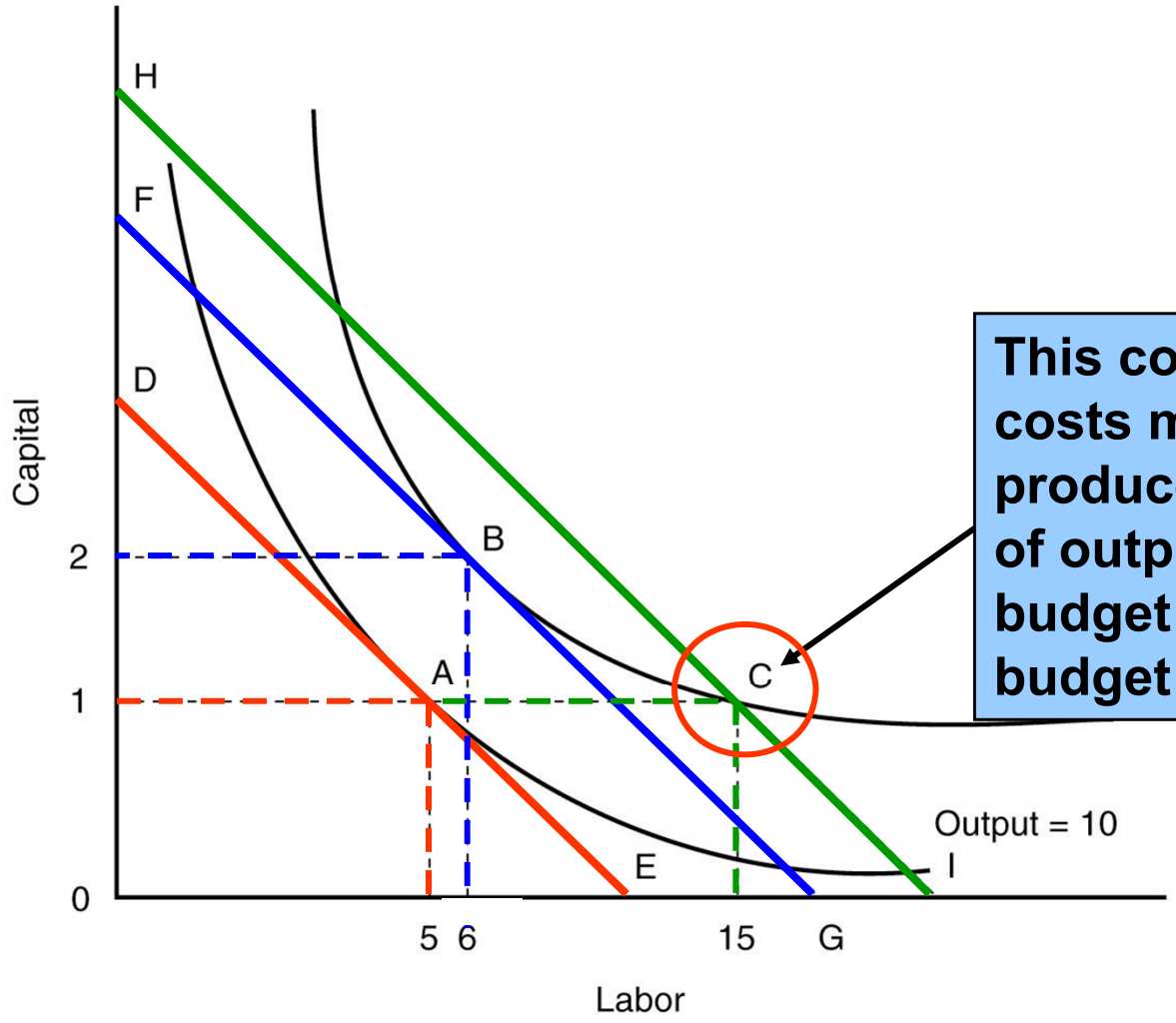
How to Expand Firm's Capacity



Expanding Firm's Capacity



Expanding Firm's Capacity



This combination costs more to produce 20 units of output since budget HI exceeds budget FG