Total, Average and Marginal Products

• The Total Product Curve shows the maximum output attainable from a given amount of a fixed input (capital) as the amount of the variable input (labor) is changed
Total, Average, and Marginal Products

Stage I  Stage II  Stage III

Total product

Units of variable input

Average and marginal product

Units of variable input

MP  AP
Total, Average and Marginal Products

• The Average Product of an input is the Total Product divided by the total amount of the variable input used to produce it.
Total, Average and Marginal Products

• The Marginal Product of an input shows the increase in total output from a one unit increase in the amount of the variable input.
# TP, AP & MP Numerical Example

<table>
<thead>
<tr>
<th>Quantity of Labor</th>
<th>Total Product</th>
<th>Average Product</th>
<th>Marginal Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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<td>0</td>
<td></td>
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<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
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</tr>
<tr>
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<td>62</td>
<td>12.4</td>
<td>2</td>
</tr>
</tbody>
</table>
TP, AP & MP Graphical Example

Points to Note:

• When AP is rising it is always less than MP and when it is falling it is always greater than MP. MP = AP when AP is at its max.

• MP = 0 when TP reaches its max and AP = 0 when TP = 0
Law of Diminishing Returns

• The law of diminishing returns states that as a firm uses more of a variable input without changing the quantity of fixed inputs, the MP of the variable input will eventually decline.

• Why? Because the productivity of additional units of the variable input (Labor) is limited by the lack of the fixed input (machines). This is the reason for the shapes of the TP, AP & MP curves.
Law of Diminishing MP

- For example: Consider a factory with 10 jean machines. Suppose one machine can be used by one worker. The first ten workers can each have a machine. The next few can carry raw materials for those on the machines. However eventually you get to a point where additional workers are just standing around getting in each others way. Eventually the MP of each additional hour worked will decline due to the bottleneck in the number of machines.
- The law of diminishing MP is the reason why TP, AP and MP curves rise reach a max and then fall.