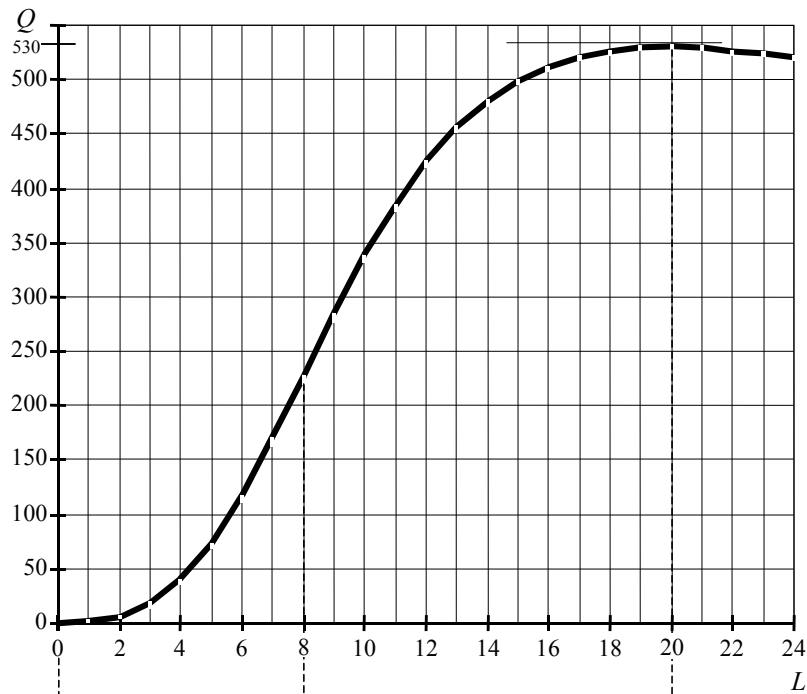


## Returns in the Short Run Production Function



L	Q
0	0
1	1
2	6
3	18
4	40
5	74
6	118
7	171
8	228
9	285
10	338
11	385
12	425
13	456
14	481
15	499
16	512
17	521
18	526
19	529
20	530
21	529
22	527
23	525
24	521

INCREASING RETURNS	DIMINISHING RETURNS	NEGATIVE RETURNS
“Hill” is getting steeper.	Still going up but it's getting less steep.	Going downhill.
Rising at a rising rate.	Rising at a falling rate	Falling (decreasing)
Vertical distance of each step forward is greater than the one before.	Vertical distance of each step forward is less than the one before.	Vertical distance of each step forward is negative.
Marginal product is increasing.	Marginal product is decreasing.	Marginal product is negative.

Total product - total output produced in a certain time period.

Marginal Product - change in output resulting from the use of one unit more (or less) of labor.

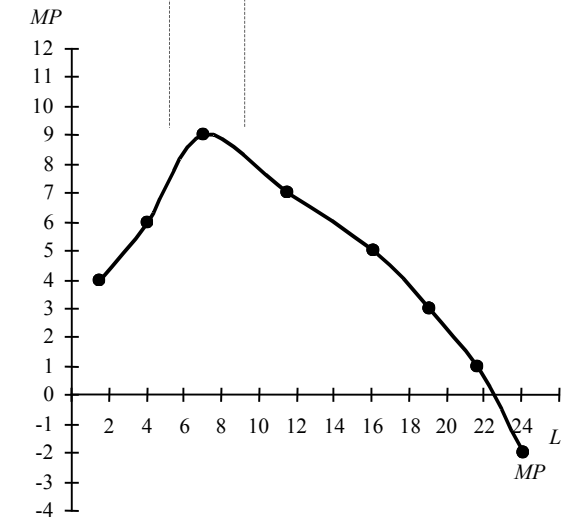
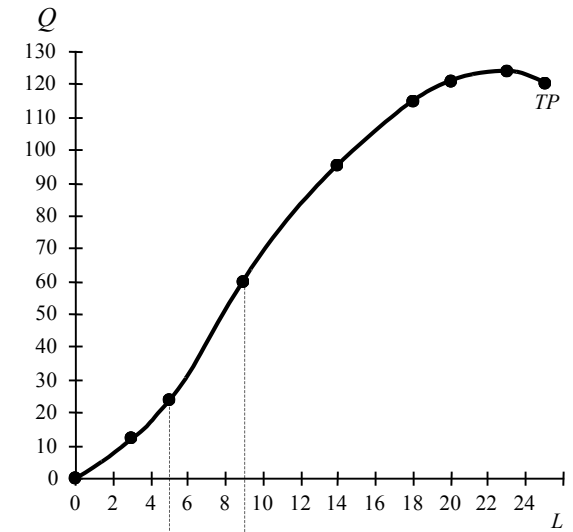
Example: add one more worker in a hour (e.g. increase from 10 to 11 workers in table above). If production rises by 47 units (from 338 to 385), then  $MP = 47$ .

Note: we cannot say that this worker added 47 to output - but instead that 47 was added to output when one more worker was brought in to work with the existing 10.

$$MP = \left( \frac{\Delta Q}{\Delta L} \right)$$

**Marginal product**  
(for irregular jumps in labor)

L	Q	MP
0	0	
3	12	>
5	24	>
9	60	>
14	95	>
18	115	>
20	121	>
23	124	>
25	120	>



### FORCES DETERMINING THE PATTERN OF MARGINAL PRODUCTS

Division of Labor - adding another unit of labor allows the workers to divide tasks so that each worker can specialize more. It tends to make the marginal product of labor rise.

Declining Factor Proportions - adding another unit of labor means each unit of labor has a smaller proportion of capital to work with. It tends to make the marginal product of labor fall.