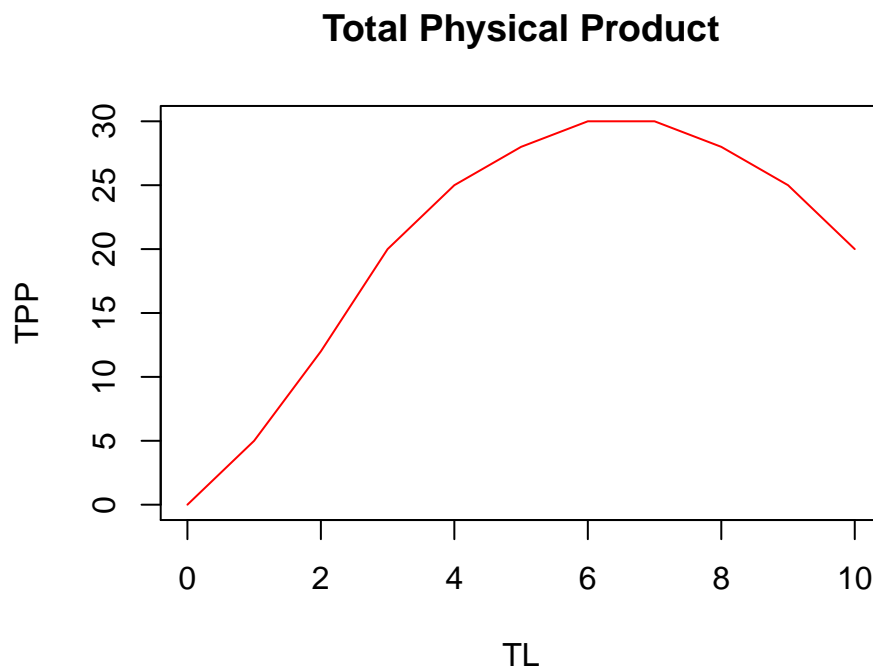# Questions on Calculus

Rob Hayward

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1. This is the total physical product curve from last week. How would you calculate the *average physical product*?

   This would be any line between the origin and the TPP curve, and it is $\frac{TPP}{Q}$.

Total Physical Product

2. How would you calculate the *marginal physical product*?

This is the gradient of the TPP, which would be $\frac{\Delta TPP}{\Delta Q}$

3. What are the drivatives of

- $y = 2 + 6x$

  $y' = 6$

- $y = 5 - 4x + 2x^3$

  $y' = -4 + 6x^2$

- $y = 25 + 6x^2 - 3x^3 + 25x^4$

  $y' = 12x - 9x^2 + 100x^3$

- $y - 3 = 2x$

  $y' = 2$

- $TPP = 24 + 5Q + 2Q^2 - Q^3$

  $TPP' = 5 + 4Q - 3Q^2$

- What does your answer to the prevous question tell you about the shape of the Total Physical Product Curve?

  It goes up initially but starts rise at a slower pace. There are diminishing returns.

  Differentiate

- $TPP = 15 + 15Q + Q^2 - Q^3$

  $TPP' = 15 + 2Q - 3Q^2$

- $TU = 25 + X_1 - X_1^2$

  $TU' = 1 - 2X_1$

- $TU = 25 + 25X_1 - 2X_1^2$

  $TU' = 25 - 4X_1$

- What does your answer to the previous question tell you about the shape of the Total Utility Curve?

  It shows that the utiity function is concave. There are diminishing returns.

4. What is the gradient of the TPP at its peak?

   Zero

5. What is the value of the MPP when TPP is at its peak?

   Zero

6. Given the $TPP = 100 + 32Q + 10Q^2 - Q^3$,

   - What is the TPP' or MPP?

     $MPP = 32 + 20Q - 3Q^2$

   - How would you find the maximum TPP?

     Find the value of Q for which the derivative or the MPP is zero.

7. Given the $TPP = 500 + 180Q + 30Q^2 - 2Q^3$,

   - What is the TPP' or MPP?

     $MPP = 180 + 60Q - 6Q^2$

   - How would you find the maximum TPP?

     $180 + 60Q - 6Q^2 = 0$

     $6Q^2 - 60Q - 180 = 0$

Sorry!!! I made a mistake. You cannot get beyond this with the usual factorisation. The maximum is not a whole number. My mistake.

8. Given the $TU = 25X - 0.5X^2$

- What is the drivative of TU?

  $TU = 25 - X$

- What can we say about the utility of X?

  There are diminishing returns.