Given:

- **cost per unit**: \( c = \$6 \) per unit, cost to producer
- **Demand Relation**: \( q = 100 - 2p \),
  - sometimes written \( D(p) = 100 - 2p \). Note, as the price per unit increases, the demand decreases.
- **production level**: \( q \),
  - assume that the number of units sold is the same as the number of units produced.
- **price per unit**: \( p \), selling price
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Marginal Analysis

example

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Find:

- \( C(q) \), Cost function
- \( R(q) \), Revenue function
- \( P(q) \), Profit function
- \( q_{\text{max}} \) production level to maximize profit
- \( p_{\text{max}} \) the price to charge for each unit to maximize profit
- maximum profit \( P_{\text{max}} \)
- \( C_{\text{avg}} = \frac{C(q)}{q} \) Average Cost function
- break even point(s), set \( P(q) = 0 \) and solve for \( q \)
Find:

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Marginal Analysis
example part 1

Find:

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There are two standard ways to approach the problem of finding $q_{\text{max}}$

1st solve $\text{MR} = \text{MC}$ i.e. set $R'(q) = C'(q)$ and solve for $q_{\text{max}}$. Using this method you never need to actually find the profit function. Sometimes this is useful.

2nd solve $\text{MP} = 0$, i.e. set $P'(q) = 0$ and solve for $q_{\text{max}}$. Here you must first find the profit function and it's derivative.

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Cost Function:

- \( \text{cost} = \text{fixed cost} + \text{variable cost} \)
- for this problem assume fixed cost is zero.
- variable cost = cost per unit times number of units
- \( C(q) = 6q \), Cost Function
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**Marginal Analysis**

**Revenue Function**

- Revenue = (income from each unit sold) • (number units sold)
- \( R(q, p) = p \cdot q \)
  - This is a function of both \( q \) and \( p \). Need Revenue as a function of \( q \) only.

- Use the demand relation to convert \( p \) to a function of \( q \),
- Demand Relation: \( q = 100 - 2p \)
- solve for \( p \) as a function of \( q \)

\[
q = 100 - 2p \\
2p = 100 - q \\
p = 50 - \frac{1}{2} \cdot q
\]

- This gives the demand relation in the form \( D(q) = 50 - \frac{1}{2} \cdot q \)

- \( R(q) = (50 - \frac{1}{2} q)q = 50q - \frac{1}{2} q^2 \), Revenue Function
Marginal Analysis
Revenue Function

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Profit:

- \( P(q) = R(q) - C(q) \)
- \( P(q) = (50q - \frac{1}{2}q^2) - (6q) \)
- \( P(q) = 44q - \frac{1}{2}q^2 \)

Profit Function: \( P(q) = 44q - \frac{1}{2}q^2 \)
Marginal Analysis
Profit Function

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**Profit Function:** \( P(q) = 44q - \frac{1}{2}q^2 \)
To find \( q_{\text{max}} \) set \( P' = 0 \) and solve for \( q \)

- \( P(q) = 44q - \frac{1}{2}q^2 \)
- solve \( MP = 0 \)
- solve \( P' = 44 - q = 0 \)
- gives \( q_{\text{max}} = 44 \) units. This is the quantity that must be made and sold to maximize profit.
- use the demand relation to find \( p_{\text{max}} \). (any form will do).
- \( p_{\text{max}} = 50 - \frac{1}{2} \cdot 44 = $28 \) per unit. This is what you should charge for each item to maximize the profit.
- Maximum profit
  \[ P_{\text{max}} = P(q_{\text{max}}) = P(28) = 44(28) - \frac{1}{2}(28)^2 = $968.00 \]
To find $q_{\text{max}}$ set $P' = 0$ and solve for $q$

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- $p_{\text{max}} = 50 - \frac{1}{2} \cdot 44 = $28 per unit. This is what you should charge for each item to maximize the profit.

- Maximum profit
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To find $q_{\text{max}}$ set $P' = 0$ and solve for $q$

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