



# B.E. International Program

Faculty of Economics, Thammasat University



## EE 320 Introductory Mathematical Economics

### In-Class Exercise 1

Given the total cost function

$$C(Q) = Q^2 - 24Q + 213$$

1. Find the average cost (MC) and marginal cost (MC) functions.

$$AC(Q) = Q - 24$$

$$MC(Q) = 2Q - 24$$

2. Determine whether  $C(Q)$  is a convex or concave function.

$$C'(Q) = MC(Q) = 2Q - 24$$

$$C''(Q) = 2 > 0$$

Thus,  $C(Q)$  is a concave function.

3. Determine the quantity level  $Q^*$  that minimizes the total cost.

$$\text{Min}_Q C(Q) = Q^2 - 24Q + 213$$

$$\text{FONC: } C'(Q) = 2Q - 24 = 0$$

$$\Rightarrow Q^* = 12$$

4. Verify that  $C(Q^*)$  is minimum by using the first-derivative test.

$$Q^* = 12$$

$$C'(12) = 0$$

$$C'(10) = 2(10) - 24 = -4 < 0$$

$$C'(14) = 2(14) - 24 = 4 > 0$$

The signs of its slope change from negative to positive, suggesting that  $C(Q)$  is a convex function.

5. Verify that  $C(Q^*)$  is minimum by using the second-derivative test.

$$\text{SOSC: } C''(Q) = 2 > 0$$

$C(2)$  is a minimum cost.

