

# Exercise MD-255

Computing a change in consumer surplus

The Economic Skills Project

## 1 Problem

### Problem

Given the willingness to pay curve and prices below, compute the change in consumer surplus,  $\Delta CS$ , when the price rises from  $P_1$  to  $P_2$ .

- $WTP = 200 - \frac{1}{2}Q$
- $P_1 = \$80$
- $P_2 = \$100$

## 2 Answer

### Answer

Here's the numerical solution:

- $\Delta CS = -\$4,400$

### 3 Method

#### Solution method

Here's one approach:

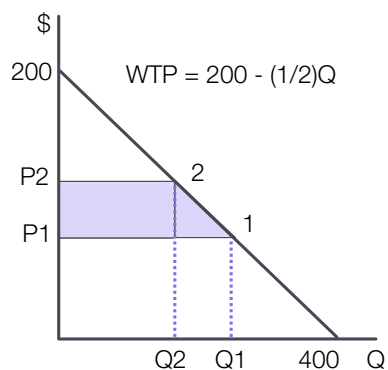
1. Draw the graph with variables for  $P_1$ ,  $P_2$ ,  $Q_1$  and  $Q_2$ .
2. Compute  $Q_1$  and  $Q_2$ .
3. Draw the graph with numerical  $P_1$ ,  $P_2$ ,  $Q_1$  and  $Q_2$ .
4. Compute the area of the trapezoid between  $P_1$  and  $P_2$ .

### 4 Solution

#### 4.1 Step 1

Draw the graph with variables for  $P_1$ ,  $P_2$ ,  $Q_1$  and  $Q_2$

Here's how it looks:



#### 4.2 Step 2

Compute  $Q_1$  and  $Q_2$

Find  $Q_1$ :

- $P_1 = WTP = 200 - \frac{1}{2}Q_1$
- $\frac{1}{2}Q_1 = 200 - P_1$
- $Q_1 = 2(200 - 80) = 240$

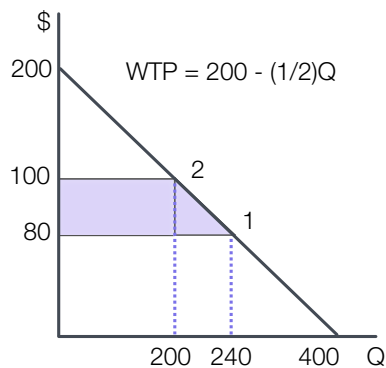
Find  $Q_2$  :

- $P_2 = WTP = 200 - \frac{1}{2}Q_2$
- $\frac{1}{2}Q_2 = 200 - P_2$
- $Q_2 = 2(200 - 100) = 200$

### 4.3 Step 3

Draw the graph with numerical  $P_1, P_2, Q_1$  and  $Q_2$

The change in consumer surplus,  $\Delta CS$ , will be a loss equal to the shaded area below. It's a loss because  $P_2$  is higher than  $P_1$  so the consumer is worse off.



### 4.4 Step 4

Compute the area of the trapezoid between  $P_1$  and  $P_2$

Computing it using the formula for the area of a trapezoid with bases  $b_1$  and  $b_2$  and height  $h$ :

- $\Delta CS = -\frac{(b_1+b_2)}{2} \cdot h = -\frac{(240+200)}{2} \cdot 20 = -\$4,400$

Alternatively,  $\Delta CS$  can be computed by summing the area of the rectangle and the triangle:

- $\Delta CS = \$20 \cdot 200 + \frac{1}{2} \cdot \$20 \cdot 40 = \$4,400$

Everything checks - done!