Monopoly Profit Maximization
Constant marginal cost example

Minimum information needed: Demand curve: \( P = 1300 - 2Q \)
Marginal cost: 500

To note: Revenue = \( PQ = (1300 - 2Q)Q = 1300Q - 2Q^2 \)

To derive: Marginal revenue: \( MR = 1300 - 4Q \) [Double the slope coefficient:
check by directly calculating \( PQ \) at \( Q = 100 \) and 101,
or even better at \( Q = 99 \) and \( Q = 101 \)]
Variable cost: \( VC = 500Q \) [if MC is constant at 500, so area under MC is a rectangle]

Solution technique:

1. Apply the cost-benefit principle: you maximize net benefit when \( MC = MR \)
   In this case \( MC = 500 \) and \( MR = 1300 - 4Q \), so equate the two and solve for \( Q^* \)
   \[ Q^* \text{ will denote the optimal value of } Q \text{ for the monopoly} \]
   \[ 500 = 1300 - 4Q^* \]
   \[ 4Q^* = 1300 - 500 = 800 \]
   \[ Q^* = 200 \]

2. "Charge what the market will bear": substitute \( Q^* \) into the demand equation to find the optimal price:
   \[ P^* = 1300 - 2Q^* = 1300 - 2(200) = 1300 - 400 \text{ or } P^* = 900 \]

3. Calculate monopoly revenue: \( Rev^* = P^*Q^* = (900)(200) = $180,000 \)

4. Calculate variable cost: \( VC^* = 500Q^* = 500(200) = 100,000 \)

5. Hence monopoly operating profit or producer surplus is \( Rev^* - VC^* = 80,000 \)

Additional notes:
You would need fixed costs to calculate total profit for the monopolist.
Note that nothing prevents fixed costs from being more than $80,000: monopolists can lose money, too. But the \( MR = MC \) rule will minimize losses.

Consumer surplus in the monopolized market may also be calculated as
\[ CS_{mono} = 0.5 (1300 - P^*) Q^* = 0.5 (1300 - 900) 200 = 0.5 (80,000) = 40,000 \]

What would it be if the monopolist adopted marginal cost pricing?
Note that here you must find the quantity demanded if \( P = MC \); the demand equation is
\[ P = 1300 - 2Q, \text{ so } Q = 650 - 0.5P = 650 - 0.5(500) = 400, \text{ so } CS \text{ will be:} \]
\[ CS_{mc} = 0.5 (1300 - 500) 400 = 0.5 (320,000) = 160,000. \]

The deadweight loss due to monopoly is \( CS_{mc} + PS_{mc} - (CS_{mono} + PS_{mono}) \)
\[ 160,000 + 0 - (40,000 + 80,000) = 160,000 - 120,000 \]
or \( DWL = 40,000 \)