

Profit Maximization by a Monopoly

The profit-maximizing monopolist works with the same key rules as any firm:

1. The optimal output level (Q^*) is the one where marginal revenue equals marginal cost ($MR = MC$).
2. The optimal price (P^*) is found on the demand curve at output Q^* .
3. The firm should shut down if at Q^* it finds its total revenue is less than its total variable cost ($TR < TVC$).

Because price (P) and MR were equal for a perfectly competitive firm, that firm could also find its Q^* by setting $P = MC$. But that is not the case for a monopoly since P and MR will be different. The monopolist will find its profit-maximizing output (Q) where $MR = MC$, not where $P = MC$. This activity shows how a monopolist finds the output at which it will maximize its total profit and the price it should charge for that output.

Part A: Determining the Optimal Output and Price for a Monopoly

Table 3-11.1 provides some revenue, cost, and profit data for a monopoly.

1. Complete Table 3-11.1. Enter the MR and MC values at the higher of the two output levels. For example, the MR value of \$300 is placed at $Q = 4$ rather than at $Q = 3$.

Be sure to distinguish between total profit ($T\Pi$), average profit ($A\Pi$), and marginal profit ($M\Pi$):

$$(A) T\Pi = TR - TC = (Q) (A\Pi)$$

$$(B) A\Pi = AR - ATC = T\Pi/Q$$

$$(C) M\Pi = MR - MC = \Delta T\Pi/\Delta Q$$



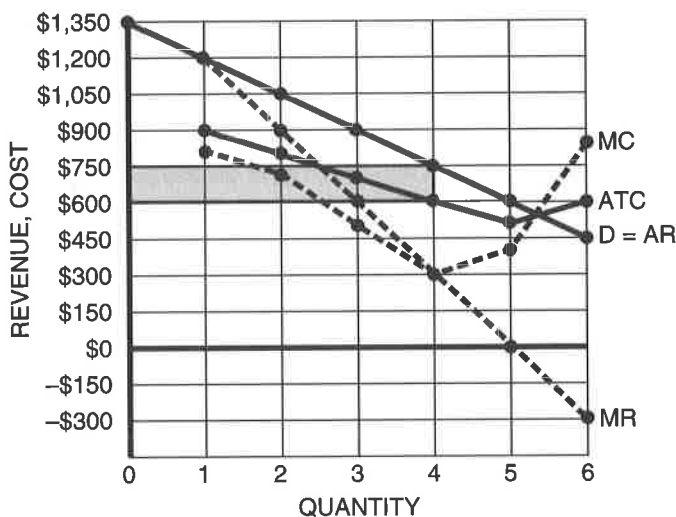
Table 3-11.1
Revenue, Cost, and Profit Values for a Monopoly

Q	P	TR	TC	T\Pi	AR	ATC	A\Pi	MR	MC	M\Pi
0	\$1,350	\$0	\$100	-\$100	-	-	-	-	-	-
1	\$1,200	\$1,200	\$900	\$300	\$1,200	\$900	\$300	+\$1,200	+\$800	+\$400
2	\$1,050	\$2,100	\$1,600	\$500	\$1,050	\$800	\$250	+\$900	+\$700	+\$200
3	\$900	\$2,700	\$2,100	\$600	\$900	\$700	\$200	+\$600	+\$500	+\$100
4	\$750	\$3,000	\$2,400	\$600	\$750	\$600	\$150	+\$300	+\$300	\$0
5	\$600	\$3,000	\$2,800	\$200	\$600	\$560	\$40	\$0	+\$400	-\$400
6	\$450	\$2,700	\$3,600	-\$900	\$450	\$600	-\$150	-\$300	+\$800	-\$1,100

2. In Figure 3-11.1, draw the monopolist's D, AR, MR, ATC, and AVC curves using the data from Table 3-11.1. Plot the MR and MC values at the higher of the two output levels rather than at the midpoint between the two levels. Use dotted lines for the MR and MC curves in your graph. Label each curve.



Figure 3-11.1
Revenue and Cost Curves of a Monopolist



3. To maximize its total profit, this monopolist should produce 4 units.
The first three units have $MR > MC$. The fourth unit has $MR = MC$. Subsequent units have $MR < MC$ and should not be produced.
4. What price should the monopolist charge for each of these units?
The highest price the firm can charge for four units is \$750. This price is found on the D curve.
5. What is the total profit this firm will earn? \$600 Shade in the total profit area in Figure 3-11.1.
*The $A\Pi$ for four units is \$150: $A\Pi = AR - ATC = \$750 - \600 .
 $T\Pi = (Q)(A\Pi) = (4)(\$150) = \600 .*

Part B: Other Monopoly Examples

6. Suppose a monopolist can sell an extra unit of its good at a price of \$50 and the MR of that unit is \$44. If the MC of producing the extra unit is \$46, the firm's total profit would (*increase / decrease*) by \$2 if the firm sells that unit. Should the firm produce this additional unit of output? Explain your answer.
The firm should not produce the extra unit because its MR is less than its MC. This unit has a marginal profit of -\$2 which means the firm's total profit would decrease by \$2 if it sold that unit. The firm compares MR to MC, not P to MC, to decide if an extra unit should be produced.

7. Figure 3-11.2 shows the MR and MC curves of a monopolist. Economists claim that the firm will maximize its total profit by producing 800 units where $MR = MC$. Show your understanding of this rule by circling the correct answer in each cell of Table 3-11.2.

Figure 3-11.2

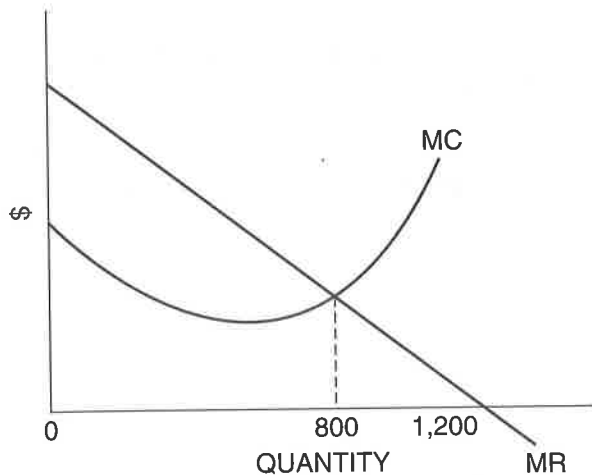


Table 3-11.2

The Logic behind the “MR = MC” Rule

Units of Q	For each extra unit of output in this range:		
1–799	MR is (\otimes) / = / (\ominus) MC.	M Π is (\otimes) / = / (\ominus) \$0.	T Π will (<u>rise</u>) / fall / not change).
800	MR is (\otimes) / (\ominus) / (\otimes) MC.	M Π is (\otimes) / (\ominus) / (\otimes) \$0.	T Π will (rise / fall / <u>not change</u>).
801–1200	MR is (\otimes) / = / (\ominus) MC.	M Π is (\otimes) / = / (\ominus) \$0.	T Π will (rise / <u>fall</u>) / not change).

8. The firm illustrated in Figure 3-11.2 will maximize its total revenue if it produces 1,200 units. So why does it not want to produce those units between 800 and 1,200?
Each of the units between 800 and 1200 has $MR < MC$ which means the firm’s total profit will be decreased if these units are produced.
9. The monopolist’s profit-maximizing output level will be in the (elastic / unitary elastic / inelastic) range of its demand curve. Explain.
The output level where $MR = MC$ must be in the elastic range because MC is always a positive value, which means MR must also be a positive value. MR is only positive in the elastic range of the demand curve.

Here's a more interesting answer to Question 9. Assume the firm is producing an output level in the inelastic range. If the firm increases its price, three things will happen:

- (1) Total revenue will increase because an increase in price when demand is inelastic increases total revenue.*
- (2) Total cost will decrease because the firm will need fewer resources since it will be selling fewer units of output because of the higher price.*
- (3) Total profit will increase because total revenue increases and total cost decreases when price is increased in the inelastic range of the demand curve. [See (1) and (2).]*

Thus, if the firm is operating in the inelastic range of its demand curve, it should keep increasing its price (and its total profit) until it backs into the elastic range where it eventually hits the output level where $MR = MC$.