April 2, 2001

Monopoly
Handout 1

A firm is a **monopoly** if it is the only supplier of a product for which there is no close substitute. A monopoly sets the price of its product without concern that the price might be undercut by rivals. A monopoly faces a downward sloping demand curve.

The demand function for a monopolist is written as $Q = D(p)$ where Q is the quantity demanded at the price p. The inverse demand function is given by $p = D^{-1}(Q) = g(Q)$ where g denotes the inverse of the function D. For example if $Q = 18 - \frac{1}{14} p$ then $p = 252 - 14Q$.

Revenue for a monopolist - The revenue of a firm (R) is given by pQ, where p is the price of the product and Q is the level of output. In market equilibrium, the price depends on the amount consumed and produced. The monopolists' revenue is therefore $R = pQ = g(Q)Q$. If the inverse demand function is linear and given by $p = A - BQ$, then revenue is given by

$$\begin{aligned} R &= pQ = g(Q) \\ &= (A - BQ)\ Q \\ &= AQ - BQ^2 \end{aligned}$$

For example if the inverse demand function is $p = 252 - 14Q$ then revenue is given by

$$\begin{aligned} R &= pQ = g(Q)Q \\ &= (252 - 14Q)Q \\ &= 252Q - 14Q^2 \end{aligned}$$

Marginal revenue is the increment, or addition, to revenue that results from producing one more unit of output. Marginal revenue is the change in total revenue from producing one more unit of output. In discrete or average terms marginal revenue is given by

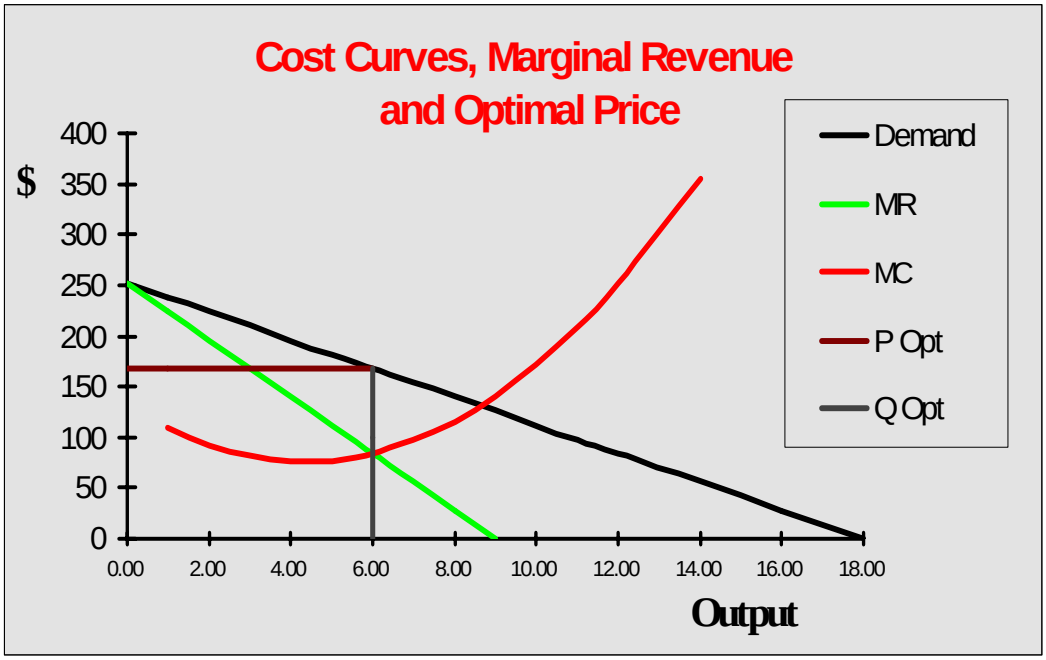
$$MR = \frac{change\ in\ revenue}{change\ in\ output} = \frac{\Delta R(Q,p)}{\Delta Q} = \frac{\Delta TR(Q,p)}{\Delta Q}$$

where Δ denotes change, R and TR both denote revenue, and Q denotes output. For a linear inverse demand function, it is easy to compute marginal revenue. If the inverse demand function is given by $p = A - BQ$ then marginal revenue is given by $MR = A - 2BQ$. So marginal revenue has the same intercept and a slope twice as steep as inverse demand. One way to draw this is to find the intercept on the Q axis for the demand function and then use ½ of that value as the Q intercept for the marginal revenue function.

Once the firm has determined the least costly way to produce each output level, it chooses the level of output which maximizes profits. Specifically, it has the following maximization problem

$$\begin{aligned} &\max_y\ pQ - C(Q, w) \\ \Rightarrow\ &\max_Q\ g(Q)Q - C(Q, w) \\ \Rightarrow\ &\max_Q\ (252 - 14Q)Q - C(Q, w) \\ \Rightarrow\ &\max_Q\ 252Q - 14Q^2 - C(Q, w) \end{aligned}$$

Q	FC	VC	C	AFC	AVC	ATC	MC Δ	MC	Demand /Price	TR	MR Δ	MR	Profit
0	100	0	100						252	0		252	-100
							120				238		
1	100	120	220	100.00	120.00	220.00		109	238	238		224	18
							100				210		
2	100	220	320	50.00	110.00	160.00		92	224	448		196	128
							86				182		
3	100	306	406	33.33	102.00	135.33		81	210	630		168	224
							78				154		
4	100	384	484	25.00	96.00	121.00		76	196	784		140	300
							76				126		
5	100	460	560	20.00	92.00	112.00		77	182	910		112	350
							80				98		
6	100	540	640	16.67	90.00	106.67		84	168	1008		84	368
							90				70		
7	100	630	730	14.29	90.00	104.29		97	154	1078		56	348
							106				42		
8	100	736	836	12.50	92.00	104.50		116	140	1120		28	284
							128				14		
9	100	864	964	11.11	96.00	107.11		141	126	1134		0	170
							156				-14		
10	100	1020	1120	10.00	102.00	112.00		172	112	1120		-28	0
							190				-42		
11	100	1210	1310	9.09	110.00	119.09		209	98	1078		-56	-232
							230				-70		
12	100	1440	1540	8.33	120.00	128.33		252	84	1008		-84	-532



Now let inverse demand be given by $p = 165 - 14Q$.

Q	FC	VC	C	AFC	AVC	ATC	MC Δ	MC	Demand /Price	TR	MR Δ	MR	Profit
0	100	0	100						165	0		165	-100
							120				151		
1	100	120	220	100.00	120.00	220.00		109	151	151		137	-69
							100				123		
2	100	220	320	50.00	110.00	160.00		92	137	274		109	-46
							86				95		
3	100	306	406	33.33	102.00	135.33		81	123	369		81	-37
							78				67		
4	100	384	484	25.00	96.00	121.00		76	109	436		53	-48
							76				39		
5	100	460	560	20.00	92.00	112.00		77	95	475		25	-85
							80				11		
6	100	540	640	16.67	90.00	106.67		84	81	486		-3	-154
							90				-17		
7	100	630	730	14.29	90.00	104.29		97	67	469		-31	-261
							106				-45		
8	100	736	836	12.50	92.00	104.50		116	53	424		-59	-412
							128				-73		
9	100	864	964	11.11	96.00	107.11		141	39	351		-87	-613
							156				-101		
10	100	1020	1120	10.00	102.00	112.00		172	25	250		-115	-870
							190				-129		
11	100	1210	1310	9.09	110.00	119.09		209	11	121		-143	-1189