Economics 201 | Fall 2013
Introduction to Economic Analysis | Jeffrey Parker
Dairy Farms Input Case Solutions

1. From Table 1 of the original case, we can calculate the marginal product of feed as $\frac{\Delta Milk}{\Delta Feed}$ and (because the firms are competitive in the milk market so *MR* = *P*) the marginal revenue product as $\frac{\Delta Milk}{\Delta Feed} \times P$. For example, moving between 5654 pounds of feed and 6117, we calculate *MP* as $\frac{8184 - 7626}{6117 - 5654} = \frac{558}{463} = 1.205$. The *MRP* = *MP* × *P*, so *MRP* at that level of feed input is 1.205 × \$0.30 = \$0.362 when the price of milk is \$0.30. (Note that this is for one cow, but the calculation would be the same for 25 cows because both numerator and denominator would just be multiplied by 25.) By similar calculations we get the following table of *MP* and *MRP* at various feed levels:

Ave Nutrients Consumed	Ave Milk Produced	Ave Nutrients Consumed	MP of Feed	MRP of Feed @ P=$0.30
5654	7626	5654		
6117	8184	6117	1.205	$0.362
6575	8824	6575	1.397	$0.419
7132	9400	7132	1.034	$0.310
7531	9780	7531	0.952	$0.286
7899	9965	7899	0.503	$0.151

2. At \$0.24 per pound, the optimal level of nutrient input (among those listed in the table) is 7531. Raising feed from 7132 to 7531 yields \$0.286 per pound of feed, which is greater than the \$0.24 that each pound costs. Raising feed input further to 7899 per cow only yields \$0.151 in revenue per pound of feed, which is less than the cost. Milk output at 7531 pounds of feed is 9780 pounds of milk per cow, or 25 × 9780 = 244,500. Calculating the output and cost levels associated with the values above gives:

Ave Milk Produced	Total Milk Produced	Ave Nutrient Consumed	Ave Nutrient Purchased	Total Nutrient Purchased	Variable Cost @ $0.24	Marginal Cost @ $0.24
7626	190,650	5654	2654	66,350	$15,924	
8184	204,600	6117	3117	77,925	$18,702	$0.199
8824	220,600	6575	3575	89,375	$21,450	$0.172
9400	235,000	7132	4132	103,300	$24,792	$0.232
9780	244,500	7531	4531	113,275	$27,186	$0.252
9965	249,125	7899	4899	122,475	$29,394	$0.477

If the price of milk output is $0.30 per pound, then the optimal output (among those in the table) is indeed 244,500, because increasing output to 249,125 costs $0.477 per pound but each pound can be sold for only $0.30.

This corresponds directly with the result of the calculation above for the optimal level of nutrients, as indeed it must.

3. If the milk price falls to $0.24, then from the output table in Question 2 the optimal output level becomes 235,000. The step from 235,000 to 244,500 costs $0.252 per pound and now yields only $0.24 in revenue per pound, so it lowers profit. In terms of feed inputs, the marginal product is unchanged, but the marginal revenue product declines:

Ave Nutrients Consumed	MP of Feed	MRP of Feed @ P=0.24
5654		
6117	1.205183585	$0.289
6575	1.397379913	$0.335
7132	1.034111311	$0.248
7531	0.952380952	$0.229
7899	0.502717391	$0.121

The optimal nutrient input at $0.24 per pound of nutrient is now 7132. Increasing from 7132 to 7531 costs $0.24 per pound of nutrient but yields only $0.229 in revenue per pound of nutrient added. This corresponds exactly to the reduction in optimal output calculated above.