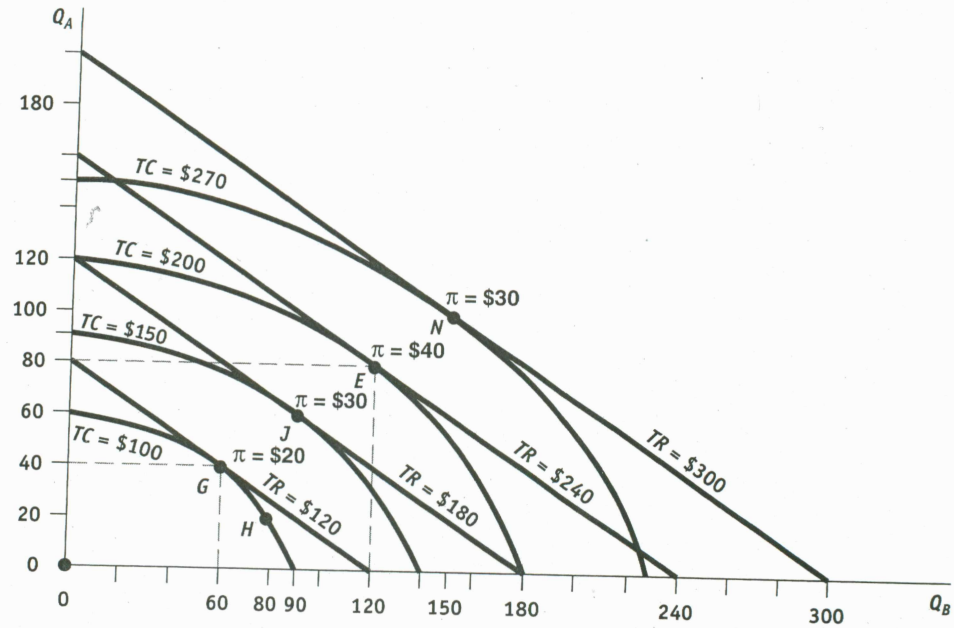

FIGURE 11-3 Profit Maximization with Joint Products Produced in Variable Proportions The curved lines are product transformation curves showing the various combinations of products A and B that the firm can produce at each level of total cost (*TC*). The curvature arises because the firm's productive resources are not perfectly adaptable in the production of products A and B that give rise to the same total revenue (*TR*) to the firm when sold at constant prices. The tangency point of an isorevenue to a *TC* curve gives the combination of products A and B that leads to the maximum profit (π) for the firm for the specific *TC*. The overall maximum profit of the firm is $\pi = \$40$. This is earned by producing and selling 80A and 120B (point *E*) with $TR = \$240$ and $TC = \$200$.

$TR = (40)(\$1.50) + (60)(\$1.00) = \$120$. The higher isorevenue lines refer to the higher levels of *TR* that the firm receives by selling larger quantities of products A and B at constant P_A and P_B. The isorevenue lines are straight on the assumption that the prices of products A and B are constant (as in the case of a perfectly competitive firm).[5]

Looking at both the product transformation curves and the isorevenue lines in Figure 11-3, we can see that for a given *TC*, the firm maximizes profits by reaching the isorevenue line that is tangent to the particular *TC* curve. For example, with $TC = \$100$, the highest total profit (π) possible is \$20, which is reached by producing 40A and 60B and reaching the $TR = \$120$ isorevenue line. With $TC = \$150$, the maximum $\pi = \$30$, which is reached by producing 60A and 90B and reaching the $TR = \$180$ isorevenue line at point *J*. The overall highest profit that the firm can earn is $\pi = \$40$. This is reached by producing 80A and 120B at $TC = \$200$ and reaching the $TR = \$240$ isorevenue line at point *E* (see Figure 11-3).[6] Case Study 11-1 examines pricing and output decisions by Gillette.

[5] Note that isorevenue lines are parallel and that their absolute slope is $P_B/P_A = \$1/\$1.50 = 2/3$. If P_A and P_B were not constant, the isorevenue lines would not be straight, but the analysis remains basically the same.

[6] Note that this is an example of constrained maximization and can easily be solved by linear programming.