

BUS 3700 Exam 1 Practice Exercises with Profit Maximization

For each problem, you are given the total cost function and the price (which is a constant). Determine the profit maximizing quantity.

1.

$$TC = 2Q^3 - 8Q^2 + 36Q + 656$$

$$P = 400$$

2.

$$TC = 2Q^3 - 12Q^2 + 45Q + 256$$

$$P = 320$$

3.

$$TC = 2Q^3 - 15Q^2 + 84Q + 480$$

$$P = 380$$

4.

$$TC = 3Q^3 - 8Q^2 + 29Q + 970$$

$$P = 780$$

5.

$$TC = 3Q^3 - 20Q^2 + 104Q + 1,024$$

$$P = 642$$

6.

$$TC = 3Q^3 - 40Q^2 + 186Q + 451$$

$$P = 659$$

7.

$$TC = 1.4Q^3 - 6Q^2 + 35Q + 273$$

$$P = 432$$

8.

$$TC = 1.5Q^3 - 9Q^2 + 52Q + 981$$

$$P = 390$$

9.

$$TC = 1.6Q^3 - 17Q^2 + 60Q + 936$$

$$P = 903$$

10.

$$TC = 1.8Q^3 - 21Q^2 + 60Q + 750$$

$$P = 810$$

Answers

1.

$$TC = 2Q^3 - 8Q^2 + 36Q + 656$$

$$MC = 6Q^2 - 16Q + 36 = P = 400$$

$$6Q^2 - 16Q - 364 = 0$$

$$Q = \frac{-(-16) + \sqrt{(-16)^2 - 4 \times 6 \times (-364)}}{2 \times 6}$$

$$Q = \frac{16 + \sqrt{256 - (-8736)}}{12}$$

$$= \frac{16 + \sqrt{8,992}}{12}$$

$$= \frac{16 + 94.8262}{12}$$

$$= \frac{110.8262}{12}$$

$$Q = 9.2355$$

2.

$$TC = 2Q^3 - 12Q^2 + 45Q + 256$$

$$MC = 6Q^2 - 24Q + 45 = P = 320$$

$$6Q^2 - 24Q - 275 = 0$$

$$Q = \frac{-(-24) + \sqrt{(-24)^2 - 4 \times 6 \times (-275)}}{2 \times 6}$$

$$Q = \frac{24 + \sqrt{576 - (-6,600)}}{12}$$

$$= \frac{24 + \sqrt{7,176}}{12}$$

$$\begin{aligned}
&= \frac{24 + 84.7113}{12} \\
&= \frac{108.7113}{12} \\
Q &= 9.0593
\end{aligned}$$

3.

$$\begin{aligned}
TC &= 2Q^3 - 15Q^2 + 84Q + 480 \\
MC &= 6Q^2 - 30Q + 84 = P = 380 \\
6Q^2 - 30Q - 296 &= 0 \\
Q &= \frac{-(-30) + \sqrt{(-30)^2 - 4 \times 6 \times (-296)}}{2 \times 6} \\
Q &= \frac{30 + \sqrt{900 - (-7,104)}}{12} \\
&= \frac{30 + \sqrt{8,004}}{12} \\
&= \frac{30 + 89.4651}{12} \\
&= \frac{119.4651}{12} \\
Q &= 9.9554
\end{aligned}$$

4.

$$\begin{aligned}
TC &= 3Q^3 - 8Q^2 + 29Q + 970 \\
MC &= 9Q^2 - 16Q + 29 = P = 780 \\
9Q^2 - 16Q - 751 &= 0 \\
Q &= \frac{-(-16) + \sqrt{(-16)^2 - 4 \times 9 \times (-751)}}{2 \times 9} \\
Q &= \frac{16 + \sqrt{256 - (-27,036)}}{18} \\
&= \frac{16 + \sqrt{27,292}}{18} \\
&= \frac{16 + 165.2029}{18} \\
&= \frac{181.2029}{18} \\
Q &= 10.0668
\end{aligned}$$

5.

$$TC = 3Q^3 - 20Q^2 + 104Q + 1,024$$

$$MC = 9Q^2 - 40Q + 104 = P = 642$$

$$9Q^2 - 40Q - 538 = 0$$

$$Q = \frac{-(-40) + \sqrt{(-40)^2 - 4 \times 9 \times (-538)}}{2 \times 9}$$

$$Q = \frac{40 + \sqrt{1,600 - (-19,368)}}{18}$$

$$= \frac{40 + \sqrt{20,968}}{18}$$

$$= \frac{40 + 144.8033}{18}$$

$$= \frac{184.8033}{18}$$

$$Q = 10.2669$$

6.

$$TC = 3Q^3 - 40Q^2 + 186Q + 451$$

$$MC = 9Q^2 - 80Q + 186 = P = 659$$

$$9Q^2 - 80Q - 473 = 0$$

$$Q = \frac{-(-80) + \sqrt{(-80)^2 - 4 \times 9 \times (-473)}}{2 \times 9}$$

$$Q = \frac{80 + \sqrt{6,400 - (-17,028)}}{18}$$

$$= \frac{80 + \sqrt{23,428}}{18}$$

$$= \frac{80 + 153.0621}{18}$$

$$= \frac{233.0621}{18}$$

$$Q = 12.9479$$

7.

$$\begin{aligned}
 TC &= 1.4Q^3 - 6Q^2 + 35Q + 273 \\
 MC &= 4.2Q^2 - 12Q + 35 = P = 432 \\
 4.2Q^2 - 12Q - 397 &= 0 \\
 Q &= \frac{-(-12) + \sqrt{(-12)^2 - 4 \times 4.2 \times (-397)}}{2 \times 4.2} \\
 Q &= \frac{12 + \sqrt{144 - (-6,669.6)}}{8.4} \\
 &= \frac{12 + \sqrt{6,813.6}}{8.4} \\
 &= \frac{12 + 82.5445}{8.4} \\
 &= \frac{94.5445}{8.4} \\
 Q &= 11.2553
 \end{aligned}$$

8.

$$\begin{aligned}
 TC &= 1.5Q^3 - 9Q^2 + 52Q + 981 \\
 MC &= 4.5Q^2 - 18Q + 52 = P = 390 \\
 4.5Q^2 - 18Q - 338 &= 0 \\
 Q &= \frac{-(-18) + \sqrt{(-18)^2 - 4 \times 4.5 \times (-338)}}{2 \times 4.5} \\
 Q &= \frac{18 + \sqrt{324 - (-6,084)}}{9} \\
 &= \frac{18 + \sqrt{6,408}}{9} \\
 &= \frac{18 + 80.0500}{9} \\
 &= \frac{98.0500}{9} \\
 Q &= 10.8944
 \end{aligned}$$

9.

$$TC = 1.6Q^3 - 17Q^2 + 60Q + 936$$

$$MC = 4.8Q^2 - 34Q + 60 = P = 903$$

$$4.8Q^2 - 34Q - 843 = 0$$

$$Q = \frac{-(-34) + \sqrt{(-34)^2 - 4 \times 4.8 \times (-843)}}{2 \times 4.8}$$

$$Q = \frac{34 + \sqrt{1,156 - (-16,185.6)}}{9.6}$$

$$= \frac{34 + \sqrt{17,341.6}}{9.6}$$

$$= \frac{34 + 131.6875}{9.6}$$

$$= \frac{165.6875}{9.6}$$

$$Q = 17.2591$$

10.

$$TC = 1.8Q^3 - 21Q^2 + 60Q + 750$$

$$MC = 5.4Q^2 - 42Q + 60 = P = 810$$

$$5.4Q^2 - 42Q - 750 = 0$$

$$Q = \frac{-(-42) + \sqrt{(-42)^2 - 4 \times 5.4 \times (-750)}}{2 \times 5.4}$$

$$Q = \frac{42 + \sqrt{1,764 - (-16,200)}}{10.8}$$

$$= \frac{42 + \sqrt{17,964}}{10.8}$$

$$= \frac{42 + 134.0298}{10.8}$$

$$= \frac{176.0298}{10.8}$$

$$Q = 16.2991$$