

Econ 302: Assignment 1–Solution
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1. (25 points) A competitive firm has a cost function given by $C(y) = 10y - 2y^2 + \frac{1}{3}y^3$.

a. Since $FC = 0$, $VC = C(y)$.

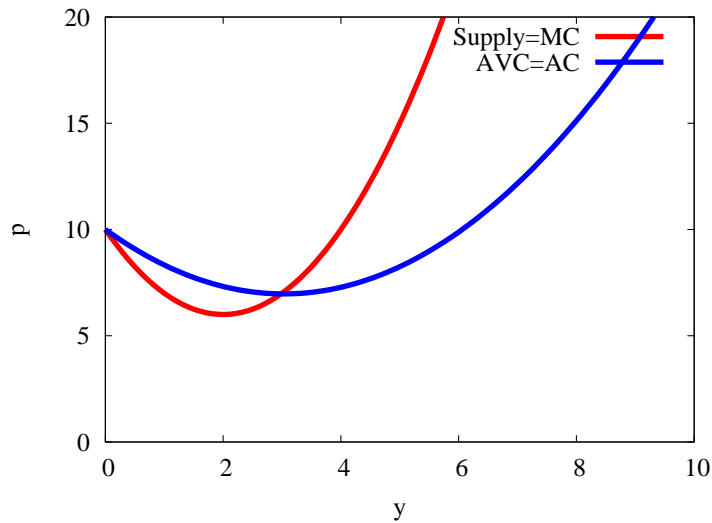
$$SAC = \frac{VC}{y} = 10 - 2y + \frac{1}{3}y^2;$$

$$SMC = 10 - 4y + y^2;$$

$$AVC = 10 - 2y + \frac{1}{3}y^2.$$

The short run supply function is part of the MC curve which is upward-sloping and above the AC curve. The MC curve and the AC curve intersect at $p = 7$, $y = 3$.

Figure 1: Problem 1-a



b. By the firm's supply curve $p = SMC$, i.e.,

$$15 = 10 - 4y + y^2 \implies y = 5;$$

$$AC_{y=5} = \frac{1}{3} \times 25 - 2 \times 5 + 10 = \frac{25}{3}$$

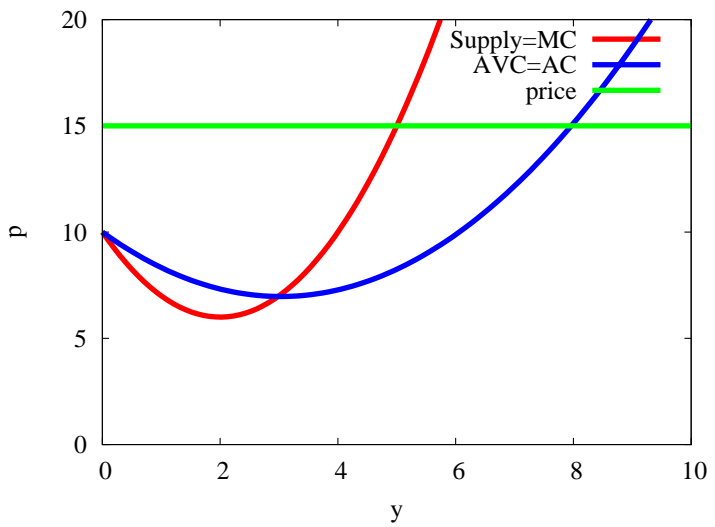
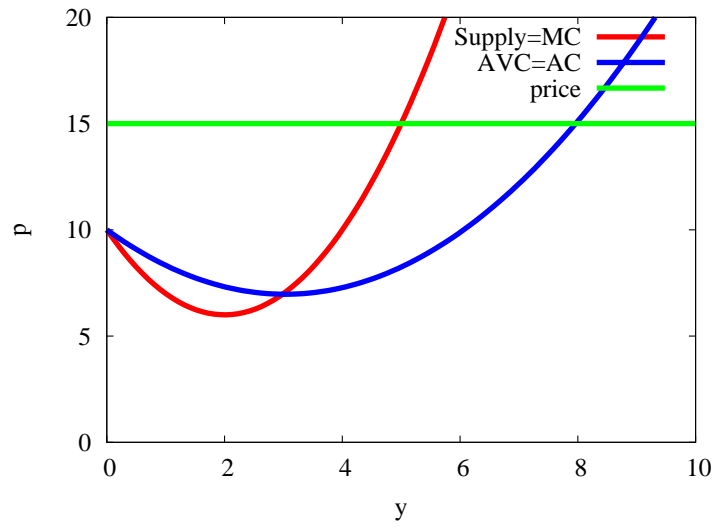
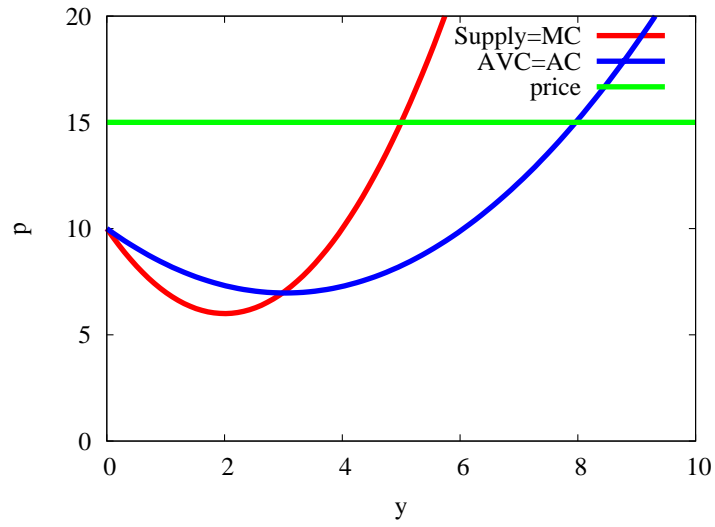
$$P.S. = (p - AVC) \times y = \frac{100}{3} = 33.33$$

2. a.

$$AVC = y + 3;$$

$$FC = 9;$$

Figure 2: Problem 1-b

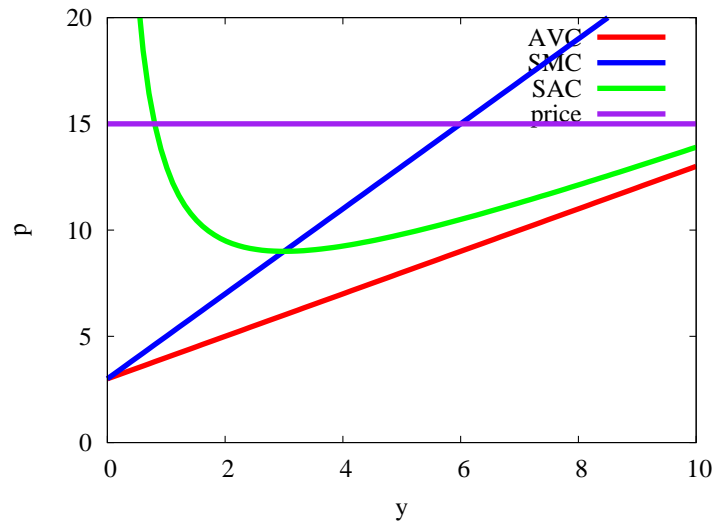


$$C(y) = VC + FC = y * AVC + FC = y^2 + 3y + 9;$$

$$SMC = 2y + 3;$$

$$SAC = y + 3 + \frac{9}{y};$$

Figure 3: Problem 2-a



b.

$$P = SMC \implies 15 = 2y + 3 \implies y = 6$$

$$\begin{aligned} \text{profit} : \pi &= py - c(y = 6) \\ &= 15 \times 6 - (6^2 + 3 \times 6 + 9) \\ &= 90 - 63 \\ &= 27 \end{aligned}$$

$$\begin{aligned} P.S &= py - vc(y = 6) \\ &= 15 \times 6 - 6 \times (6 + 3) \\ &= 90 - 54 \\ &= 36 \end{aligned}$$

$$P.S. - \pi = FC = 9$$

3.

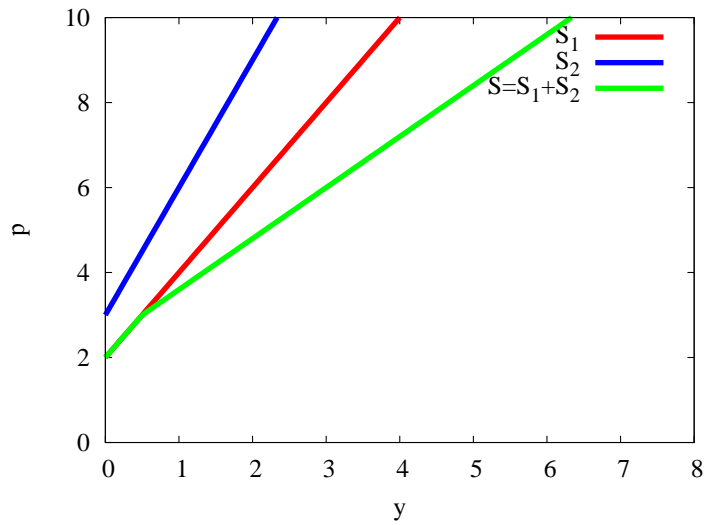
$$MC_1(y) = 2y + 2 \implies p = 2y + 2 \implies s_1 = \frac{p-2}{2};$$

$$MC_2(y) = 3y + 3 \implies p = 3y + 3 \implies s_2 = \frac{p-3}{3};$$

The aggregate supply is:

$$S = \begin{cases} 0 & \text{if } p \leq 2 \\ \frac{p}{2} - 1 & \text{if } 2 < p \leq 3 \\ \frac{5}{6}p - 2 & \text{if } p > 3 \end{cases}$$

Figure 4: Problem 3



4.

$$C_1 = y^2 + 9;$$

$$C_2 = y^2 + y + 9;$$

$$C_3 = y^2 + 2y + 9;$$

a. For Firm 1:

$$SAC = y + \frac{9}{y}$$

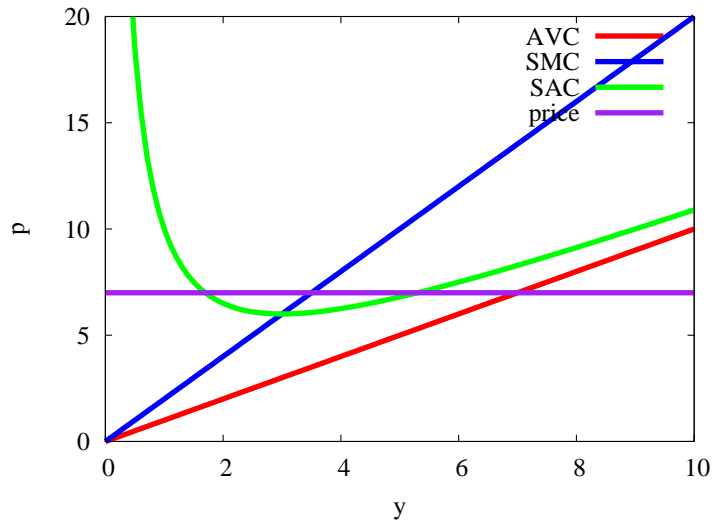
$$SMC = 2y$$

$$AVC = y$$

For Firm 2:

$$SAC = y + 1 + \frac{9}{y}$$

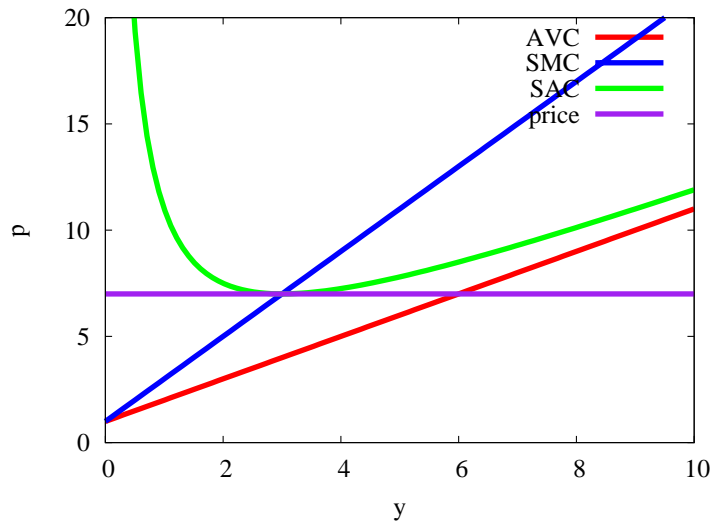
Figure 5: Problem 4-Firm 1



$$SMC = 2y + 1$$

$$AVC = y + 1$$

Figure 6: Problem 4-Firm 2



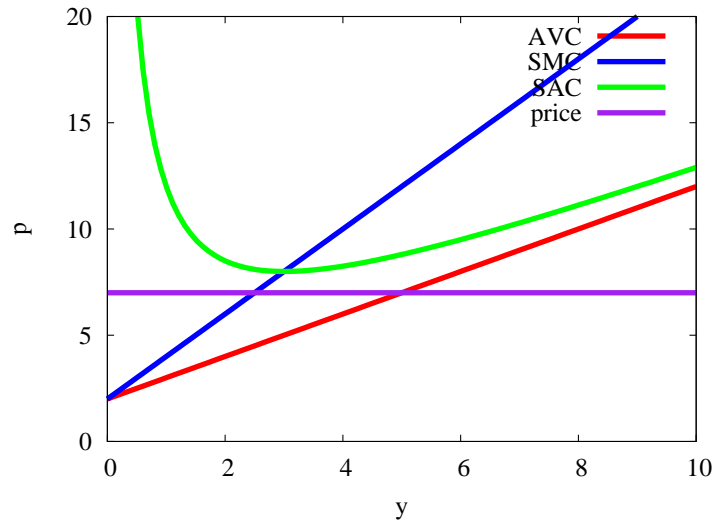
For Firm 3:

$$SAC = y + 2 + \frac{9}{y}$$

$$SMC = 2y + 2$$

$$AVC = y + 2$$

Figure 7: Problem 4-Firm 3



b. Firm 1:

$$p = SMC_1 \implies 7 = 2y \implies y = 3.5$$

$$\pi = py - C_1(y) = 7 * 3.5 - (3.25^2 + 9) = 3.25$$

Firm 2:

$$p = SMC_2 \implies 7 = 2y + 1 \implies y = 3$$

$$\pi = py - C_2(y) = 7 * 3 - (3^2 + 3 + 9) = 0$$

Firm 3:

$$p = SMC_3 \implies 7 = 2y + 2 \implies y = 2.5$$

$$\pi = py - C_3(y) = 7 * 2.5 - (2.5^2 + 2 * 2.5 + 9) = -2.75$$

All three firms will produce in the short run, since the price is above the shutdown price, i.e., the revenue covers the variable costs in all three cases.