1.

A)$p_1 x_1^A + p_2 x_2^A = 20p_1$

$p_1 x_1^B + p_2 x_2^B = 20p_2$

B) $x_1^A = \frac{\frac{1}{2}(20p_1)}{p_1} = 10$

$x_2^A = \frac{\frac{1}{2}(20p_1)}{p_2} = \frac{10p_1}{p_2}$

C) $x_1^B = x_2^B = \frac{20p_2}{p_1+p_2}$

D) $x_1^A = 10, x_2^A = 5, x_1^B = \frac{40}{3}, x_2^B = \frac{40}{3}$

E) No, total demand for good 1 apples) is $10 + \frac{40}{3} = \frac{70}{3} \neq 20$.

F) Let's find a price p_2 that clears the market for apples. Total demand is:

$$x_1^A + x_1^B = 10 + \frac{20p_2}{1+p_2}$$

To clear the market we need:

$$10 + \frac{20p_2}{1+p_2} = 20$$

The solution is $p_2 = 1$.

2.

A) $x_1^A = \frac{10p_1}{p_1} = 10$

$x_2^A = \frac{10p_1}{p_2}$

B) $x_1^B = \frac{\frac{2}{3}(30p_2)}{p_1}$

$x_2^B = \frac{\frac{2}{3}(30p_2)}{p_2} = 20$

C) Let's do the same as in the previous question:

$$10 + \frac{\frac{2}{3}(30p_2)}{1} = 20$$

$$p_2 = \frac{1}{2}$$