

College Algebra, Section 3.2, #74  
Solving Quadratic Equations

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**Market Equilibrium** The demand for diamond studded watches is given by  $p = 7000 - 2x$  dollars, and the supply of watches is given by  $p = 0.01x^2 + 2x + 1000$  dollars, where  $x$  is the number of watches demanded and supplied when the price per watch is  $p$  dollars. Find the equilibrium quantity and the equilibrium price.<sup>1</sup>

Additional instructions are given to solve this problem analytically and then check graphically.

We're asked to find equilibrium quantity and the equilibrium price. This equilibrium happens when supply and demand are equal. To find this point, we'll set the supply function equal to the demand function and solve for  $x$ , the number of watches. Then we'll go back and solve for  $p$ , the price..

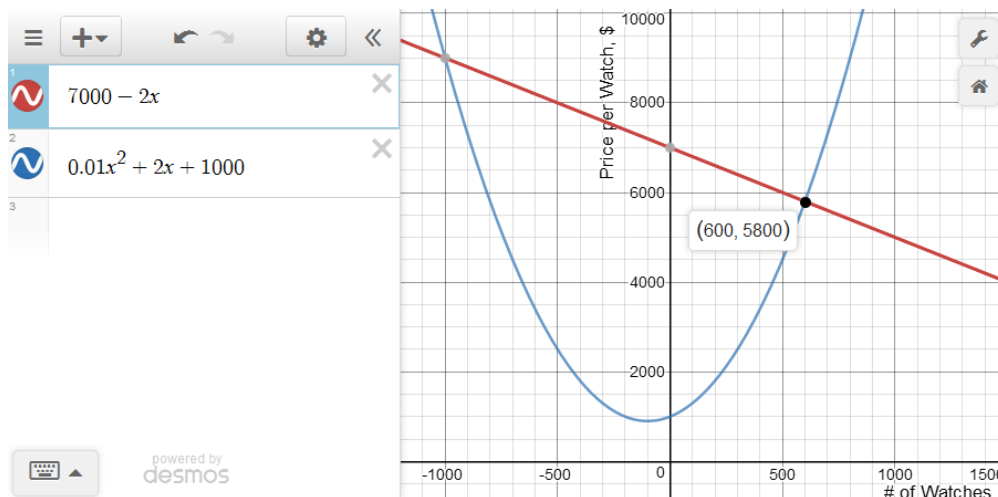
$$\begin{aligned} 0.01x^2 + 2x + 1000 &= 7000 - 2x \\ 0.01x^2 + 4x - 6000 &= 0 \\ x^2 + 400x - 600,000 &= 0 \\ (x - 600)(x + 1000) &= 0 \\ x - 600 = 0 \text{ or } x + 1000 &= 0 \\ x = 600 \text{ or } x = -1000 \end{aligned}$$

We can disregard the solution  $x = -1000$  because it isn't possible to supply a negative quantity of watches. Now back-substitute  $x = 600$  into either the supply or demand function to find  $p$ , the equilibrium price.

$$\begin{aligned} p &= 7000 - 2x \\ p &= 7000 - 2(600) \\ p &= 5800 \end{aligned}$$

The equilibrium quantity is 600 and the equilibrium price is \$5,800.

To check graphically, we'll graph  $p = 7000 - 2x$  and  $p = 0.01x^2 + 2x + 1000$  and look for the intersection of the two graphs.



The point of intersection is  $(600, 5800)$  which confirms that the equilibrium quantity is 600 and the equilibrium price is \$5,800.

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<sup>1</sup>Harshbarger/Yocco, *College Algebra In Context*, 5e, p. 196, #74.