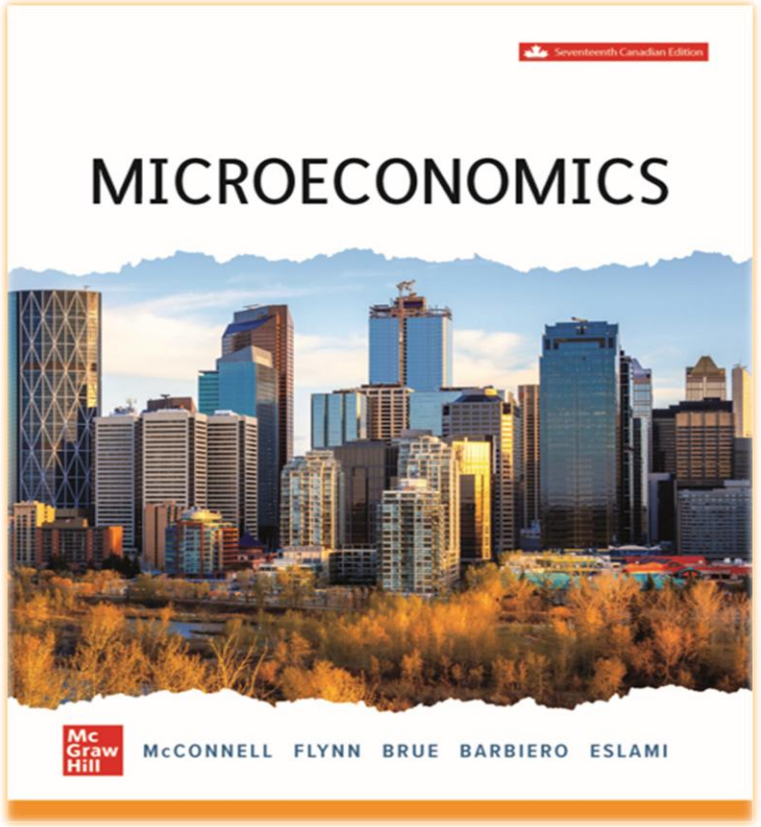
CHAPTER 3

Math Appendix to Chapter 3:
Demand, Supply, and Market Equilibrium



PowerPoint Presentation Prepared by:
Adian McFarlane, King's University College at Western University

INTRODUCTION

- Market equilibrium is represented by the price and quantity pair (Q*, P*).
- It is derived by analyzing market demand (buyers' behavior) and market supply (sellers' behavior).
- The negotiating process determines the agreed-upon price (P*) and quantity (Q*).
- Equilibrium occurs when the quantity demanded (Qd) equals the quantity supplied (Qs) at the negotiated price (P*).

A3.1 THE MATHEMATICS OF MARKET EQUILIBRIUM 1/12

- The Market Equilibrium

$$(\boldsymbol{Q}^*, \boldsymbol{P}^*)$$

- The Demand Equation

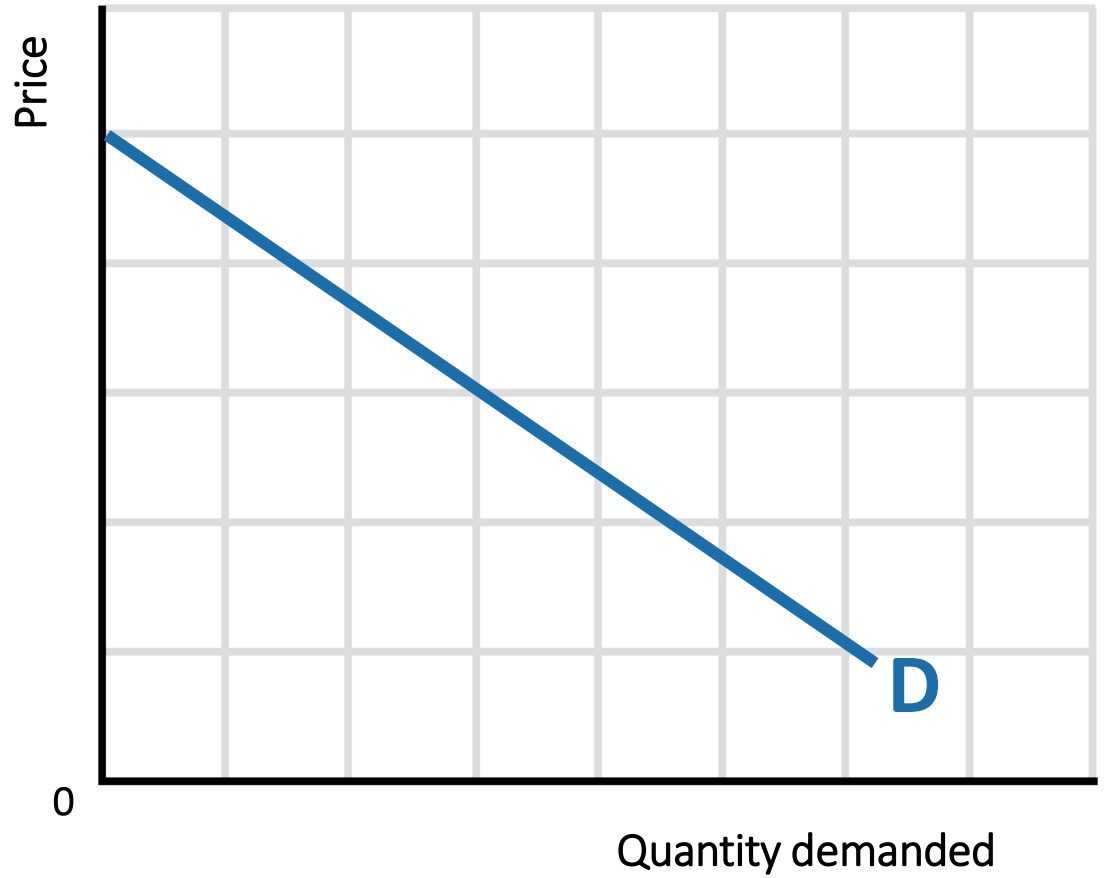
$$\boldsymbol{P} = \boldsymbol{a} - \boldsymbol{b}\boldsymbol{Q}_{\boldsymbol{d}}$$

- The Supply Equation

$$\boldsymbol{P} = \boldsymbol{c} + \boldsymbol{d}\boldsymbol{Q}_{\boldsymbol{s}}$$

A3.1 THE MATHEMATICS OF MARKET EQUILIBRIUM 2/12

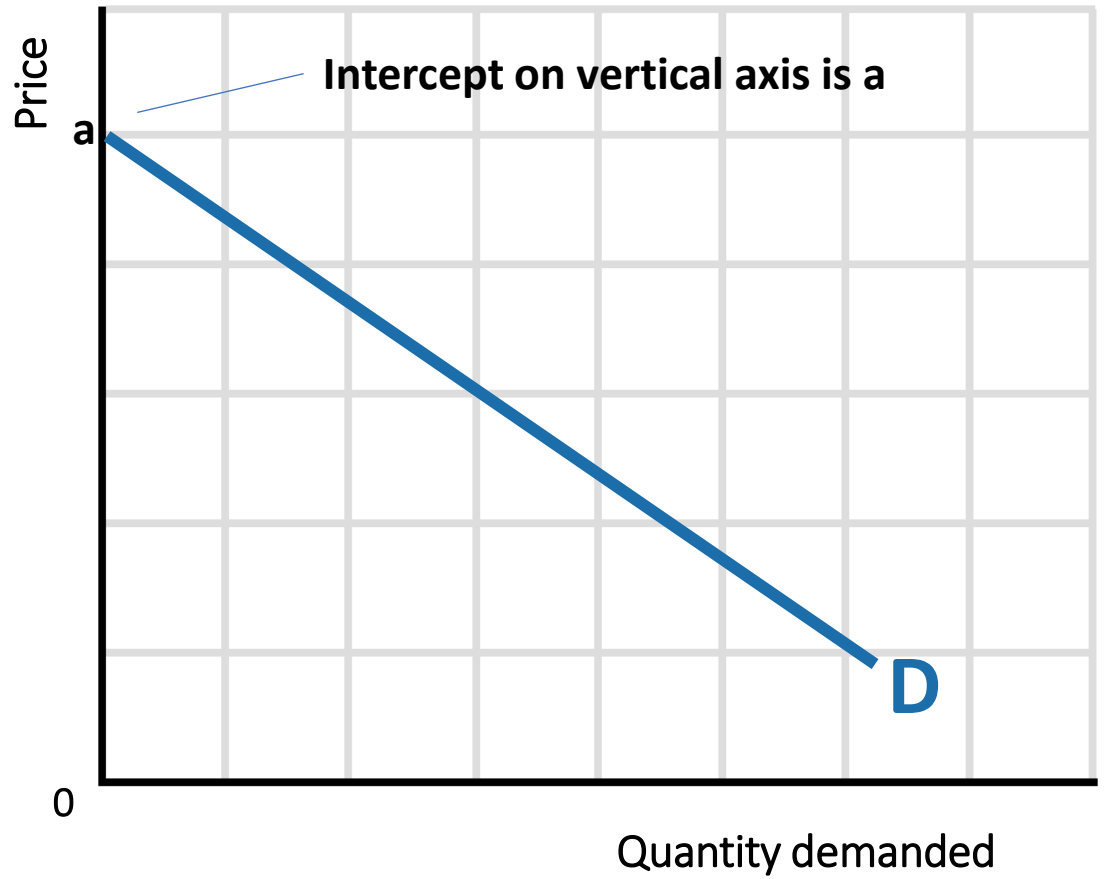
The Demand Curve



$$P = a - bQ_d$$

A3.1 THE MATHEMATICS OF MARKET EQUILIBRIUM 3/12

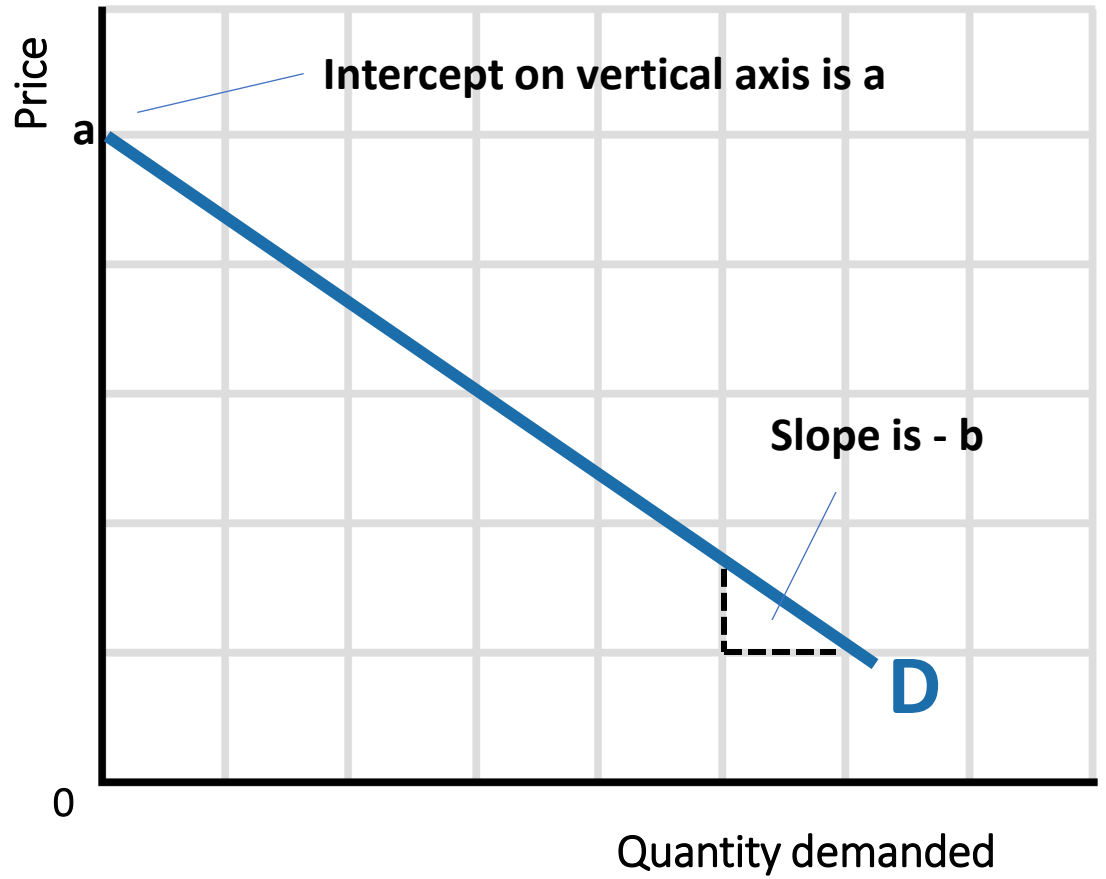
The Demand Curve



$$P = \mathbf{a} - bQ_d$$

A3.1 THE MATHEMATICS OF MARKET EQUILIBRIUM 4/12

The Demand Curve



$$P = a - bQ_d$$

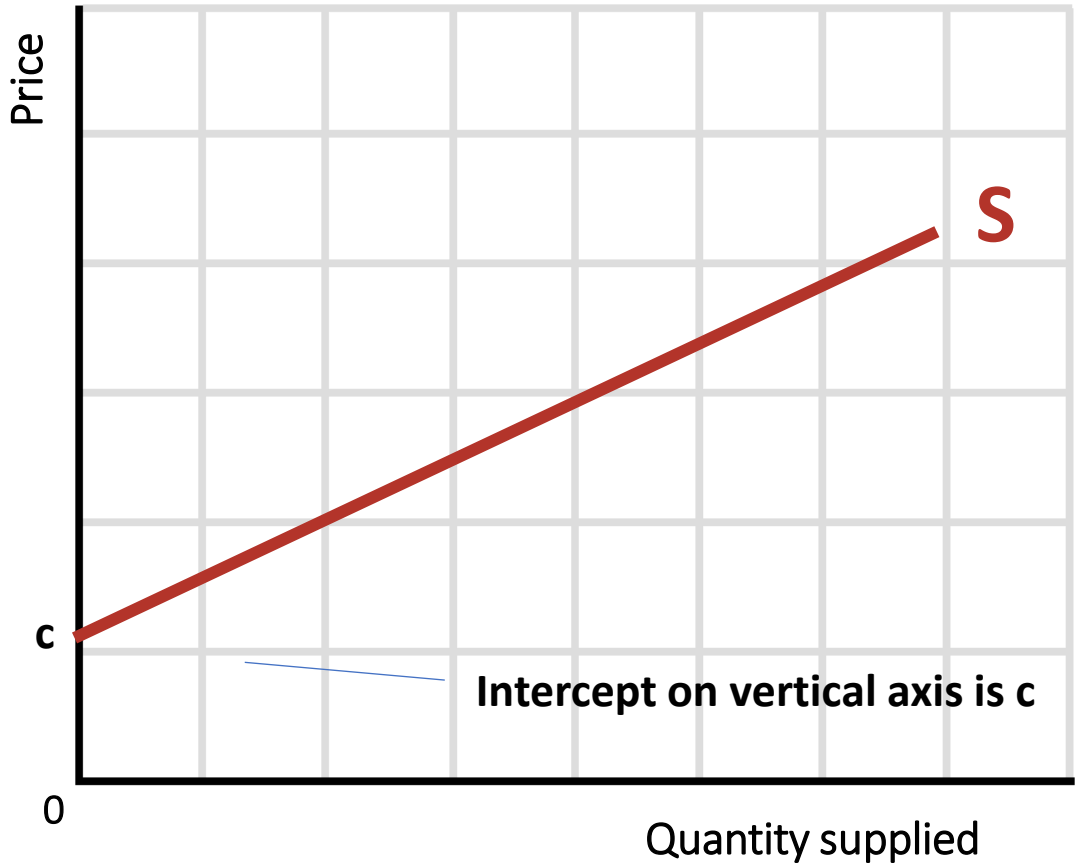
A3.1 THE MATHEMATICS OF MARKET EQUILIBRIUM 5/12

The Supply Curve

$$P = c + dQ_s$$

A3.1 THE MATHEMATICS OF MARKET EQUILIBRIUM 6/12

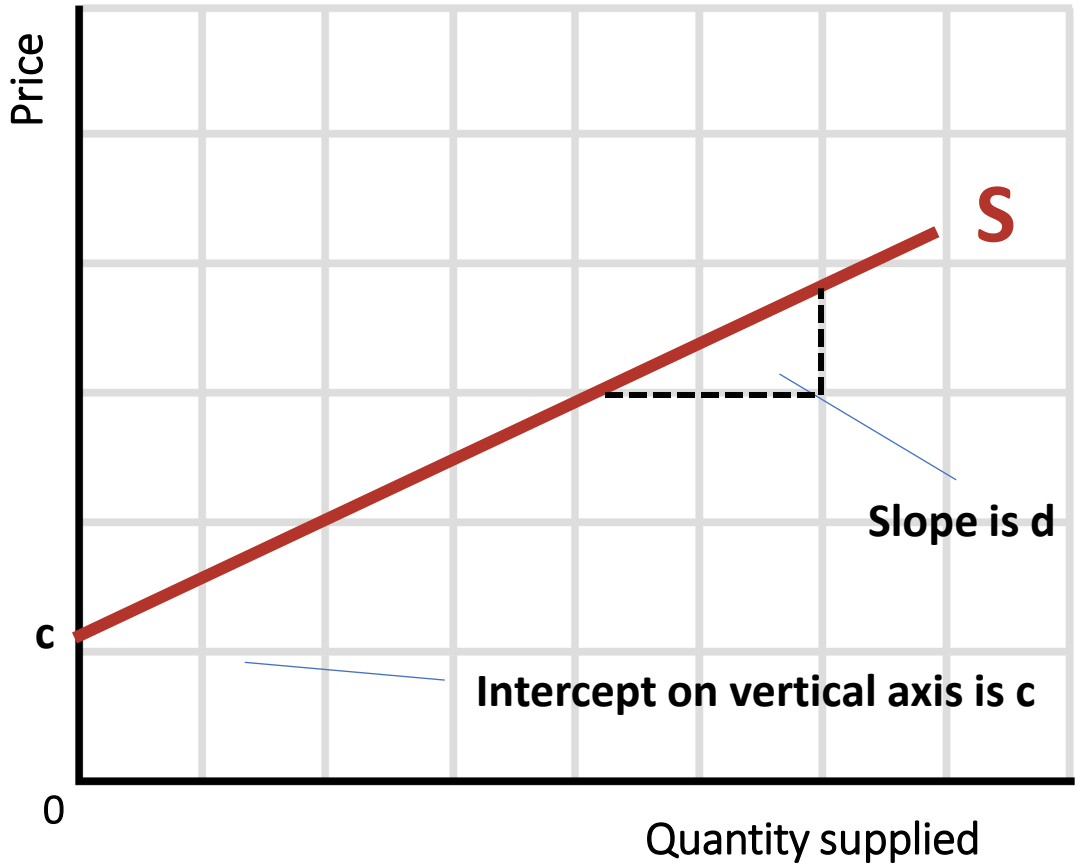
The Supply Curve



$$P = c + dQ_s$$

A3.1 THE MATHEMATICS OF MARKET EQUILIBRIUM 7/12

The Supply Curve



$$P = c + dQ_s$$

A3.1 THE MATHEMATICS OF MARKET EQUILIBRIUM 8/12

- **The Market Equilibrium**
  - The negotiating process (in which price or quantity or both adjust) provides the mechanism by which, eventually, buyers and sellers agree upon a price, P*, and a quantity, Q*.

$$\boldsymbol{Q^* = Q_d = Q_s}$$

$$\boldsymbol{(Q^*, P^*) = \left[\frac{(a-b)}{(b+d)}, \frac{(ad-bc)}{(b+d)}\right]}$$

A3.1 THE MATHEMATICS OF MARKET EQUILIBRIUM 9/12

- **The Market Equilibrium**

- Set demand and supply equal to each other:

$$\boldsymbol{a - bQ_d = c + dQ_s}$$

$$\boldsymbol{a - bQ^* = c + dQ^*}$$

- Solve by substitution method to get:

$$\boldsymbol{Q^*}\text{and } \boldsymbol{P^*}$$

A3.1 THE MATHEMATICS OF MARKET EQUILIBRIUM 10/12

- **The Market Equilibrium**

$$P^* = a - bQ^*$$

$$P^* = c + dQ^*$$

- Since P* is the same agreed-upon price by both buyer and seller:

$$a - bQ* = c + dQ*$$

$$Q^* = \frac{(a - c)}{b + d}$$

A3.1 THE MATHEMATICS OF MARKET EQUILIBRIUM 11/12

- **The Market Equilibrium**

- To find *P**, substitute $\frac{(a-c)}{b+d}$ in the supply (or demand) function.

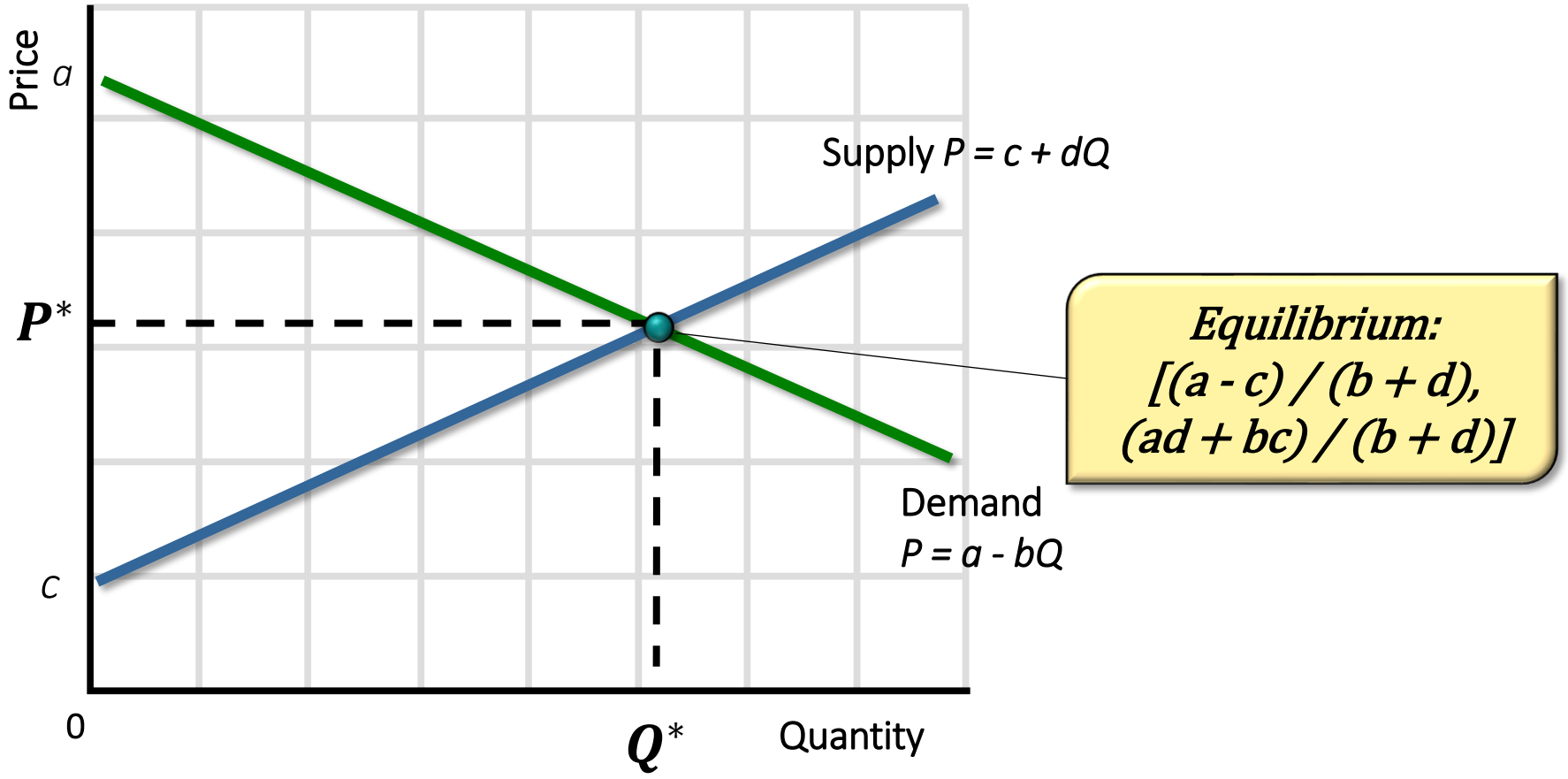
$$P^* = c + d\frac{(a-c)}{(b+d)}$$

$$P^* = \frac{(ad-bc)}{(b+d)}$$

$$(Q^*, P^*) = [\frac{(a-b)}{(b+d)}, \frac{(ad-bc)}{(b+d)}]$$

A3.1 THE MATHEMATICS OF MARKET EQUILIBRIUM 12/12

The Market Equilibrium



CHAPTER SUMMARY

- The equilibrium price (P*) and quantity (Q*) are found by matching the quantity demanded (Qd) with the quantity supplied (Qs) at an agreed price through the negotiation process.
- The demand curve describes buyers' behavior, showing that as price decreases, the quantity demanded increases, represented by the equation $P = a - bQd$.
- The supply curve describes sellers' behavior, showing that as price increases, the quantity supplied increases, represented by the equation $P = c + dQs$.
- The equilibrium condition is achieved when $Qd = Qs$, leading to equations that solve for the equilibrium quantity (Q*) and price (P*) using the demand and supply functions.