

Growing Coffee

MAFS.912.A-CED.1.3

The coffee variety *Arabica* yields about 750 kg of coffee beans per hectare, while *Robusta* yields about 1200 kg per hectare (reference). Suppose that a plantation has α hectares of *Arabica* and r hectares of *Robusta*.

- Write an equation relating α and r if the plantation yields 1,000,000 kg of coffee.
- On August 14, 2003, the world market price of coffee was \$1.42 per kg of *Arabica* and \$0.73 per kg of *Robusta*. Write an equation relating α and r if the plantation produces coffee worth \$1,000,000.



Commentary

This task is designed to make students think about the meaning of the quantities presented in the context and choose which ones are appropriate for the two different constraints presented. In particular, note that the purpose of the task is to have students *generate* the constraint equations for each part (though the problem statements avoid using this particular terminology), and not to have students *solve* said equations. If desired, instructors could also use this task to touch on such solutions by finding and interpreting solutions to the system of equations created in parts (a) and (b).

Solution: Growing coffee

- a. We see that a hectares of *Arabica* will yield $750a$ kg of beans, and that r hectares of *Robusta* will yield $1200r$ kg of beans. So the constraint equation is

$$750a + 1200r = 1,000,000.$$

- b. We know that a hectares of *Arabica* yield $750a$ kg of beans worth \$1.42/kg for a total dollar value of $1.42(750a) = 1065a$. Likewise, r hectares of *Robusta* yield $1200r$ kg of beans worth \$0.73/kg for a total dollar value of $0.73(1200r) = 876r$. So the equation governing the possible values of a and r coming from the total market value of the coffee is

$$1065a + 876r = 1,000,000.$$

