Answers to the Problems – Chapter 2

1. a. Wendell’s opportunity cost of an hour of tennis is 2.5 percentage points. When Wendell increases the time he plays tennis from 4 hours to 6 hours, his grade in economics falls from 75 percent to 70 percent. His opportunity cost of 2 hours of tennis is 5 percentage points. So his opportunity cost of 1 hour of tennis is 2.5 percentage points.

   b. Wendell’s opportunity cost of an hour of tennis is 5 percentage points. When Wendell increases the time he plays tennis from 6 hours to 8 hours, his grade in economics falls from 70 percent to 60 percent. His opportunity cost of 2 hours of tennis is 10 percentage points. So his opportunity cost of 1 hour of tennis is 5 percentage points.

2. a. Wendell’s grade in economics is 66 percent. When Wendell increases the time he plays tennis from 4 hours to 6 hours, his opportunity cost of the additional 2 hours of tennis is 5 percentage points. So his opportunity cost of an additional 1 hour is 2.5 percentage points. Plot this opportunity cost at 5 hours on the graph (the midpoint between 4 and 6 hours). When he increases the time he plays tennis from 6 hours to 8 hours, his opportunity cost of the additional 2 hours of tennis is 10 percentage points. So his opportunity cost of the additional 1 hour of tennis is 5 percentage points. Plot this opportunity cost at 7 hours on the graph (the midpoint between 6 and 8 hours). When he increases the time he plays tennis from 8 hours to 10 hours, his opportunity cost of the additional 2 hours of tennis is 20 percentage points. So his opportunity cost of the additional 1 hour of tennis is 10 percentage points. Plot this opportunity cost at 9 hours on the graph (the midpoint between 8 and 10 hours). Wendell’s opportunity cost of playing tennis increases as he spends more time on tennis. Join the points plotted. This curve is Wendell’s marginal cost of an additional hour of tennis.

   Wendell uses his time efficiently if he plays tennis for 7 hours a week because when he plays 7 hours a week his marginal benefit from tennis equals its marginal cost. Wendell’s marginal benefit is 5 percentage points and his marginal cost is 5 percentage points. When Wendell plays 7 hours of tennis, his grade in economics (from his PPF) is 66 percent.

   b. If Wendell studied for enough hours to get a higher grade, he would have fewer hours to play tennis. Wendell’s marginal benefit from tennis would be greater than his marginal cost, so he would be more efficient (better off) if he played more hours of tennis and took a lower grade.

3. a. Sunland’s PPF is a straight line. To make a graph of Sunland’s PPF, measure the quantity of one good on the x-axis and the quantity of the other good on the y-axis. Then plot the quantities in each row of the table and join the points.

   b. The opportunity cost of 1 pound of food is 1/2 gallon of sunscreen. The opportunity cost of the first 150 pounds of food is 75 gallons of sunscreen. To find the opportunity cost of the first 150 pounds of food, increase the quantity of food from 0 pounds to 150 pounds. In doing so, Sunland’s production of sunscreen decreases from 150 gallons to 75 gallons. The opportunity cost of the first 150 pounds of food is 75 gallons of sunscreen. Similarly, the opportunity costs of producing the second 150 pounds of food is 75 gallons of sunscreen. So the opportunity cost of 1 pound of food is 75 gallons of sunscreen/150 pounds of food, or 1/2 gallon of sunscreen per pound of food.

   c. The opportunity cost of 1 gallon of sunscreen is 2 pounds of food. The opportunity cost of producing the first 75 gallons of sunscreen is 150 pounds of food. To calculate this opportunity cost, increase the quantity of sunscreen from 0 gallons to 75 gallons. Sunland’s production of food decreases from 300 pounds to 150 pounds. Similarly,
the opportunity cost of producing the second 75 gallons of sunscreen is 150 pounds of food. So the opportunity cost of 1 gallon of sunscreen is 150 pounds of food/75 gallons of sunscreen, or 2 pounds of food per gallon of sunscreen.

4. a. The marginal benefit curve slopes downward.
   To draw the marginal benefit from sunscreen, plot the quantity of sunscreen on the x-axis and the willingness to pay for sunscreen (that is, the number of pounds of food that they are willing to give up to get a gallon of sunscreen) on the y-axis.
   b. The efficient quantity is 75 gallons a month.
   The efficient quantity to produce is such that the marginal benefit from the last gallon equals the opportunity cost of producing it. The marginal cost of a gallon of sunscreen is 2 pounds of food. The marginal benefit of the 75th gallon of sunscreen is 2 pounds of food. So the marginal benefit equals marginal cost when Sunland produces 75 gallons of sunscreen per month.

5. a. The PPF will have the quantity of wheat on one axis and the quantity of pork on the other axis. The PPF will be bowed outward from the origin.
   b. The PPF will shift outward so that the maximum quantity of pork increases but the maximum quantity of wheat does not change. The PPF will remain bowed outward from the origin.
   c. The opportunity cost of a ton of wheat has increased because the new technology means that more pork must be forgone for each ton of wheat. In the PPF diagram, if the quantity of wheat is measured along the horizontal axis, the opportunity cost of a ton of wheat equals the slope of the PPF. With the new technology, the PPF has shifted so that the magnitude of the slope is larger, which means that the opportunity cost of a ton of wheat is larger. If the quantity of wheat is measured along the horizontal axis, the opportunity cost of a ton of wheat equals the reciprocal of the slope. With the new technology, the PPF has shifted so that the magnitude of the slope is smaller, which means that the opportunity cost of a ton of wheat is larger.
   d. As long as the farm produces on its PPF, it is production efficient both before and after the change in technology.

6. a. Tom’s opportunity cost of producing a ball is 4 bats/40 balls, or 0.10 bats per ball.
   b. Tessa’s opportunity cost of producing a ball is 4 bats/80 balls, or 0.05 bats per ball.
   c. Tessa has the comparative advantage in producing balls because her opportunity cost of a ball is lower than Tom’s opportunity cost.
   d. Both Tom and Tessa gain from the specialization and trade.
   Tom specializes in producing bats and Tessa specializes in producing balls. Tom produces 4 bats per hour and Tessa produces 80 balls, for total production of 4 bats and 80 balls. If neither specialized and both spent half their time producing balls and the other half producing bats, Tom would produce 2 bats and 20 balls and Tessa would produce 2 bats and 40 balls. The total production would be 4 bats (2 from Tom and 2 from Tessa) and 60 balls (20 from Tom and 40 from Tessa). Specialization means that Tom can trade 2 bats for 30 balls and so have 2 bats and 30 balls, 10 more balls than the case without specialization and trade. Tessa would have 2 bats and 50 balls, (also) 10 more balls than the case without specialization and trade.
   e. Tessa has the comparative advantage in producing bats.
   Tom’s opportunity cost of a bat is 40 balls/4 bats, or 10 balls per bat. Tessa’s opportunity cost of a bat is 80 balls/20 bats or 4 balls per bat. Tessa has the comparative advantage in
producing bats because her opportunity cost of producing a bat is lower than Tom’s opportunity cost of producing a bat.

f. Tom and Tessa can still gain from trade if each specializes in his or her comparative advantage (Tom in balls, Tessa in bats) and then trades.

g. Tessa specializes in bats and is definitely willing to trade 1 bat for 15 balls because her opportunity cost of producing a bat is only 4 balls. Tom, however, is not willing to pay Tessa 15 balls for a bat because his cost of producing a bat is only 10 balls. Tom can produce bats at a lower cost than 15 balls per bat. The price of a bat will settle so that it is less than Tom’s opportunity cost of producing a bat and more than Tessa’s opportunity cost of producing a bat.

**Critical Thinking**

1. a. The allocatively efficient point on the PPF is the point where the marginal benefit of education goods and services equals the marginal cost of education goods and services. The marginal cost of education goods and services can be derived from the PPF and equals the reciprocal of the magnitude of the slope of the PPF curve. The marginal benefit depends on the person’s views about the marginal benefits from education. The allocatively efficient quantity of education is the point where the upward sloping marginal cost curve intersects the downward sloping marginal benefit curve.

b. If the cost of tuition rises, the PPFs shift downward so that the maximum quantity of consumption goods and services does not change but the maximum quantity of education goods and services decreases. The PPFs become flatter, which indicates that the opportunity cost of education goods and services rises. The higher opportunity cost of education decreases the quantity of education goods and services people consume.

c. If a person reaps all the marginal benefits and pays all the marginal costs from education, then the person likely obtains an efficient quantity of education. But if the person does not reap all the benefits or if the person does not pay all of the marginal costs of if the person miscalculates either the marginal benefits or the marginal costs, then the quantity of education consumed is not efficient.

2. a. Before the war the South had a comparative advantage in producing cotton.

b. The PPF will have the quantity of cotton on one axis and the quantity of food and manufactured goods on the other axis. The production point has the South producing a great deal of cotton and very little food and manufactured goods; indeed, in the unlikely case that the South completely specialized, the production point is at the maximum quantity of cotton and zero food and manufactured goods. From the production point a trade line with a negative slope touches the PPF and extends beyond the PPF. The trade line shows that the South traded cotton for manufacturing goods and food and consumed at a point beyond its PPF.

c. Assuming that the Civil War did not affect the South’s PPF (which was likely true only for the first part of the war) the North’s blockade meant that the South could no longer trade with others. As a result, the South increased its production of manufacture goods (especially munitions) and food, which caused the South to decrease its production of cotton. The blockade forced the South’s consumption point to lie on its PPF, so the South’s consumption of manufactured goods and food decreased.

d. The Civil War increased the opportunity cost of food and manufactured goods. However it decreased the opportunity cost of cotton.
The opportunity cost of cotton decreased because the blockade lead the South to produce less cotton. Moving along a PPF, as less of a good is produced, its opportunity cost falls.

3. a. The United States does not have a comparative advantage in producing ethanol. In the United States, $1.00 worth of other goods and services must be foregone for a gallon of ethanol whereas in Brazil only $0.90 of other goods and services must be foregone for a gallon of ethanol.

b. If there are no technological changes in the production of ethanol so that the PPF between ethanol and other goods and services does not shift, then the opportunity cost of producing ethanol in the United States will increase as more ethanol is produced.

c. The United States could gain from trade with Brazil by importing ethanol from Brazil. Brazil produces ethanol at lower opportunity cost than the United States, so the opportunity cost to the United States of consuming ethanol would be lower if the United States consumed ethanol produced in Brazil.

4. a. The PPFs might be linear, though more realistic PPFs would be bowed out from the origin. The important point about the two PPFs is that the opportunity cost of producing tea is lower in India. If tea is measured along the horizontal axis, the magnitude of the slope of the PPF is equal to the opportunity cost of producing tea, so in this case the U.S. PPF would be steeper than the Indian PPF.

b. The downward sloping marginal benefit curve for tea has shifted rightward after more baby-boomers have started to appreciate tea.

c. The United States imports tea.

d. If the PPF in India between tea and other goods and services is bowed out from the origin, increasing the production of tea raises the opportunity cost of producing tea. The opportunity cost of cotton decreased because the blockade lead the South to produce less cotton. Moving along a PPF, as less of a good is produced, its opportunity cost falls.