

This entire set is one case. The case illustrates the material in Chapters 14, 15, 16, 17, 18, and 24. The numbers in later parts of the case refer back to numbers you develop in the earlier parts. KEEP YOUR ANSWERS TO EACH PART SO THAT YOU CAN REFER BACK AS NEEDED.

Economics 102 Case Part 1 (Chapter 14) Name _____

Today, you have purchased a company manufacturing widgets. You own a building and the machinery needed to produce widgets. You must also hire workers to assemble and package the widgets. In this case, the numbers will be kept simple. All of your calculations should involve relatively easy numbers. The numbers are not meant to be realistic. But they will illustrate all of the key economic principles of Chapters 14, 15, 16, 17, 18, and 24. The time frame in this case will be **“per day”**.

Let us examine the costs. Let us assume that we hire **53 full-time workers** (or the equivalent). Each is paid **\$100 per day**, making the **labor cost equal \$5,300 per day**. In this case, we will **ignore the costs of the natural resources**. The company has buildings and machinery. Our measure of cost here is the part of the building and machines used up (called **depreciation**). Let us assume that **the cost of all of this capital for the year is \$320 per day**. Finally, let us assume that you paid \$1,460,000 for business; this money could have been earning **10% interest** per year. We shall assume here that you do not work in this business. **The interest that could have been earned** comes to \$146,000 (10% of \$1,460,000) per year, or **\$400 per day**. (All of the numbers in our case are “per day”)

The **explicit costs** of owning this company are \$_____.

The **implicit costs** of owning this company are \$_____.

The **variable costs** of owning this company are \$_____.

The **fixed costs** of owning this company are \$_____.

The **total economic cost** of owning this company is \$_____.

If we assume that we **sell 5 widgets each day** at a price of **\$1,500 per widget**, the business would receive total revenue of \$7,500 (5 times \$1,500). We would say that the **economic profit** is equal to \$_____.

What does this mean?

SHOW ALL CALCULATIONS.

Economics 102 Case Part 2 (Chapter 14) Name _____

1. The following table describes the relation between the number of widgets sold per day and the number of workers hired. This relation is known as a **production function**.

Number of Workers	Number of Widgets Per Day
0	0
10	1
18	2
27	3
40	4
55	5
72	6

In the table below, calculate the **average physical product** and the **marginal physical product**. **The average physical product is the total production divided by the total number of workers. The marginal physical product is the change in the total production divided by the change in the number of workers.**

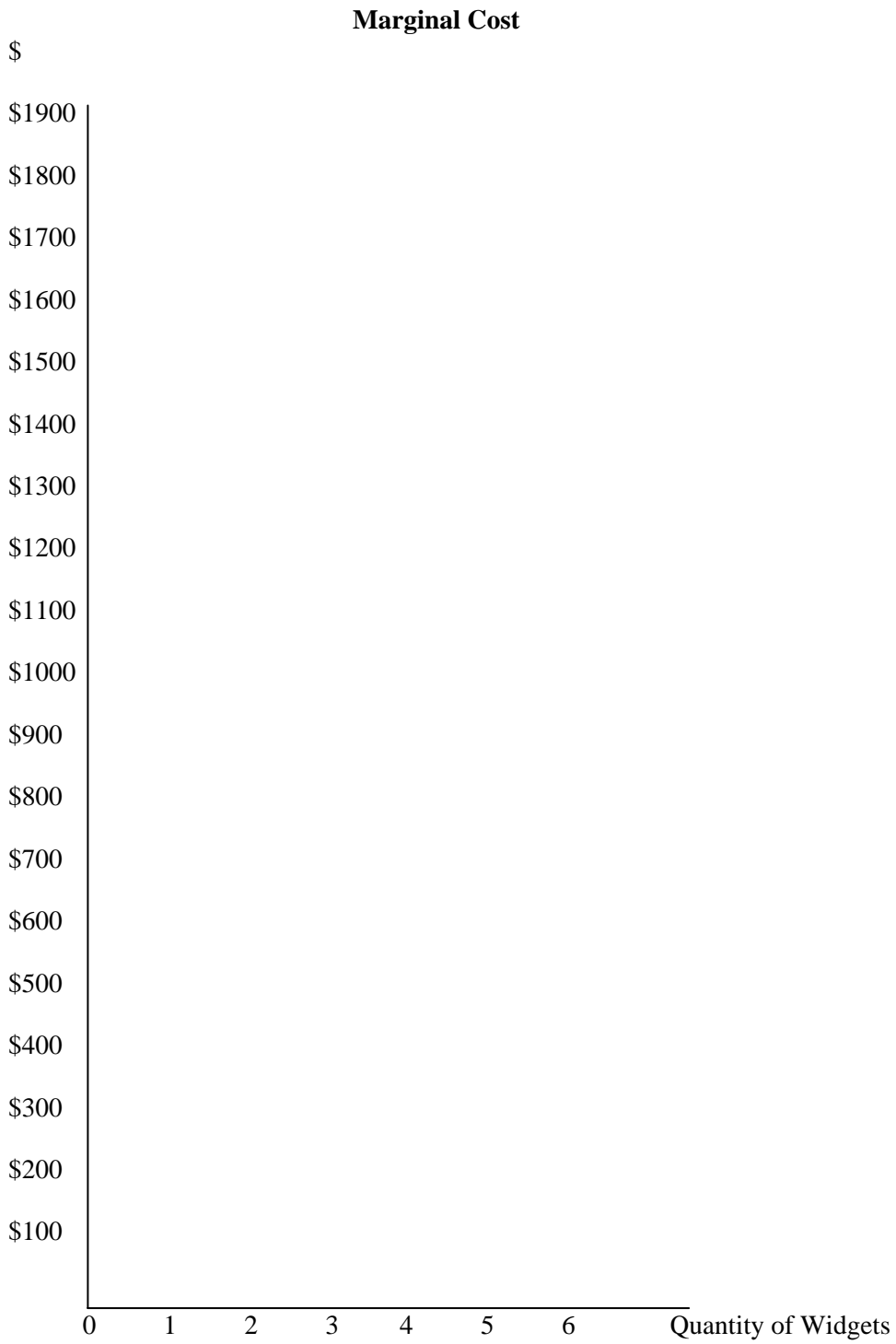
Number of Workers	Average Physical Product	Marginal Physical Product
10	1/10	1/10
18		
27		
40		
55		
72		

Hint: The first answer is given to you. The average physical product is 1/10 because the total production is 1 and the number of workers is 10. $1 \text{ divided by } 10 = 1/10$. The number is 1/10 for **each** worker because it takes 10 workers to produce one widget. The marginal physical product is 1/10 because the change in production is 1 (the change from 0 to 1) and the change in the number of workers is 10 (0 to 10). $1 \text{ divided by } 10 = 1/10$. **It took an addition of 10 workers to increase production by one widget.** Now do the same with the rest of the table.

2. Assume, as in Part 1, that each worker is paid \$100 per day by your company. Since we are ignoring the cost of the natural resources, the Labor Cost is equal to the Total Variable Cost. Fill in the table on the next page in order to calculate the marginal cost. **Remember that the marginal cost is the change in the total cost divided by the change in the quantity produced.**

<u>Quantity</u>	<u>Labor Cost = Total Variable Cost</u>	<u>Marginal Cost</u>
1		
2		
3		
4		
5		
6		

3. Using the numbers in question 2, draw a **graph** of the marginal cost curve.



- Using the table on page 2 (average physical product and marginal physical product), up to how many widgets are there **increasing marginal returns**?

What **reasons** can you give as to why there might be increasing marginal returns?

- Using the same table, show where there are **diminishing marginal returns**.

Give some **reasons** why there might be diminishing marginal returns.

- Examine your two tables. When **the marginal physical product is rising**, the **marginal cost** is _____. And when the **marginal physical product is falling**, the **marginal cost** is _____. (Answer “rising” or “falling”.)

Economics 102 Case Part 3 (Chapter 14) Name _____

1. A. The **Total Variable Cost**, in this case, is the only cost of the labor. The workers are paid \$100 per day. The numbers are repeated below. **Calculate the average variable cost.**

Quantity of Widgets	Total Variable Cost	Average Variable Cost
0	0	
1	(10 x \$100) = \$1,000	
2	(18 x \$100) = \$1,800	
3	(27 x \$100) = \$2,700	
4	(38 x \$100) = \$3,800	
5	(53 x \$100) = \$5,300	
6	(72 x \$100) = \$7,200	

B. **Explain why** the average variable cost **decreases** from producing 1 widget to producing 3 widgets.

C. Then, **explain why** the average variable cost **increases** when four or more widgets are produced.

D. Finally, plot the numbers on the **graph** at the end of this part.

2. A. We must also consider the fixed cost. The fixed costs are generally the costs of the capital and the implicit costs. In Part I, the cost of the capital was given as \$320 per day and the implicit cost was given as \$400 per day. Therefore, the Total Fixed Cost is \$720 per day. **Calculate the average fixed cost** in the following table.

Quantity of Widgets	Total Fixed Cost	Average Fixed Cost
0	\$720	-----
1	720	
2	720	
3	720	
4	720	
5	720	
6	720	

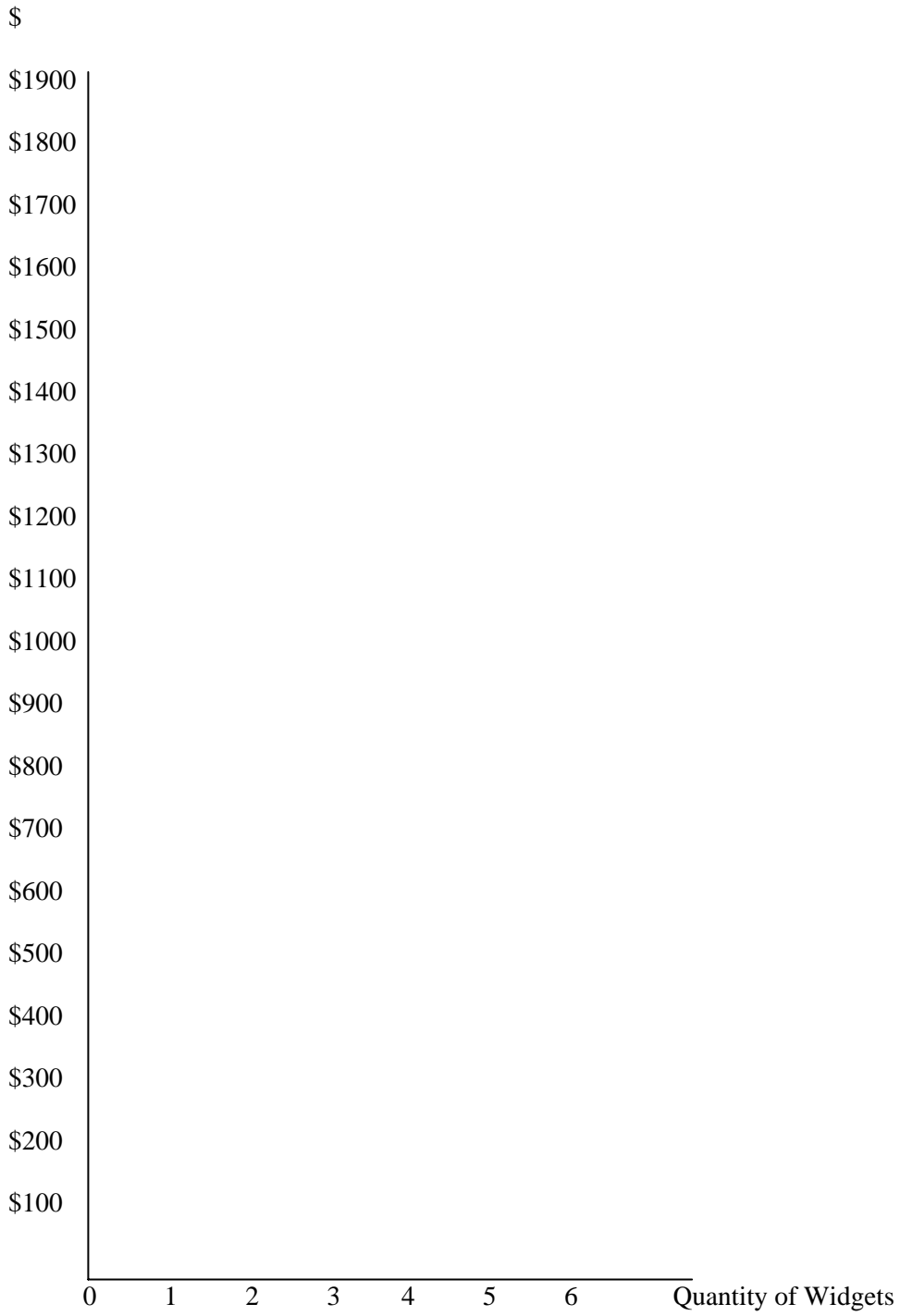
B. Plot the numbers on the **graph** at the end of this part.

3. A. Now we are ready to examine the **average total cost** --- the cost of producing each pound of oranges. Calculate the average total cost from the following table.

Quantity of Widgets Per Day	Total Cost	Average Total Cost
0	\$ 720	
1	1,720	
2	2,520	
3	3,420	
4	4,520	
5	6,020	
6	7,920	

- B. Plot the points on the **graph** at the end of this part.
- C. Notice that Average Total Cost has a U - shape. First, **explain why it declines** up to 4 widgets per day. Consider the factors affecting both the average variable cost and the average fixed cost.
- D. Then, **explain why Average Total Cost rises** after producing 4 widgets per day.
4. In Part 2, you calculated the **Marginal Cost**. The numbers are repeated below. Compare these numbers with the Average Variable Cost numbers and with the Average Total Cost numbers.
- | <u>Quantity</u> | <u>Labor Cost = Total Variable Cost</u> | <u>Marginal Cost</u> |
|-----------------|---|----------------------|
| 1 | \$1,000 | \$1,000 |
| 2 | 1,800 | 800 |
| 3 | 2,700 | 900 |
| 4 | 3,800 | 1,100 |
| 5 | 5,300 | 1,500 |
| 6 | 7,200 | 1,900 |
- A. When the average variable cost is falling, the marginal cost is _____ the average variable cost. When the average variable cost is rising, the marginal cost is _____ the average variable cost. (Answer “below” or “above”)
- B. When the average total cost is falling, the marginal cost is _____ the average total cost. When the average total cost is rising, the marginal cost is _____ the average total cost. (Answer “below” or “above”)
- C. Plot the Marginal Cost on the same **graph** at the end of this Part.
5. In the number set above, when we increased production from 3 widgets to 4 widgets, the **marginal cost rose but the average variable cost and the average total cost both fell**. How do you explain this?
6. Explain why there is no relation between the Marginal Cost and the Average Fixed Cost.

COST CURVES



Economics 102 Case Part 4 (Chapter 15) Name _____

Go back to Part 3. The numbers are repeated below:

Quantity	Total Variable Cost	Total Fixed Cost	Total Cost	Average Variable Cost	Average Fixed Cost	Average Total Cost
0	0	\$720	\$720	----	----	----
1 (10 x \$100) =	\$1,000	\$720	\$1,720	\$1,000	\$ 720	\$1,720
2 (18 x \$100) =	\$1,800	\$720	\$2,520	\$ 900	\$ 360	\$1,260
3 (27 x \$100) =	\$2,700	\$720	\$3,420	\$ 900	\$ 240	\$1,140
4 (38 x \$100) =	\$3,800	\$720	\$4,520	\$ 950	\$ 180	\$1,130
5 (53 x \$100) =	\$5,300	\$720	\$6,020	\$1,060	\$ 144	\$1,204
6 (72 x \$100) =	\$7,200	\$720	\$7,920	\$1,200	\$ 120	\$1,304

A. Now, let us consider two choices in the amount of capital. One is the choice we have used above. Call this Size 1. The other is a larger building with more machinery. Call this Size 2. For Size 2, the total amount of capital and implicit cost is now \$900, instead of \$720. The larger amount of capital means that we do not need as many workers. The machinery can do some of the work that people were previously doing. And the additional machinery makes the remaining workers more productive. Let us assume that the reduced need for labor lowers the Total Variable Cost as shown in the table below. **Calculate the new Average Fixed Cost, the new Average Variable Cost, and the new Average Total Cost for Size 2.**

Quantity	Total Variable Cost	Total Fixed Cost	Total Cost	Average Variable Cost	Average Fixed Cost	Average Total Cost
0	0	\$900	\$900	----	----	----
1 (9 x \$100) =	\$ 900	\$900	\$1,800			
2 (17 x \$100) =	\$1,700	\$900	\$2,600			
3 (24 x \$100) =	\$2,400	\$900	\$3,300			
4 (34 x \$100) =	\$3,400	\$900	\$4,300			
5 (48 x \$100) =	\$4,800	\$900	\$5,700			
6 (63 x \$100) =	\$6,300	\$900	\$7,200			

B. Show the **graph** of the original Average Total Cost curve for Size 1 and the new Average Total Cost curve for Size 2 on the graph at the end of Part 4 (on Page 10)

C. Up to _____ widgets per day, it is cheaper to produce with Size 1. Above this quantity, it is cheaper to produce with Size 2. Show the relevant portions of the two Average Total Cost curves in the **graph** at the end of Part 4.

D. Notice also that Size 2, if utilized sufficiently, will allow us to produce at a lower possible cost than Size 1. That is, with Size 2, if we produce and sell 4 widgets per day, we can produce each widget at a cost \$1,080 each. There is no way we can produce a widget at a cost this low with the Size 1. This phenomenon is called _____.

E. Now assume there is an even larger amount of capital, called Size 3. For Size 3, the total amount of capital and implicit cost is now \$1,120, instead of \$920. The larger amount of capital means that we do not need as many workers. The machinery can do some of the work that people were previously doing. And the additional machinery makes the remaining workers more productive. Let us assume that the reduced need for labor lowers the Total Variable Cost as shown in the table below. **Calculate the new Average Fixed Cost, the new Average Variable Cost, and the new Average Total Cost for Size 2.**

Quantity	Total Variable Cost	Total Fixed Cost	Total Cost	Average Variable Cost	Average Fixed Cost	Average Total Cost
0	0	\$1,120	\$1,120	-----	-----	-----
1 (8 x \$100) =	\$ 800	\$1,120	\$1,920			
2 (12 x \$100) =	\$1,200	\$1,120	\$2,320			
3 (15 x \$100) =	\$1,500	\$1,120	\$2,620			
4 (20 x \$100) =	\$2,000	\$1,120	\$3,120			
5 (35 x \$100) =	\$3,500	\$1,120	\$4,620			
6 (48 x \$100) =	\$4,800	\$1,120	\$5,920			

F. Show the **graph** of the Average Total Cost curve for Size 3 on the graph that you drew in Part B above (the one that already has the Average Total Cost curves for Size 1 and Size 2)

G. Above _____ widgets per day, it is cheaper to produce with Size 3. Show the relevant portions of the two Average Total Cost curves in the **graph** at the end of Part 4 (on Page 10). The portion you have shown is called the _____.

\$

\$1900

\$1800

\$1700

\$1600

\$1500

\$1400

\$1300

\$1200

\$1100

\$1000

\$900

\$800

\$700

\$600

\$500

\$400

\$300

\$200

\$100

0

1

2

3

4

5

6

Quantity of Widgets



Economics 102 Case Part 5 (Chapter 16) Name _____

1. In Part 3, you calculated the Marginal Cost for the Widget Company. The calculations are repeated below. Now assume that the company sells its product in perfect competition at a market price of \$1,500 per widget. Using the principles described in the reading, the profit-maximizing **quantity** is _____ and the **economic profit** is \$_____

SHOW ALL CALCULATIONS

Quantity	Price	Total Revenue	Marginal Revenue	Marginal Cost
1	\$1,500			\$1,000
2	\$1,500			\$ 800
3	\$1,500			\$ 900
4	\$1,500			\$1,100
5	\$1,500			\$1,500
6	\$1,500			\$1,900

2. On the graph on the next page, re-draw the Average Total Cost and the Marginal Cost as they were drawn in Part 3. Then, draw the **Marginal Revenue**. Show on the graph the profit-maximizing **quantity** as well as the **economic profits or losses**

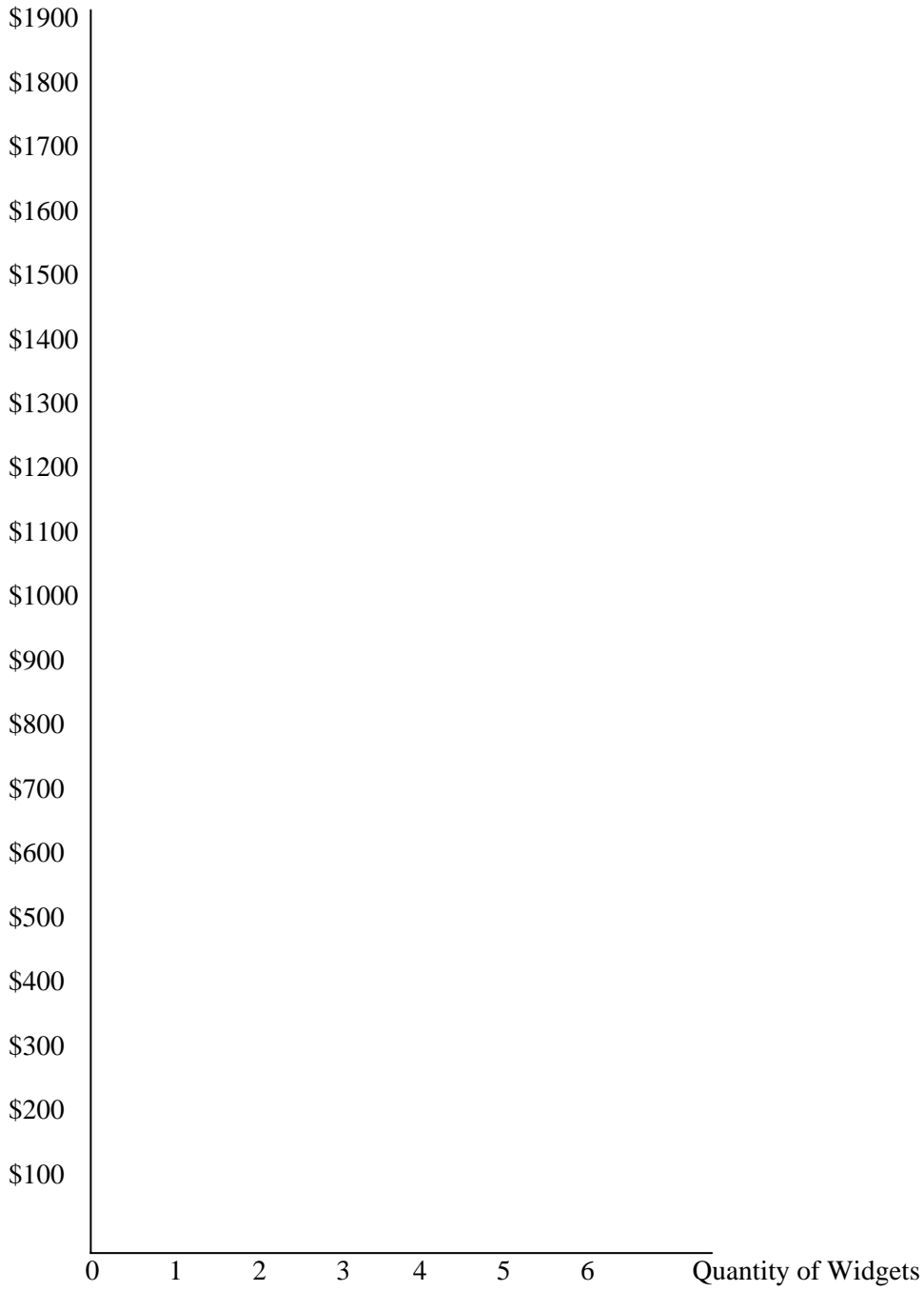
3. Now, assume that the company sells its product in perfect competition, but that the market price has fallen to \$1,100 per widget. Using the principles described in the reading, the profit-maximizing **quantity** is _____ and the **economic profit** is \$_____

SHOW ALL CALCULATIONS

Quantity	Price	Total Revenue	Marginal Revenue	Marginal Cost
1	\$1,100			\$1,000
2	\$1,100			\$ 800
3	\$1,100			\$ 900
4	\$1,100			\$1,100
5	\$1,100			\$1,500
6	\$1,100			\$1,900

4. Use the principles of Chapter 16 to answer the following question: since the company is making an **economic loss**, should it still continue to produce in the short-run or should it shut down? Explain why.

\$



5. Now assume that the company sells its product in perfect competition but that the market price has fallen to \$800 per widget. Using the principles described in the reading, the profit-maximizing **quantity** is _____ and the **economic profit** is \$_____.

SHOW ALL CALCULATIONS

Quantity	Price	Total Revenue	Marginal Revenue	Marginal Cost
1	\$800			\$1,000
2	\$800			\$ 800
3	\$800			\$ 900
4	\$800			\$1,100
5	\$800			\$1,500
6	\$800			\$1,900

6. Use the principles of Chapter 16 to answer the following question for this new situation: since the company is making an **economic loss**, should it continue to produce in the short-run or should it shut down? Explain why.

7. What is the lowest price at which the company will continue to produce in the short-run, even though it is making an economic loss? _____

8. Fill in the following table. The **supply of one widget producer** is the number of widgets your company will produce at that price. Then, assume that there are **100 widget producers** in the industry and that each is exactly identical. The **industry supply** is the total supplied by all 100 producers. You are also given **the relevant part of a demand curve** for widgets.

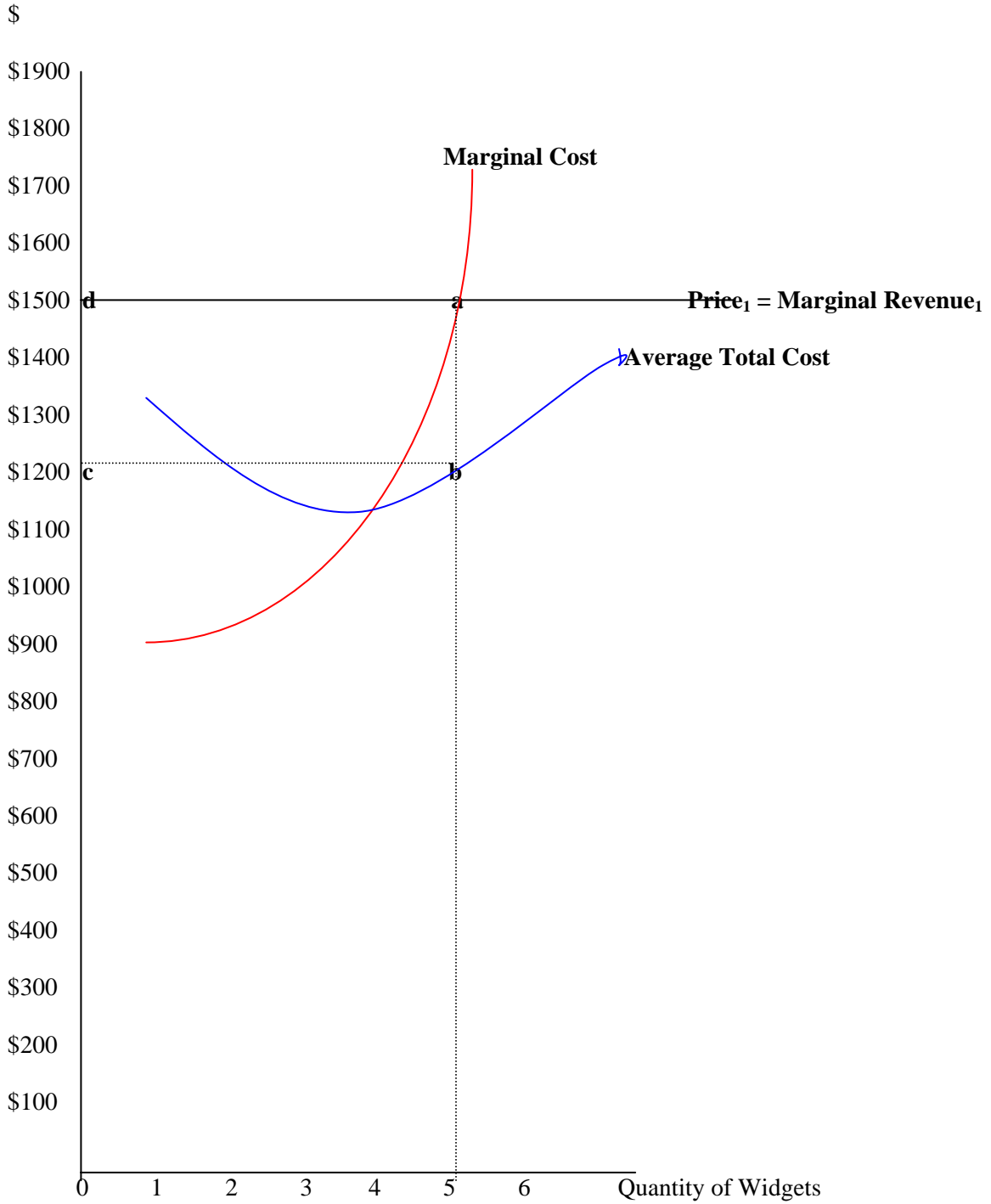
Price	Supply of One Producer	Industry Supply	Quantity Demanded
\$ 800			1,200
\$ 900			1,100
\$1,100			900
\$1,500			500
\$1,900			250

9. From this table, the **equilibrium price** of widgets is \$_____ and the **equilibrium quantity** of widgets is _____.

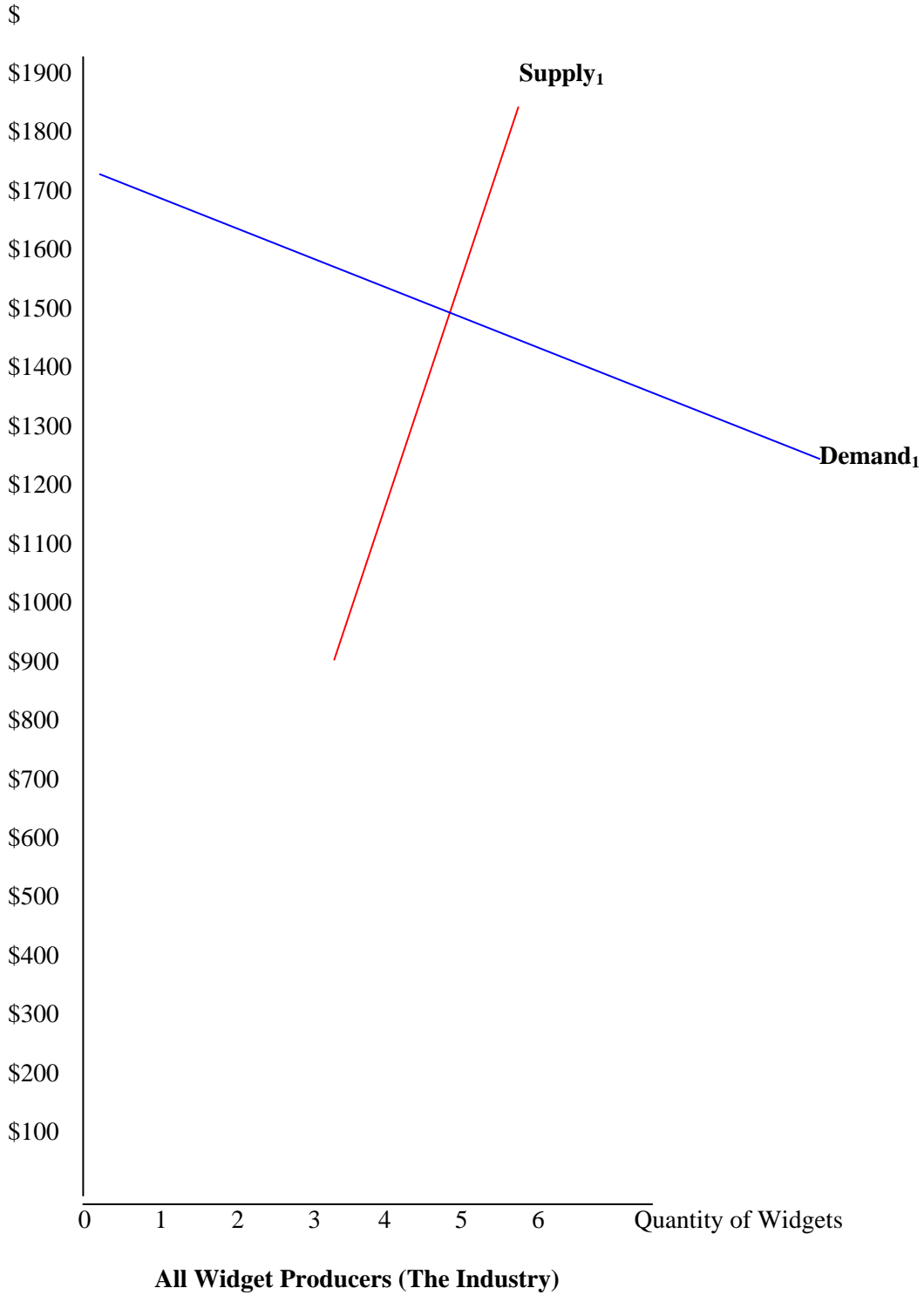
Economics 102 Case Part 6 (Chapter 17) Name _____

- In Part 5, you filled-in the following table. Assume again that there are 100 widget producers and that they are identical. You decided that the equilibrium price of oranges was \$1,500, that 500 widgets would be produced, and that the economic profits equaled \$1,480 for each of the 100 producers. The situation is shown on the **graphs** at the end of this Part.
- Now assume that the **demand for widgets rises**, because buyers' incomes rise. The new demand is shown on the table below as Quantity Demanded₂. What is the new equilibrium **price**? _____ What is the new equilibrium **quantity** of oranges? _____ What economic **profits** will each producer make in the short-run? _____ (To answer this, you have to look up the costs from Part 3.) Show the result of the rise in demand for oranges on the **graphs**.
- Now, explain what will occur in the **long-run**. **Why** will this occur? Show the changes of the long-run on the **graphs**.

Price	Supply of One Company	Industry Supply	Quantity Demanded ₁	Quantity Demanded ₂
\$ 800	0	0	1,200	1,600
\$ 900	3	300	1,100	1,500
\$1,100	4	400	900	1,300
\$1,500	5	500	500	900
\$1,900	6	600	250	650



One Typical Widget Producer



Economics 102 Case Part 7 (Chapter 17) Name _____

1. Return to the widget producer. In Part 1, the fixed costs were the costs of the capital, the land, and the opportunity costs of the owners. Let us assume that **these rise by \$720 from \$720 to \$1,440**. Everything else (the variable cost and the price of widgets) stays the same. The calculations now become as follows:

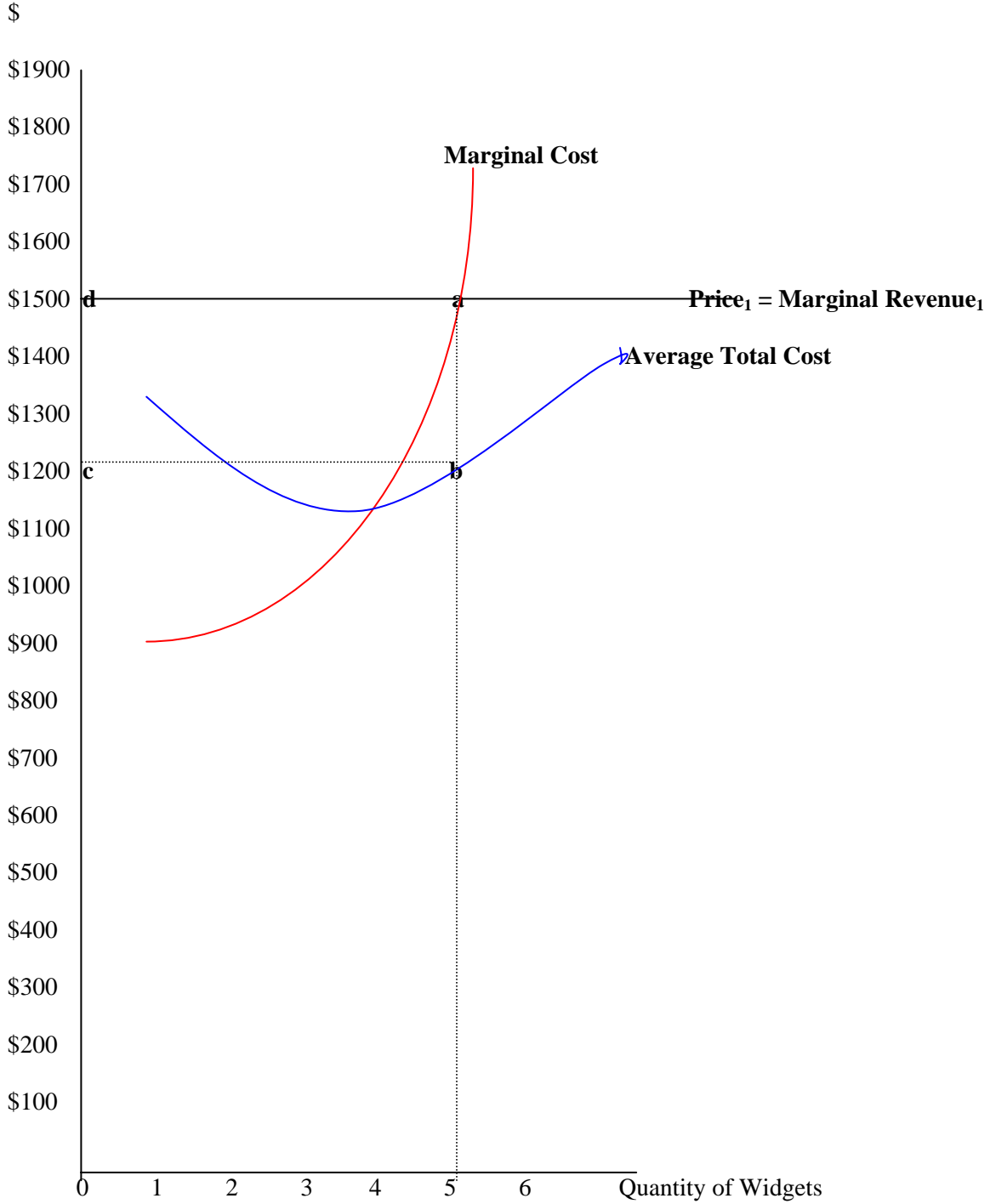
Quantity	Total Variable Cost	Total Fixed Cost	Total Cost	Average Total Cost	Marginal Cost	Marginal Revenue = Price
0	0	\$1,440	\$1,440			\$1,500
1	\$1,000	\$1,440	\$2,440			\$1,500
2	\$1,800	\$1,440	\$3,240			\$1,500
3	\$2,700	\$1,440	\$4,140			\$1,500
4	\$3,800	\$1,440	\$5,240			\$1,500
5	\$5,300	\$1,440	\$6,740			\$1,500
6	\$7,200	\$1,440	\$8,620			\$1,500

Compare these calculations to the earlier ones. On the **graphs** on the following pages, the situation for one widget producer and for all widget producers (the industry) is shown. Now, **show the results of the change in the fixed cost**.

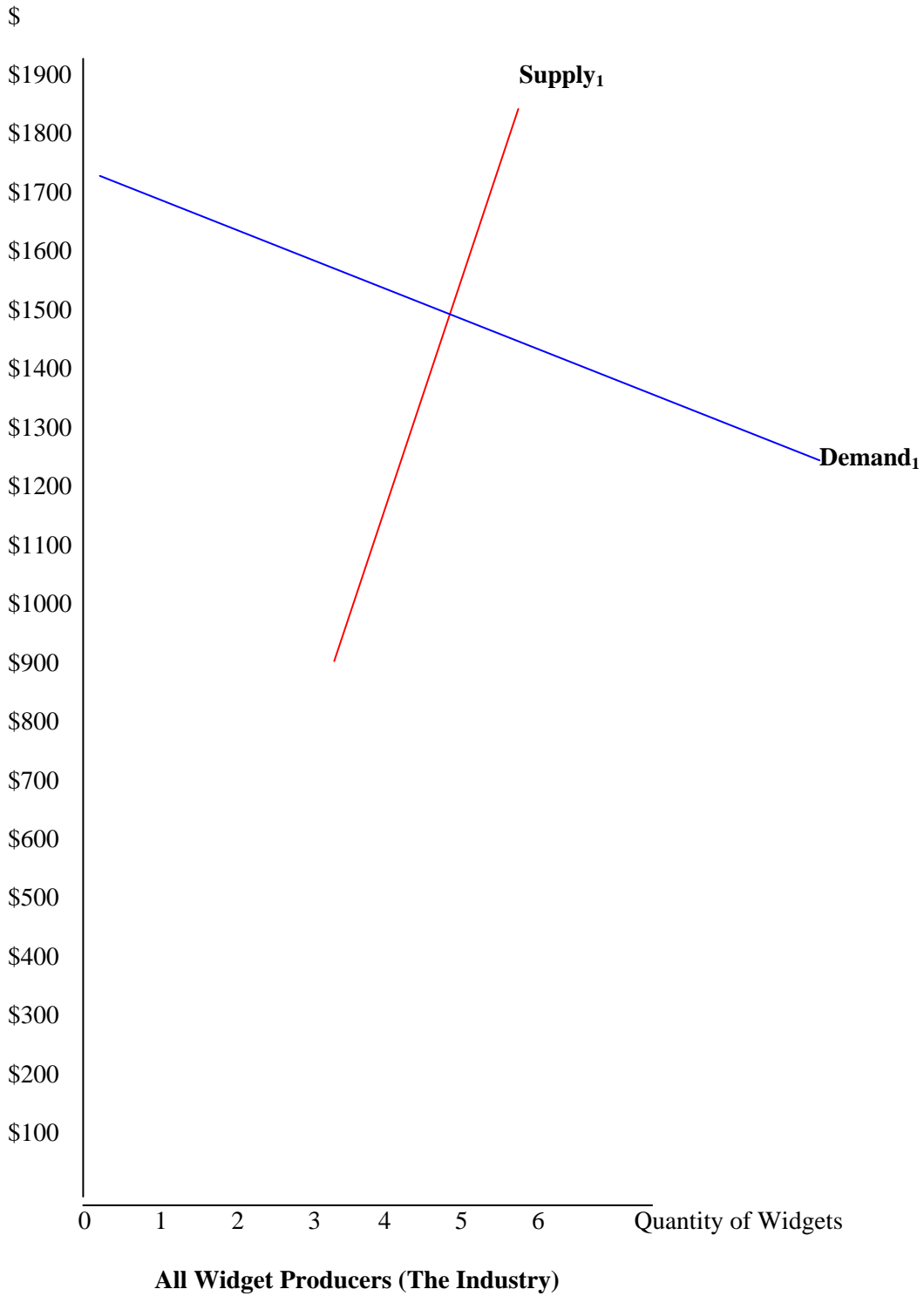
2. The company maximizes profits by producing _____ widgets. With 100 companies, the **market supply** is _____ widgets. **Economic profits** are now equal to _____.

3. In the **long-run**, the situation will change. New companies will be attracted by the economic profits being earned and will enter the industry. Show the results in the **long-run** on the **graphs**. In the space below, **explain what you did and what resulted**.

4. The long-run results of a decrease in a fixed cost are as follows: the quantity produced in the market is _____ and the market price is _____.



One Typical Widget Producer

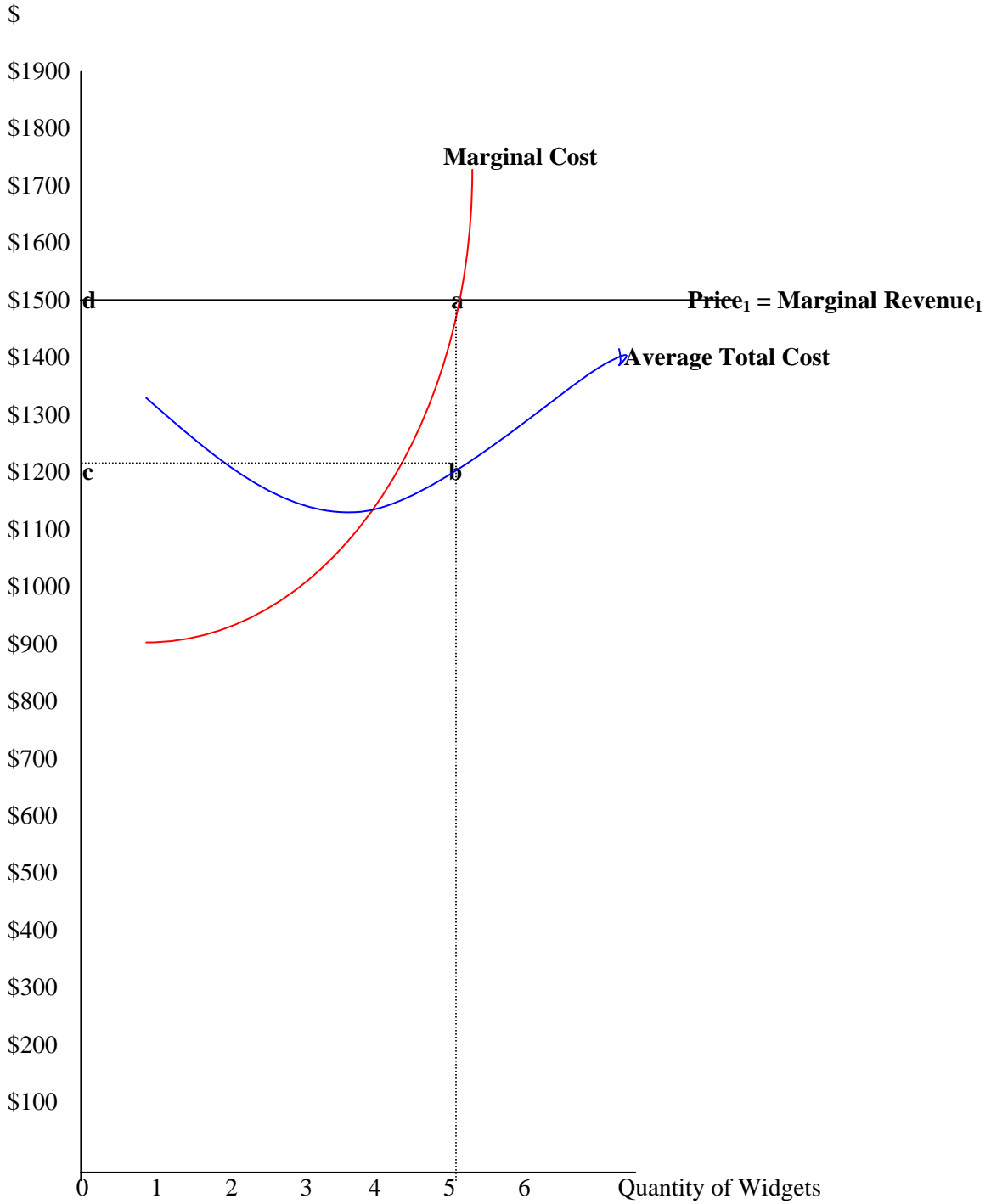


Economics 102 Case Part 8 (Chapter 17) Name _____

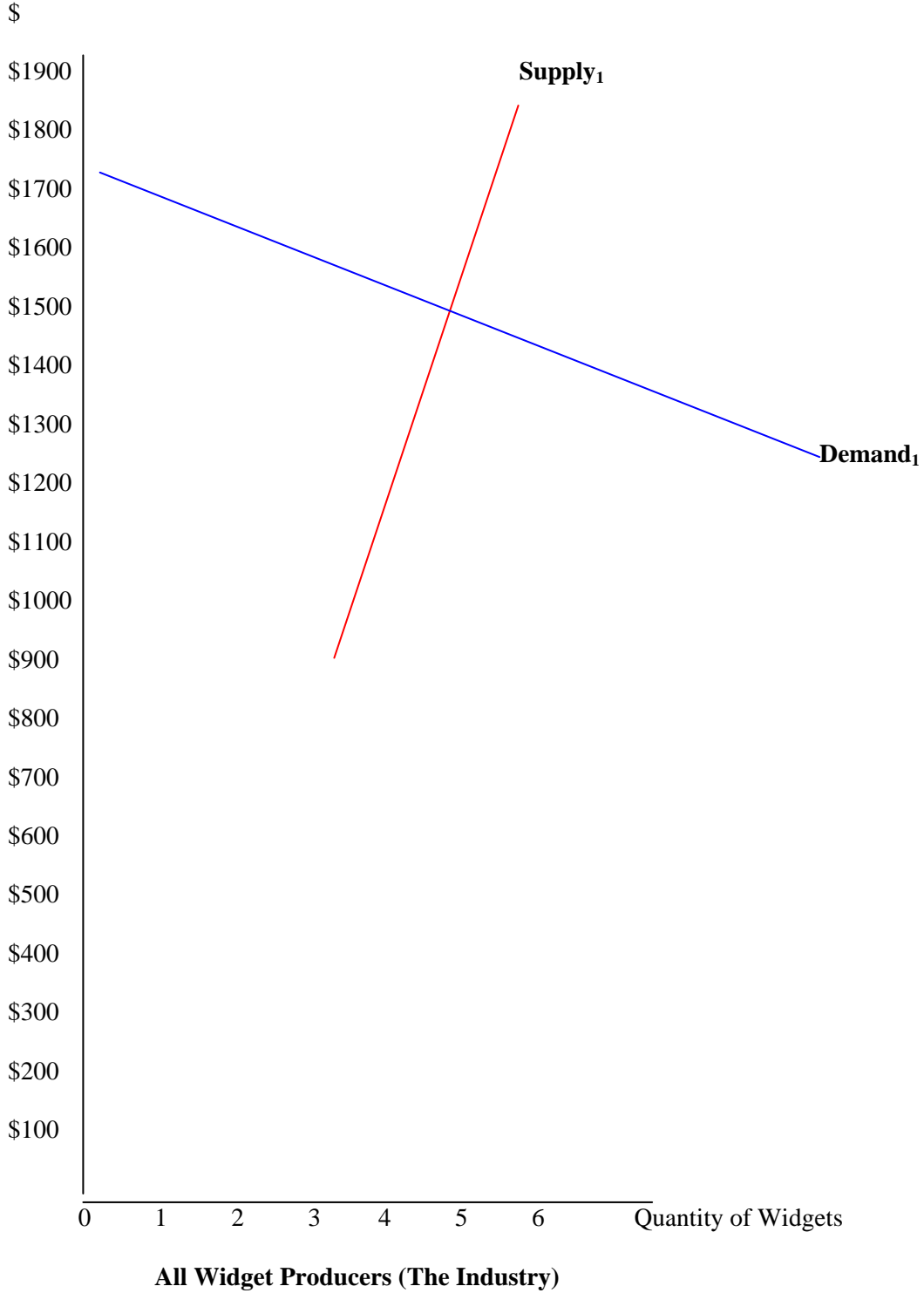
Now, let us consider a **decrease in a variable cost of production**. The variable cost, in this case, is the cost of the labor. Now, let us assume there is a productivity increase that reduces the cost of the labor. The results of the productivity increase were given in Part 4 and are reproduced here. Our calculations are now as follows:

Quantity	Total Variable Cost	Total Fixed Cost	Total Cost	Average Total Cost	Marginal Cost	Marginal Revenue = Price
0	0	\$ 720	\$ 720			\$1,500
1	\$900	\$ 720	\$1,620			\$1,500
2	\$1,700	\$ 720	\$2,420			\$1,500
3	\$2,400	\$ 720	\$3,120			\$1,500
4	\$3,400	\$ 720	\$4,120			\$1,500
5	\$4,800	\$ 720	\$5,520			\$1,500
6	\$6,300	\$ 720	\$7,020			\$1,500

1. Compare these calculations to the original calculations from Part 3. Show the changes in the **graphs** on the next pages.
2. The company will maximize profits at that quantity for which the marginal revenue equals the marginal cost. This is now _____ widgets. One company increasing the quantity produced will have no effect on the market. But if all companies increase the quantity produced, the result is to create a **surplus** in the market. Show the **change in supply** on the **graph** for all widget producers. The result is that the **price** of widgets _____ (rises or falls?). The individual company must now respond to the new price. Show the new price equals marginal revenue line. Then, show the **new quantity** produced by the typical company as point c. Show the **total industry equilibrium quantity** as point C. Show the individual producer's **economic profit** on the graph. The economic profit is now equal to \$_____ (remember that the economic profit is calculated as $(\text{Price} - \text{Average Total Cost}) \times \text{Quantity}$).
3. The analysis thus far has been confined to the short-run. In the **long-run**, there will be a response to the economic profits that are now being earned. New companies will _____ (enter or leave?) the industry. Show the change on the **graphs**. In the space below, explain what you did and **what happened to the price, the quantity produced, and the economic profits**.
4. When the new long-run equilibrium is reached, who benefits from the productivity increase that created the reduction in the variable cost of production?



One Typical Widget Producer



Economics 102 Case Part 9 (Chapter 18) Name _____

Now assume that all 100 widget producers are merged into one company, a **pure monopoly**. The **demand curve** for widgets was given in Part 5. Only part of it was given there. The rest is shown in the table below. (Notice that the quantity is now in the hundreds, because the 100 separate companies have been merged into one.)

The **average total cost** and the **marginal cost** were calculated in Part 3 and are repeated below as well. (Notice that each number you calculated in Part 3 has been multiplied by 100 because the 100 separate companies have been merged into one.)

In perfect competition, each of the 100 companies produced 5 widgets (500 in total) and each company earned \$1,480 in economic profits (\$1,480,000 in total).

Fill-in the table below. Remember that the Marginal Revenue is the *Change in the Total Revenue* divided by the *Change in the Quantity*

Quantity	Price	Total Revenue	Marginal Revenue	Average Total Cost	Marginal Cost
100	\$2,900			\$1,720	\$1,000
200	\$2,100			\$1,260	\$ 800
300	\$1,800			\$1,140	\$ 900
400	\$1,625			\$1,130	\$1,100
500	\$1,500			\$1,200	\$1,500
600	\$1,400			\$1,320	\$1,900

The **quantity** that the monopolist will choose in order to maximize profits is _____.
Explain the reason that this quantity will be produced.

The **price** that this monopolist will charge is \$_____.

The **economic profits** that this monopolist will earn will equal \$_____.
Show calculations.

Compared to perfect competition, using the same demand and the same costs of production, the quantity produced is _____, the price is _____, and the economic profits are _____. (Answer "**higher**" or "**lower**")

Economics 102 Case Part 10 (Chapter 23) Name _____

In Part 2, you were given a table describing the relation between the number of widgets sold per year and the number of workers hired. This was the **production function**. You were asked to calculate the marginal physical product (MPP). Refer back to Part 2.

Number of Workers	Number of Widgets Per Day
0	0
10	1
18	2
27	3
40	4
55	5
72	6

You were also given that the price of a widget is \$1,500 each and that the wage paid to each worker was \$100 per day. Assume that widgets are sold in a perfectly competitive product market and that the workers are hired in a perfectly competitive labor market.

In the table below, calculate the **marginal revenue product** & the **marginal resource cost**.

<u>Workers</u>	<u>MPP</u>	<u>Price</u>	<u>Marginal Revenue Product</u>	<u>Wage</u>	<u>Marginal Resource Cost</u>
10		\$1,500		\$100	
18		\$1,500		\$100	
27		\$1,500		\$100	
40		\$1,500		\$100	
55		\$1,500		\$100	
72		\$1,500		\$100	

This company will hire _____ workers because _____.

(Compare this to the number hired in Part 1.)