Chapter 6: Perfectly Competitive Supply

Wednesday, June 30

QUESTION 1 (quantity supplied, discrete)

emeralds	TC
1	50
2	150
3	350
4	750
5	1550

The table above gives my total cost schedule for supplying emeralds. If the market price of emeralds is $500, how many should I supply?

A) 1 B) 2 C) 3 D) 4 E) 5

answer to question 1

emeralds	TC	MC	P
1	50	50	500
2	150	100	500
3	350	200	500
4	750	400	500
5	1550	800	500

I can produce four emeralds with marginal cost less than $500, which is the price, A.K.A. the marginal revenue, A.K.A. my marginal benefit as a seller.

The table above gives my total cost schedule for supplying emeralds. If the market price of emeralds is $500, how many should I supply?

A) 1 B) 2 C) 3 D) 4 E) 5

QUESTION 2 (supply schedule, discrete)

emeralds	TC
1	50
2	150
3	350
4	750
5	1550

Which of the following gives my correct supply schedule for emeralds?

P	QS
0 - 1	0
1 - 2	1
2 - 3	2
3 - 4	3
4 - 5	4
> 5	5

(A)

P	QS
0 - 50	0
50 - 150	1
150 - 350	2
350 - 750	3
750 - 1550	4
> 1550	5

(B)

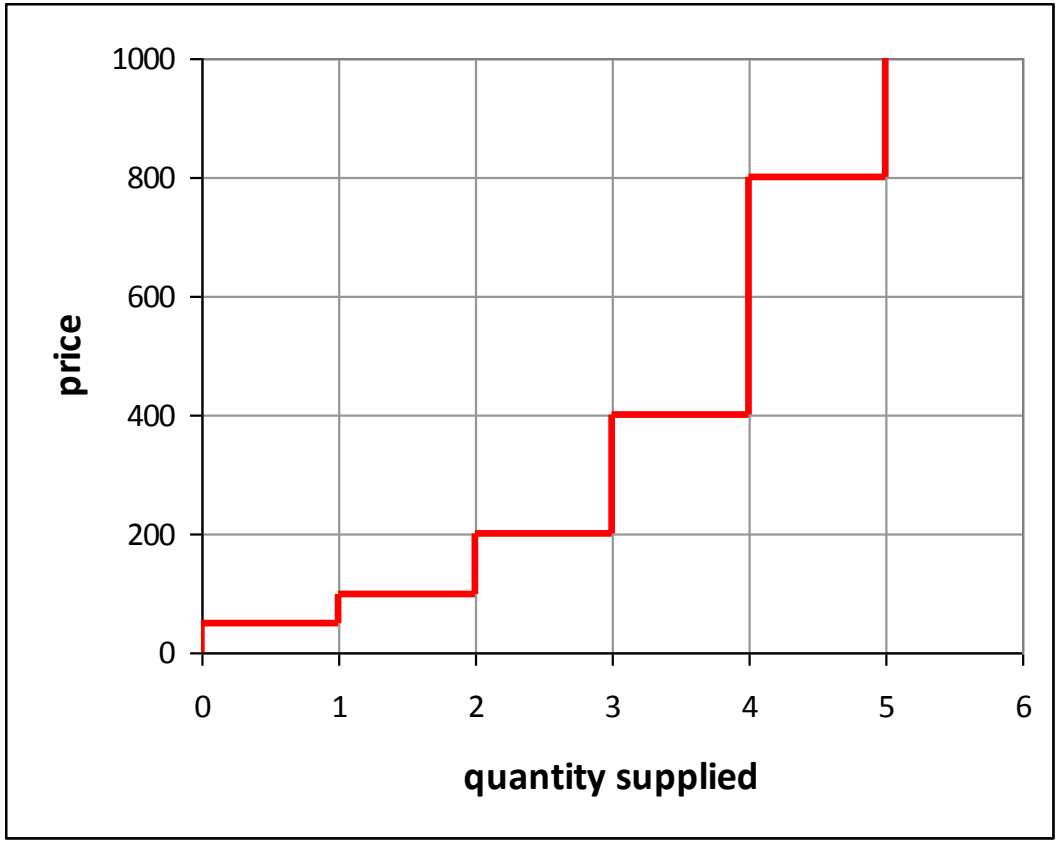
P	QS
> 1550	0
750 - 1550	1
350 - 750	2
150 - 350	3
50 - 150	4
0 - 50	5

(C)

P	QS
0 - 50	0
50 - 100	1
100 - 200	2
200 - 400	3
400 - 800	4
> 800	5

(D)

answer to question 2



emeralds	TC	MC
1	50	50
2	150	100
3	350	200
4	750	400
5	1550	800

P	QS
0 - 50	0
50 - 100	1
100 - 200	2
200 - 400	3
400 - 800	4
> 800	5

(D)

QUESTION 3 (producer surplus, discrete)

emeralds	TC
1	50
2	150
3	350
4	750
5	1550

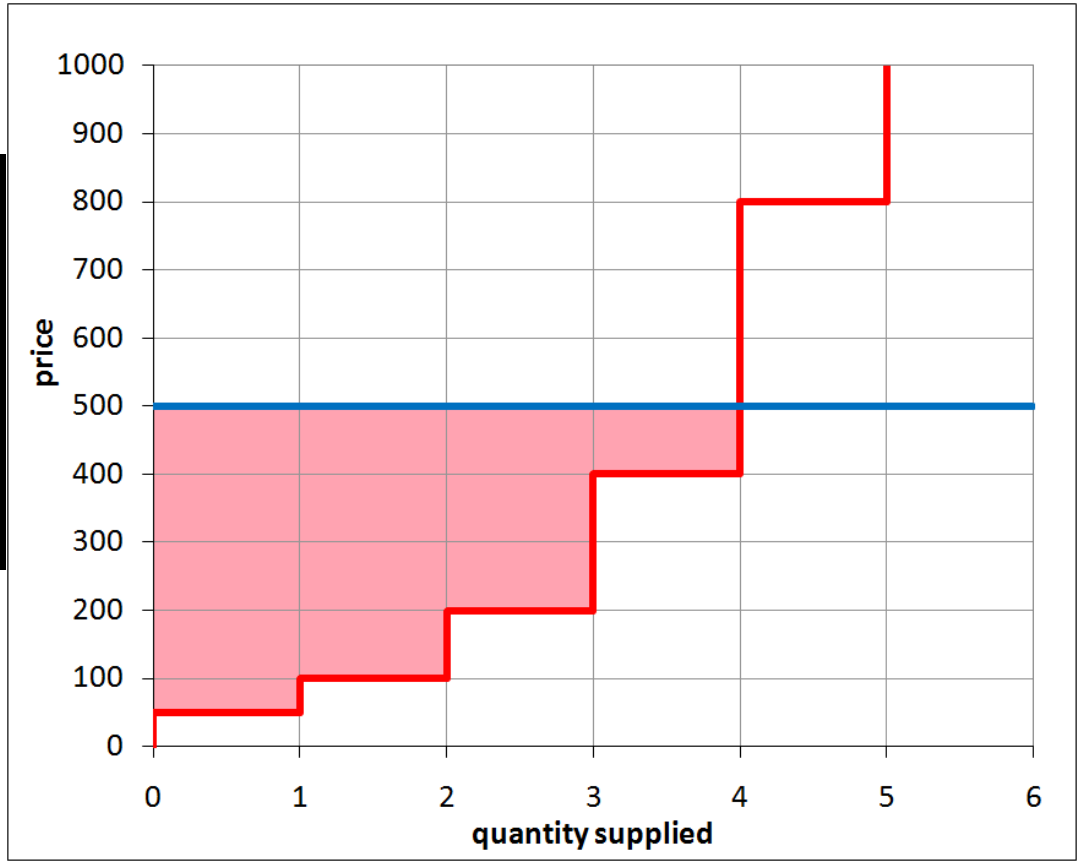
Producer surplus is total revenue minus total (non-fixed) costs.

If the market price of emeralds is $500, and I supply 4 emeralds, then how much producer surplus will I get?

A) $750 B) $1550 C) $4 D) $2000 E) $1250

answer to question 3

Q	TC	MC	TR	PS
1	50	50	500	450
2	150	100	1000	850
3	350	200	1500	1150
4	750	400	2000	1250
5	1550	800	2500	950



If the market price of emeralds is $500, and I supply 4 emeralds, then how much producer surplus will I get?

A) $750 B) $1550 C) $4 D) $2000 **E) $1250**

QUESTION 4 (quantity supplied, continuous)

Suppose that my marginal cost function for supplying homemade gravy is MC = 12 + 3Q, where MC is my marginal cost of supplying gravy (in dollar terms), and Q is the quantity of gravy that I produce, in gallons.

If the going price of gravy is $24 per gallon, then how many gallons of gravy should I supply?

A) 1 B) 1.5 C) 2 D) 3 E) 4

answer to question 4

MC(Q) = 12 + 3Q

MC(Q) = P

12 + 3Q = 24

3Q = 12

Q = 4

A) 1 **B) 1.5** **C) 2** **D) 3** **E) 4**

QUESTION 5 (producer surplus, continuous)

Suppose that my marginal cost function for supplying homemade gravy is MC = 12 + 3Q, where MC is my marginal cost of supplying gravy (in dollar terms), and Q is the quantity of gravy that I produce, in gallons.

If the going price of gravy is $24 per gallon, then I should supply 4 gallons of gravy. If I do so, what is my producer surplus?

A) 10 B) 18 C) 20 D) 24 E) 36

answer to question 5

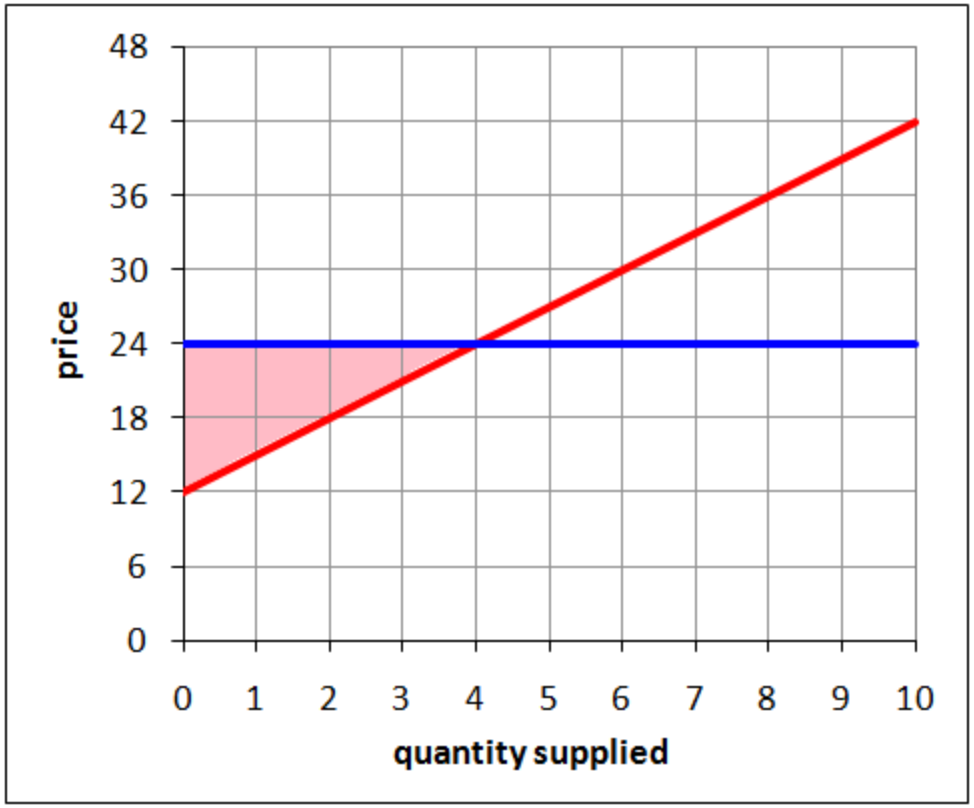
MC = 12 + 3Q

P = $24

$Q^* = 4$

PS = .5 × 4 × 12

PS = 24



A) 10 B) 18 C) 20 **D) 24** E) 36

QUESTION 6 (supply curve, continuous)

Again, my marginal cost function for supplying homemade gravy is MC = 12 + 3Q.

Which of the following gives my supply curve?

A) $Q_S = P/3 - 4$

B) $Q_S = 12 + 3P$

C) $Q_S = 12 - 3P$

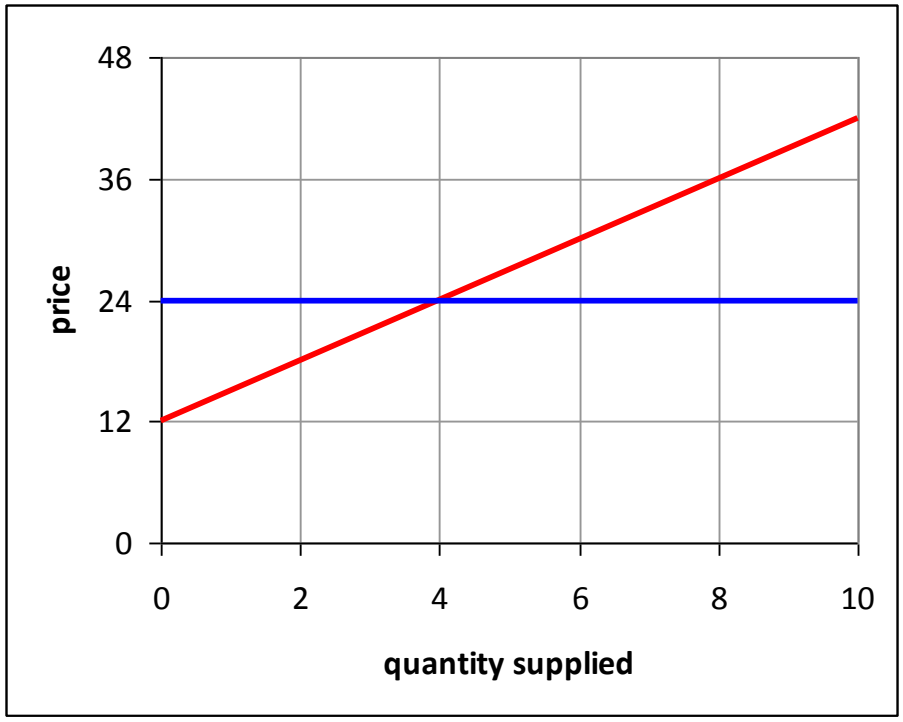
D) $Q_S = 3P - 36$

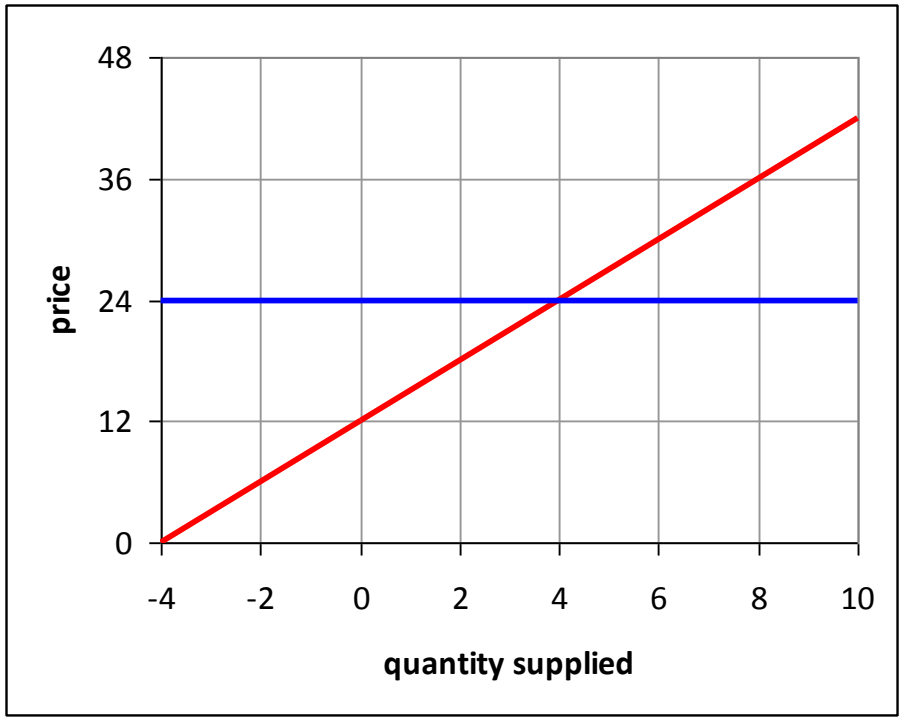
E) $Q_S = P/2 - 6$

answer to question 6

MC = 12 + 3Q

P = MC → P = 12 + 3Q → 3Q = P – 12 → Q = P/3 – 4 (A)





ADDING SUPPLY CURVES

Suppose that there are 2 identical firms, each with cost structure defined by $TC = 12Q + 1.5Q^2$ and $MC = 12 + 3Q$.

What does the supply curve look like?

First, find the supply curve for each firm. We've already done this part; each individual firm has the supply function $Q_i = P/3 - 4$.

To find the market demand, add the these two supply functions together.

$$Q = Q_1 + Q_2 = 2P/3 - 8$$

ADDING SUPPLY CURVES

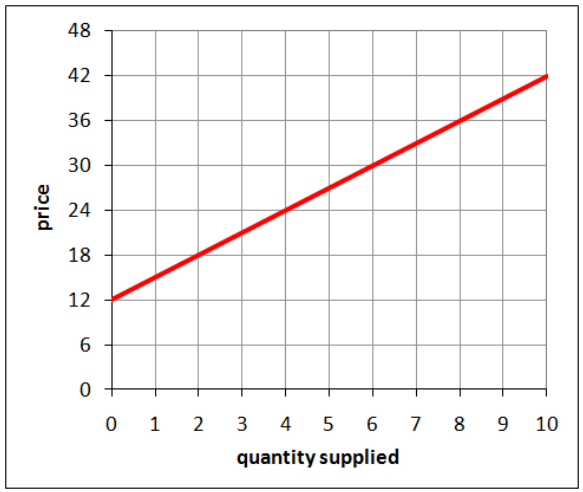
2 identical firms

$TC = 12Q + 1.5Q^2$

$MC = 12 + 3Q$

$Q_i = P/3 - 4$

$Q = Q_1 + Q_2 = 2P/3 - 8$



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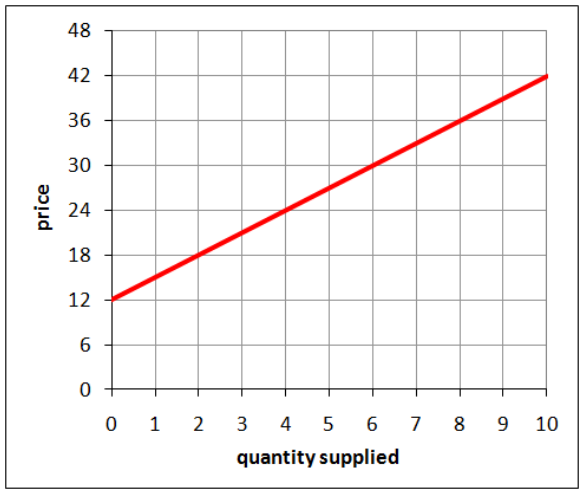

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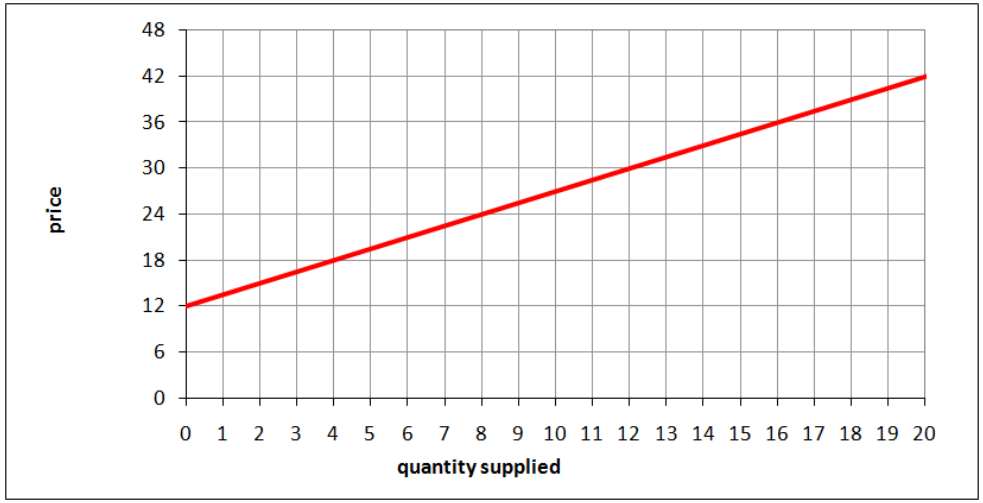


QUESTION 7 (adding supply curves)

Suppose that there are 10 identical firms, each with MC = 10 + Q/5.

Which of the following gives the correct market-wide supply curve (the quantity supplied from all firms combined, as a function of price)?

A) $Q_S = 50P - 500$

B) $Q_S = P/2 - 50$

C) $Q_S = 5P - 50$

D) $Q_S = 30P - 300$

E) $Q_S = 120 + 30P$

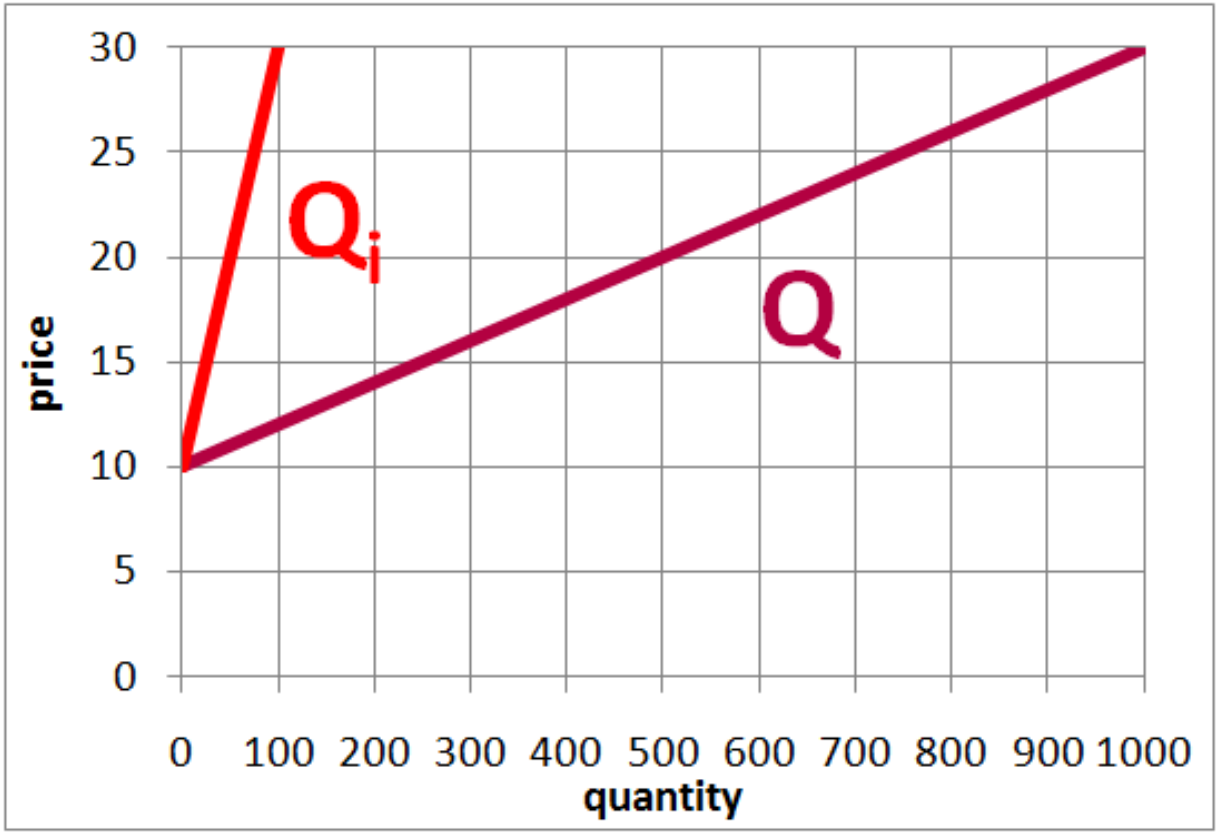
answer to question 7

Suppose that there are 10 identical firms, each with MC = 10 + Q/5.

Which of the following gives the correct market-wide supply curve (the quantity supplied from all firms combined, as a function of price)?

$MC = 10 + Q_i/5$
$P = 10 + Q_i/5$
$Q_i/5 = P - 10$
$Q_i = 5P - 50$

A) $Q_S = 50P - 500$



diminishing marginal product

hours	mushrooms	marginal mushrooms
1	20	20
2	35	15
3	45	10
4	50	5
5	50	0

The longer I spend looking for mushrooms, the fewer mushrooms I find during each additional hour.

If my time has a fixed or increasing value, this implies that my marginal cost of producing mushrooms is increasing…

diminishing marginal product

hours	mushrooms	marginal mushrooms	extra hours per 'shroom
1	20	20	1/20 = .05
2	35	15	1/15 ≈ .07
3	45	10	1/10 = .1
4	50	5	1/5 = .2
5	50	0	

In the first hour, I can find 20 mushrooms. Thus, each of these mushrooms costs me about 1/20 or .05 of an hour to get.

In the second hour, I can find 15 additional mushrooms. Thus, each of these cost me about 1/15 or .07 of an hour to get. So, my marginal cost of mushrooms is increasing with the quantity I get.

optimal supply: 3 methods

hours	mushrooms
1	20
2	35
3	45
4	50
5	50

Suppose that mushrooms are worth 20¢ each, and my time is worth $1 per hour. How many hours should I spend searching for mushrooms?

At least three ways to solve…

1. Find producer surplus (profit) for every alternative, and choose the maximum.

2. Compare the marginal benefit of hours (mushroom revenue per hour) to the marginal cost of hours (time value).

3. Compare the marginal benefit of mushrooms (the selling price of mushrooms) to the marginal cost of mushrooms.

optimal supply: finding producer surplus

hours	‘shrooms	cost	revenue	surplus
1	20	1	4	3
2	35	2	7	5
3	45	3	9	6
4	50	4	10	6
5	50	5	10	5

Mushrooms are worth 20¢
Time is worth $1 per hour

1. Find producer surplus (profit) for every alternative, and choose the maximum.

Spending 3 or 4 hours will both give me the maximum producer surplus of $6.

optimal supply: marginal cost and benefit of inputs

hours	mushrooms	marginal mushrooms	marginal revenue per hour	time cost per hour
1	20	20	$4	$1
2	35	15	$3	$1
3	45	10	$2	$1
4	50	5	$1	$1
5	50	0	$0	$1

2. I can compare the marginal benefit of hours (mushroom revenue per hour) to the marginal cost of hours (time value)...

- mushrooms are worth 20¢ each,

- time costs $1 per hour

optimal supply: marginal benefit and cost of inputs

hours	mushrooms	marginal mushrooms	marginal revenue per hour	time cost per hour
1	20	20	$5	$1
2	35	15	$3	$1
3	45	10	$2	$1
4	50	5	$1	$1
5	50	0	$0	$1

For the fourth hour, the marginal benefit in mushroom revenue is just equal to the marginal cost in lost time. So, I'm indifferent between spending 3 and 4 hours.

optimal supply: marginal benefit of output

hours	mushrooms	extra hours per ‘shroom	marginal time cost per ‘shroom	marginal revenue per ‘shroom
1	20	1/20 = .05	$0.05	$0.2
2	35	1/15 ≈ .07	$0.07	$0.2
3	45	1/10 = .1	$0.1	$0.2
4	50	1/5 = .2	$0.2	$0.2
5	50			$0.2

3. or, I can compare marginal benefit of mushrooms (the selling price of mushrooms) to the marginal cost of mushrooms (time value, multiplied by extra time per mushroom, on the margin).

Again, I’m indifferent about spending the fourth hour looking for mushrooms.

QUESTION 8 (diminishing marginal product)

workers	trinkets
1	60
2	105
3	135
4	150
5	160
6	165

I can hire people to make trinkets out of free materials. The table shows how many trinkets my company can make per day, depending on how many employees I have.

I must pay each employee $50 per day, and I can sell each trinket for $2.

How many employees should I get to make trinkets for me today?

A) 1 B) 2 C) 3 D) 4 E) 5

answer to question 8

workers	trinkets	marginal trinkets per worker	marginal trinket revenue per worker	marginal cost per worker
1	60	60	$120	$50
2	105	45	$90	$50
3	135	30	$60	$50
4	150	15	$30	$50
5	160	10	$20	$50
6	165	5	$10	$50

trinkets sell for $2, workers cost $50

A) 1 B) 2 **C) 3** D) 4 E) 5

a pizza restaurant

N	Q
1	10
2	30
3	70
4	150
5	220
6	280
7	330
8	370
9	400
10	420
11	435

I own a pizza restaurant.

N is the number of employees that I have...

Q is the number of pizzas that I can sell per week...

Suppose that I get $5 for each pizza that I sell, and I have to pay each worker $100 per week. Not only that, but I also have to pay $500 per week just to keep the restaurant open.

a pizza restaurant (marginal revenue and cost of labor)

N	Q	MP	VMP	W
1	10	10	$50	$100
2	30	20	$100	$100
3	70	40	$200	$100
4	150	80	$400	$100
5	220	70	$350	$100
6	280	60	$300	$100
7	330	50	$250	$100
8	370	40	$200	$100
9	400	30	$150	$100
10	420	20	$100	$100
11	435	15	$75	$100

MP: marginal product per worker

VMP: value of marginal product; marginal revenue per worker

W: wage; marginal cost of an additional worker

My optimal number of workers is 9 or 10.

$5 per pizza, $100 per worker, $500 for the restaurant

a pizza restaurant (finding and maximizing profit)

N	Q	TR	VC	TC	Π
1	10	$50	$100	$600	-$550
2	30	$150	$200	$700	-$550
3	70	$350	$300	$800	-$450
4	150	$750	$400	$900	-$150
5	220	$1,100	$500	$1,000	$100
6	280	$1,400	$600	$1,100	$300
7	330	$1,650	$700	$1,200	$450
8	370	$1,850	$800	$1,300	$550
9	400	$2,000	$900	$1,400	$600
10	420	$2,100	$1,000	$1,500	$600
11	435	$2,175	$1,100	$1,600	$575

TR: total revenue
TR = P × Q

VC: variable cost

TC: total cost

Π: profit
Π = TR - TC

again, 9 or 10 workers will maximize my profit

$5 per pizza, $100 per worker, $500 for the restaurant

a pizza restaurant (marginal cost and revenue per pizza)

N	Q	MP	MC	MR
1	10	10	$10.00	$5.00
2	30	20	$5.00	$5.00
3	70	40	$2.50	$5.00
4	150	80	$1.25	$5.00
5	220	70	$1.43	$5.00
6	280	60	$1.67	$5.00
7	330	50	$2.00	$5.00
8	370	40	$2.50	$5.00
9	400	30	$3.33	$5.00
10	420	20	$5.00	$5.00
11	435	15	$6.67	$5.00

MC: marginal cost per pizza;
$MC = \Delta TC/\Delta Q$
In this case,
MC = $100/MP

MR: marginal revenue per pizza, simply equal to the selling price for pizza, $5

This slide *also* shows that 9 or 10 employees is best!

$5 per pizza, $100 per worker, $500 for the restaurant

a pizza restaurant (ATC and AVC)

Q	VC	TC	AVC	ATC
10	$100	$600	$10.00	$60.00
30	$200	$700	$6.67	$23.33
70	$300	$800	$4.29	$11.43
150	$400	$900	$2.67	$6.00
220	$500	$1,000	$2.27	$4.55
280	$600	$1,100	$2.14	$3.93
330	$700	$1,200	$2.12	$3.64
370	$800	$1,300	$2.16	$3.51
400	$900	$1,400	$2.25	$3.50
420	$1,000	$1,500	$2.38	$3.57
435	$1,100	$1,600	$2.53	$3.68

AVC: average variable cost

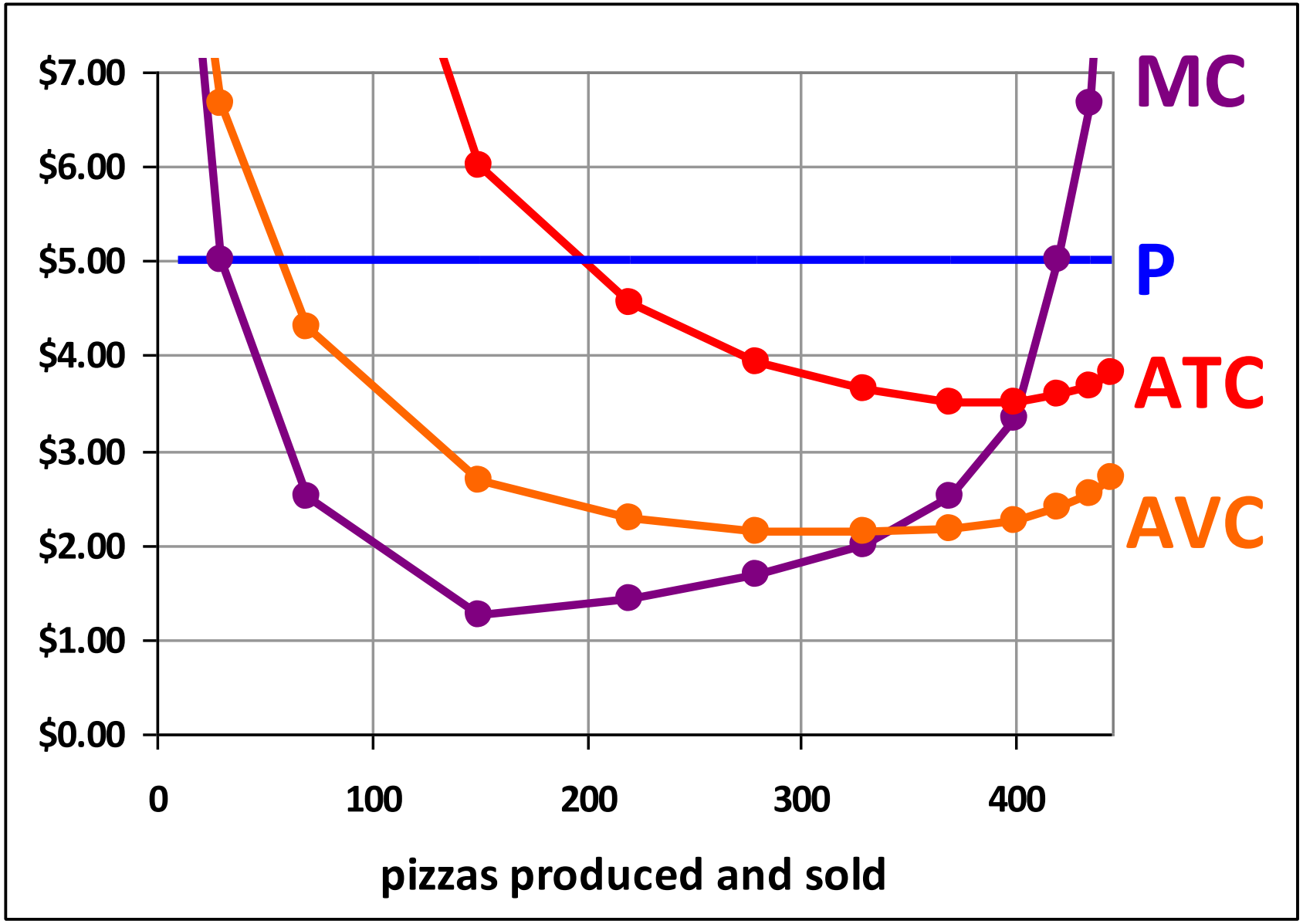
AVC = VC / Q

ATC: average total cost

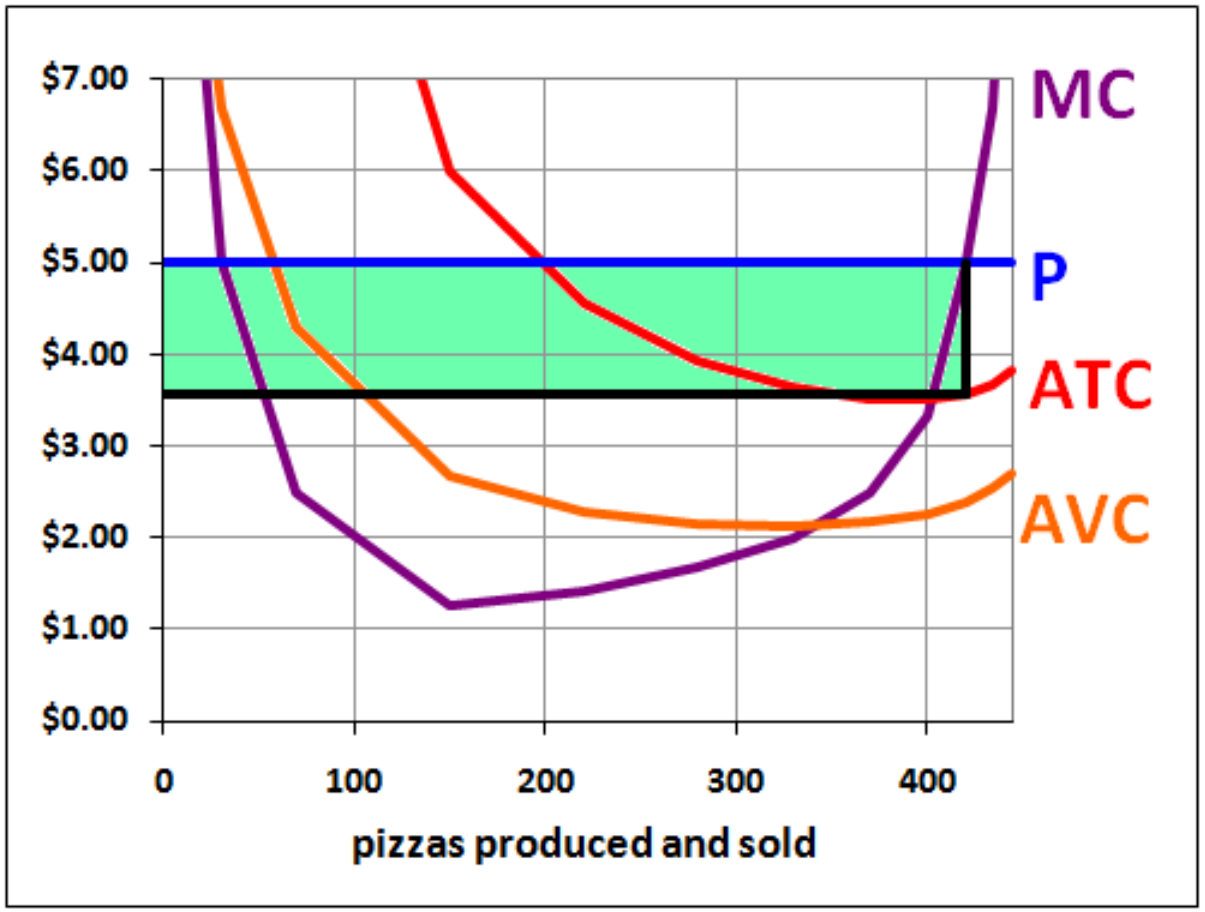
ATC = TC / Q

$5 per pizza, $100 per worker, $500 for the restaurant

pizza restaurant graph



pizza restaurant graph, with profit



$$\Pi = TR - TC$$

$$ATC = TC / Q$$

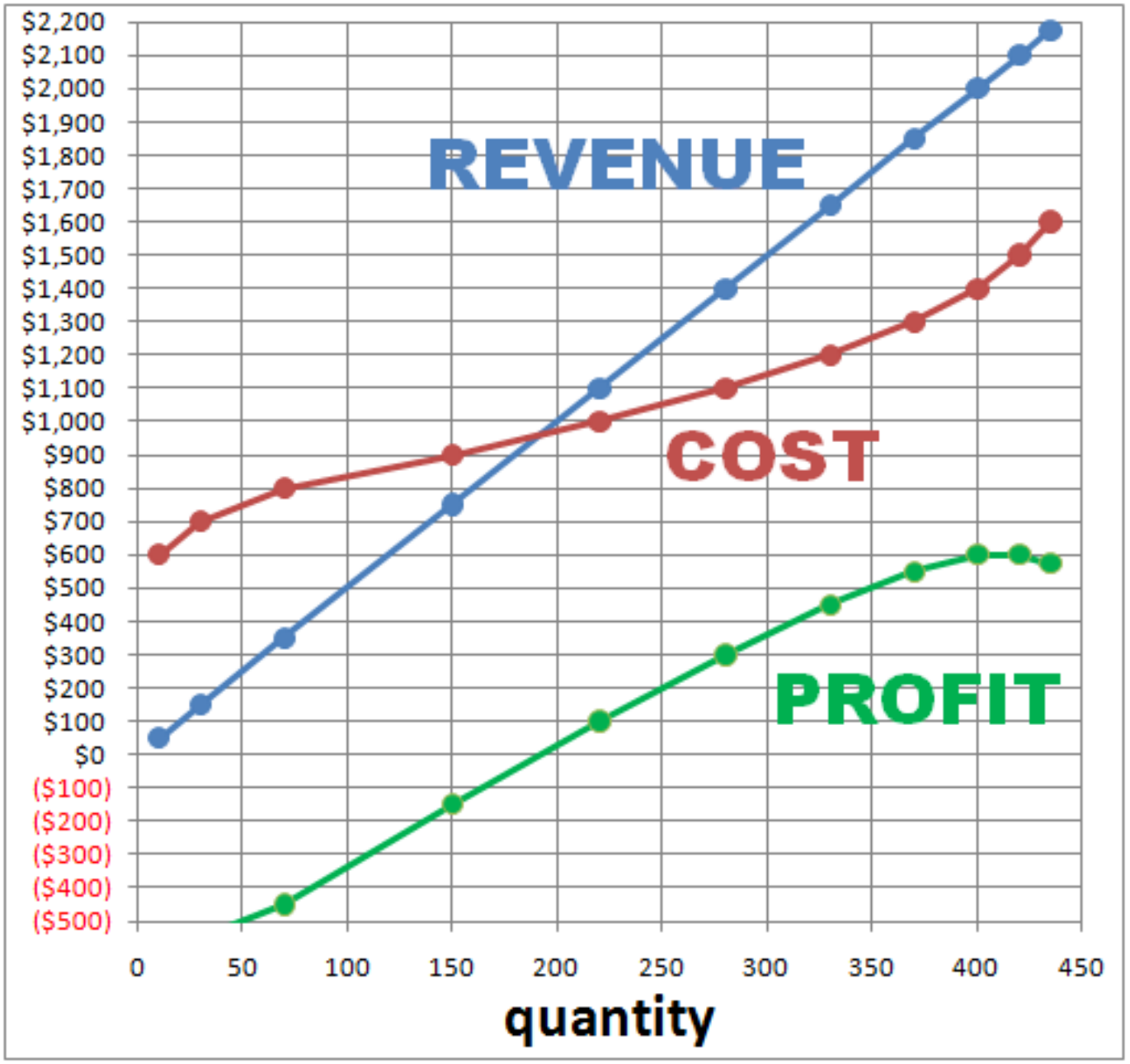
$$TC = Q \times ATC$$

$$\Pi = Q \times P - Q \times ATC$$

$$\Pi = Q \times (P - ATC)$$

the optimal quantity, Q, is where P = MC

one more pizza restaurant graph



QUESTION 9 (fixed cost, continuous)

My firm has the total cost function $TC = 1000 + Q^2$, and the marginal cost function $MC = 2Q$. If I sell my products on a competitive market where the price is given at $P = 100$, what is my profit-maximizing quantity?

A) 10 B) 20 C) 30 D) 40 E) 50

answer to question 9

My firm has the total cost function $TC = 1000 + Q^2$, and the marginal cost function $MC = 2Q$. If I sell my products on a competitive market where the price is given at $P = 100$, what is my profit-maximizing quantity?

$P = MC$

$100 = 2Q$

$Q^* = 50$

A) 10 B) 20 C) 30 D) 40 **E) 50**

QUESTION 10 (fixed cost, continuous)

My firm has the total cost function $TC = 1000 + Q^2$, and the marginal cost function $MC = 2Q$. If I sell my products on a competitive market where the price is given at $P = 100$, my profit-maximizing quantity is 50. At this quantity, what is my profit?

A) 1100 B) 1200 C) 1300 D) 1400 E) 1500

answer to question 10

My firm has the total cost function $TC = 1000 + Q^2$, and the marginal cost function $MC = 2Q$. If I sell my products on a competitive market where the price is given at $P = 100$, my profit-maximizing quantity is 50. At this quantity, what is my profit?

profit = revenue – cost

$$\Pi = P \times Q - TC$$

$$\Pi = (100) \times (50) - [1000 + (50)^2]$$

$$\Pi = 5000 - [1000 + 2500]$$

$$\Pi = 1500$$

A) 1100 B) 1200 C) 1300 D) 1400 **E) 1500**