Chapter 5: Demand

Tuesday, June 29

UTILITY

"Utility" is a fancy word for happiness.

The basic assumptions in economic theory are that consumers make choices to maximize their utility, and that firms make choices to maximize their profit.

Consumer choice is often modeled using utility functions (which give a level of 'happiness', dependent on different variables, e.g. consumption of different goods. Consumers maximize these subject to the constraints imposed by their personal budgets, etc.

For example, a utility function over goods X and Y could be something like $U(X,Y) = X^{2/3}Y^{1/2}$

UTILITY

Utility is measured in "utils", but no one really knows what a util is, or how many utils anyone has.

Utility is not necessarily measured in dollar amounts. That is, a "util" is not necessarily the amount of happiness that you would get from an extra dollar of spending.

Models of utility can be constructed in this way, but the concept itself is more general.

QUASILINEAR UTILITY (bonus slide, not required)

In econ 1, we will basically be assuming something called 'quasilinear utility', i.e. a utility function that takes the form

$$\underbrace{U = \underbrace{V(X)}_{\text{total benefit from good } X} + Y}_{\text{total utility, from } X \text{ and } Y}$$

total benefit from good *X*
(This is the 'total benefit function' that we often use in this class.)

total utility, from *X* and *Y*.
(This takes into account both the happiness gained from consuming good X, and the happiness from consuming other goods.)

QUASILINEAR UTILITY (bonus slide, not required)

In econ 1, we will basically be assuming something called ‘quasilinear utility’, i.e. a utility function that takes the form

$$U = V(X) + Y$$

Consumers maximize this function, subject to the constraint that $P_X X + P_Y Y = I$, or simply $PX + Y = I$, which implies that $Y = I - PX$.

Thus, consumers are effectively maximizing the value of the function $U = V(X) + I - PX$.

Setting the derivative with respect to X equal to zero, we get the condition $V'(X) = P$, that is, **marginal benefit equals price**.

OTHER EXMPLES OF UTILITY FUNCTIONS
(also not required)

Cobb-Douglas utility: $U = X^{\alpha} Y^{\beta}$

Perfect complements utility: $U = \min\{\alpha X, \beta Y\}$

Perfect substitutes utility: $U = \alpha X + \beta Y$

MARGINAL UTILITY

The marginal utility of good X is the amount of extra happiness (measured in utils, not necessarily in dollar amounts) that you get from one extra unit of good X.

Equivalently, it is the rate of change in utility as more of good X is consumed, ΔU/ΔX.

Bonus information: With quasilinear utility

$U = V(X) + Y$, the marginal utility of good X is $V'(X)$, or $\frac{dV}{dX}$, and the marginal utility of good Y (the 'numeraire') is 1.

INCOME AND SUBSTITUTION EFFECTS

Definitions from the book…

***Substitution effect*: The change in the quantity demanded of a good that results because buyers switch to or from substitutes when the price of the good changes.**

***Income effect*: The change in the quantity demanded of a good that results because a change in the price of a good changes the buyer's purchasing power.**

SUBSTITUTION EFFECTS

***Substitution effect*: The change in the quantity demanded of a good that results because buyers switch to or from substitutes when the price of the good changes.**

In other words, if a good becomes more expensive, people have an incentive to switch over to consuming other, similar goods.

e.g. if beef becomes more expensive, people have an incentive to eat more chicken instead.

INCOME EFFECTS

***Income effect*: The change in the quantity demanded of a good that results because a change in the price of a good changes the buyer's purchasing power.**

That is, if a good that you buy becomes more expensive, this reduces your purchasing power. All else being equal, this makes you effectively poorer. Thus, a change in the price of a good you buy can have a comparable effect to a change in your income.

The direction of this income effect will depend on whether the good is a "normal good" or an "inferior good".

NORMAL AND INFERIOR GOODS

A **normal good** is something that people tend to buy more of when their income is higher, and less of when their income is lower.

An **inferior good** is the opposite of this, i.e. something that people tend to buy less of when their income is higher, and more of when their income is lower.

To say that something is an inferior good in economics doesn't imply a value judgment on that good, just an observation of purchasing behavior.

INCOME AND SUBSTITUTION EFFECTS

Suppose that the price of potatoes goes up.

As a result of the substitution effect, I would buy fewer potatoes, and buy more of similar products (like yams?) instead.

Because the price of a good that I buy has gone up, then my purchasing power—and thus my effective income—has decreased.

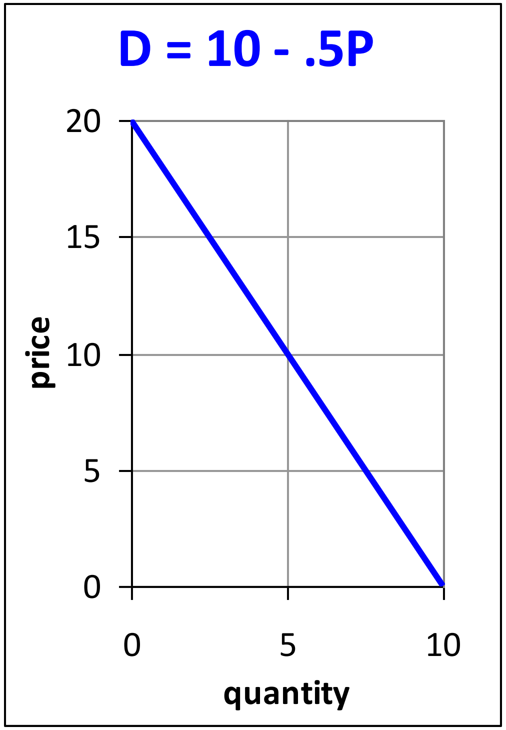
If potatoes are a normal good, then the income effect will also cause me to buy fewer potatoes, working in the same direction as the substitution effect.

If potatoes are an inferior good, then the income effect will cause me to buy more potatoes, working in the opposite direction of the substitution effect.

ADDING DEMAND FUNCTIONS

Suppose that there are three people with identical demand functions D = 10 - .5P

What does their collective demand curve look like?



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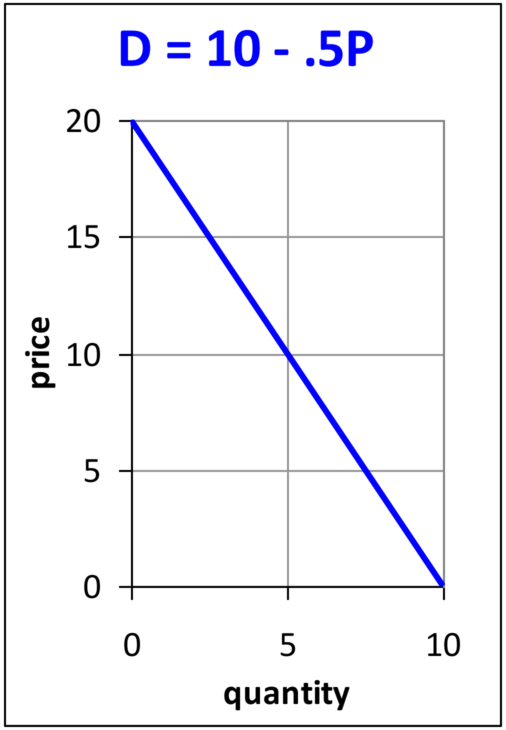

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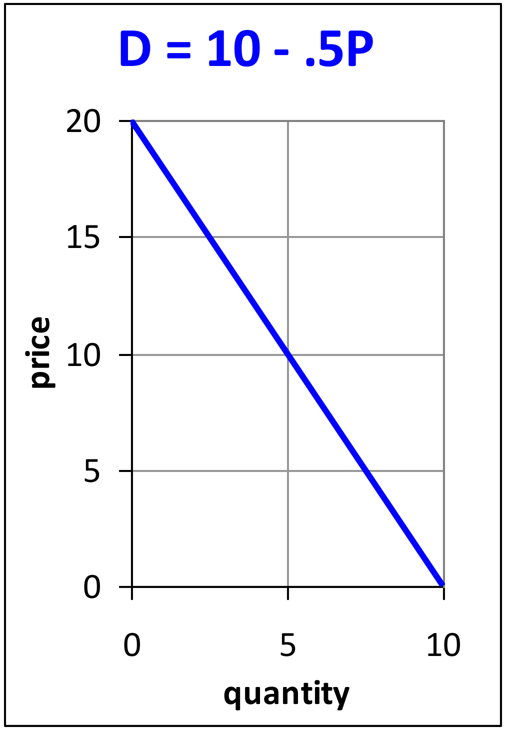

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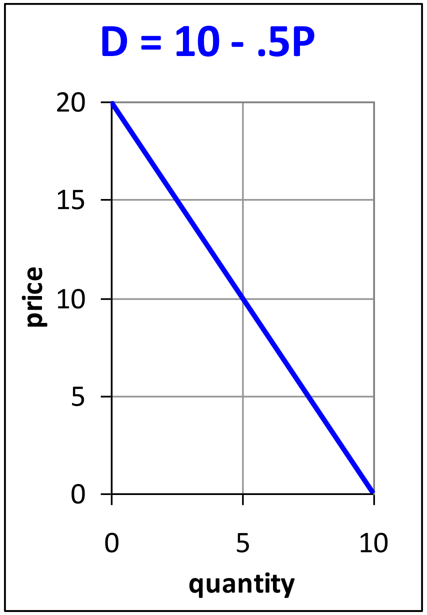
ADDING DEMAND FUNCTIONS



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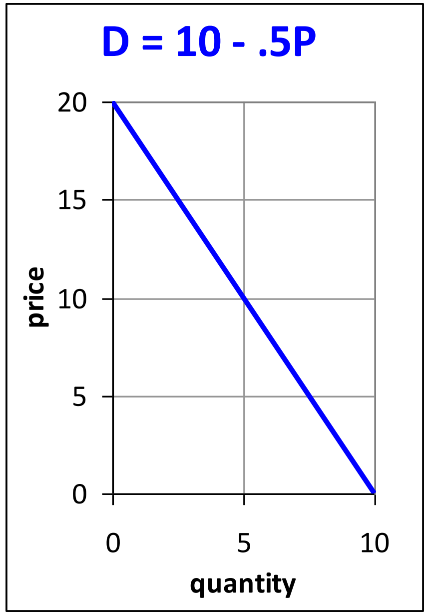

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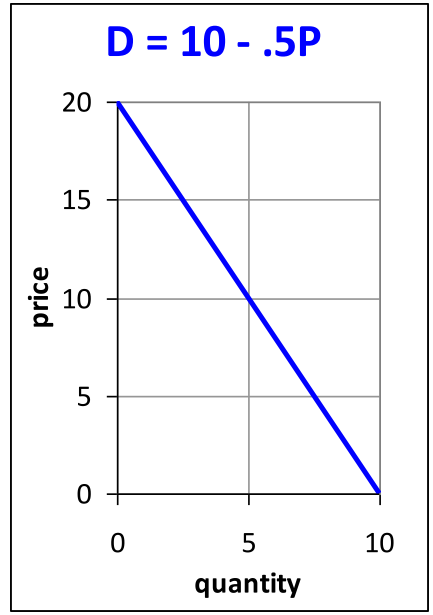

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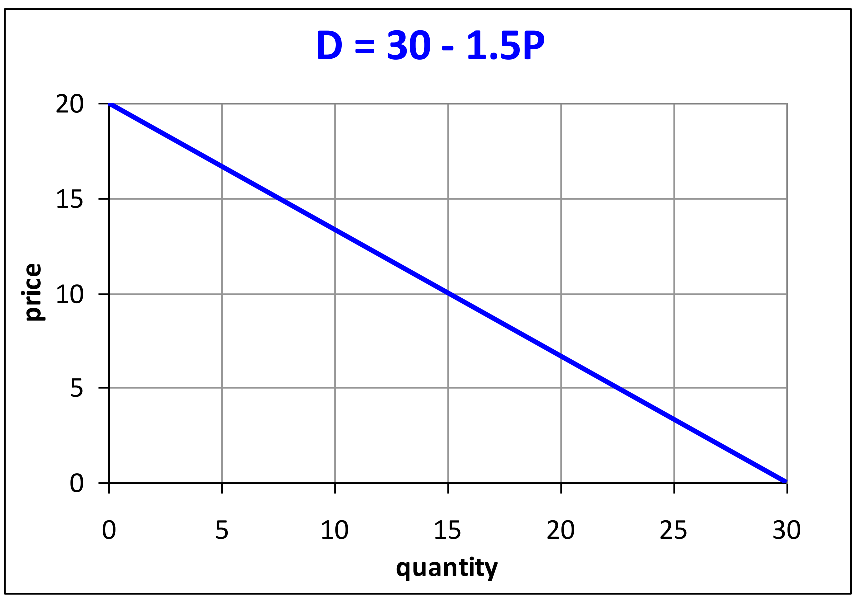
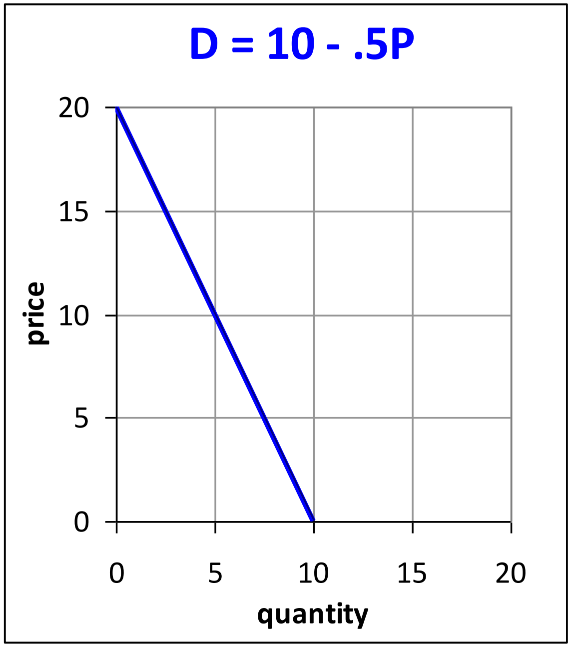


Since we're adding quantities, sum along the *horizontal* axis.

ADDING DEMAND FUNCTIONS



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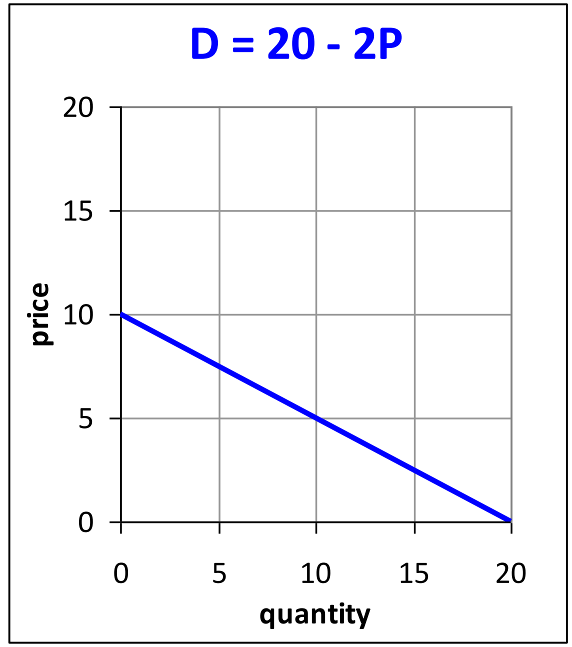

We usually assume that people can't consume negative quantities of a good…

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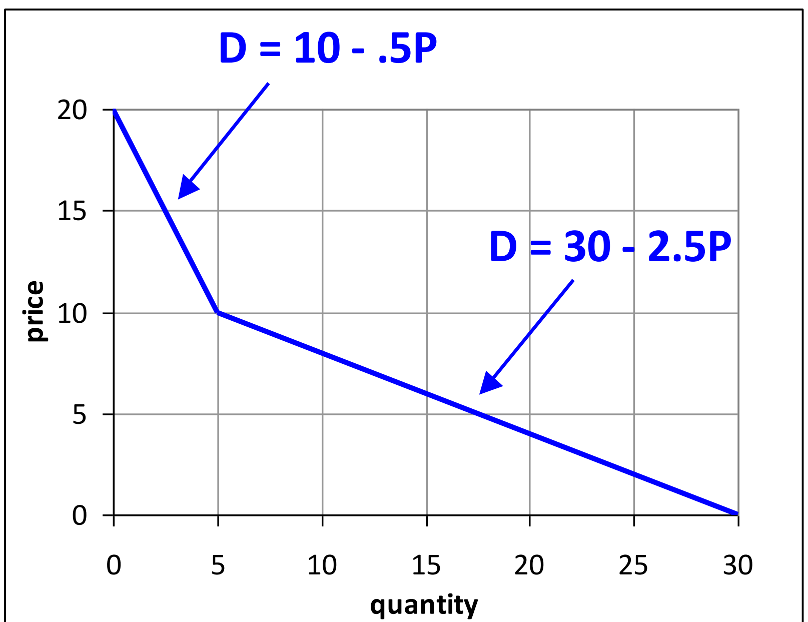

When buyers exit the market at different prices, there can be kinks in the graph.

QUESTION 1 (adding demand functions)

Suppose that there are 5 consumers in the market for brie cheese, each with an individual total benefit function $TB_i(Q_i) = 10Q_i - .5Q_i^2$ and a marginal benefit function $MB_i(Q_i) = 10 - Q_i$. Which of the following gives the correct market demand function (including all five consumers)?

A) $Q_D = 10 - P$
B) $Q_D = 10 - P/5$
C) $Q_D = 25 - 5P$
D) $Q_D = 50 - P$
E) $Q_D = 50 - 5P$

answer to question 1

Suppose that there are 5 consumers in the market for brie cheese, each with an individual total benefit function $TB_i(Q_i) = 10Q_i - .5Q_i^2$ and a marginal benefit function $MB_i(Q_i) = 10 - Q_i$. Which of the following gives the correct market demand function (including all five consumers)?

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E) $Q_D = 50 - 5P$

$MB_i = P$

$P = 10 - Q_i$

$Q_i = 10 - P$

$Q = 5Q_i = 50 - 5P$

QUESTION 2 (adding demand functions)

Suppose that there are 100 consumers in the market for brie cheese, each with an individual total benefit function $TB_i(Q_i) = 6Q_i – Q_i^2$ and a marginal benefit function $MB_i(Q_i) = 6 – 2Q_i$. Which of the following gives the correct market demand function (including all one hundred consumers)?

A) $Q_D = 600 – 200P$
B) $Q_D = 6 – P/50$
C) $Q_D = 3 – P/2$
D) $Q_D = 300 – 50P$
E) $Q_D = 600 – 2P$

answer to question 2

Suppose that there are 100 consumers in the market for brie cheese, each with an individual total benefit function $TB_i(Q_i) = 6Q_i - Q_i^2$ and a marginal benefit function $MB_i(Q_i) = 6 - 2Q_i$. Which of the following gives the correct market demand function (including all five consumers)?

A) $Q_D = 600 - 200P$
B) $Q_D = 6 - P/50$
C) $Q_D = 3 - P/2$
D) $Q_D = 300 - 50P$
E) $Q_D = 600 - 2P$

$MB_i = P$
$P = 6 - 2Q_i$
$2Q_i = 6 - P$
$Q_i = 3 - P/2$
$Q = 100Q_i = 300 - 50P$

CONSUMER SURPLUS (discrete)

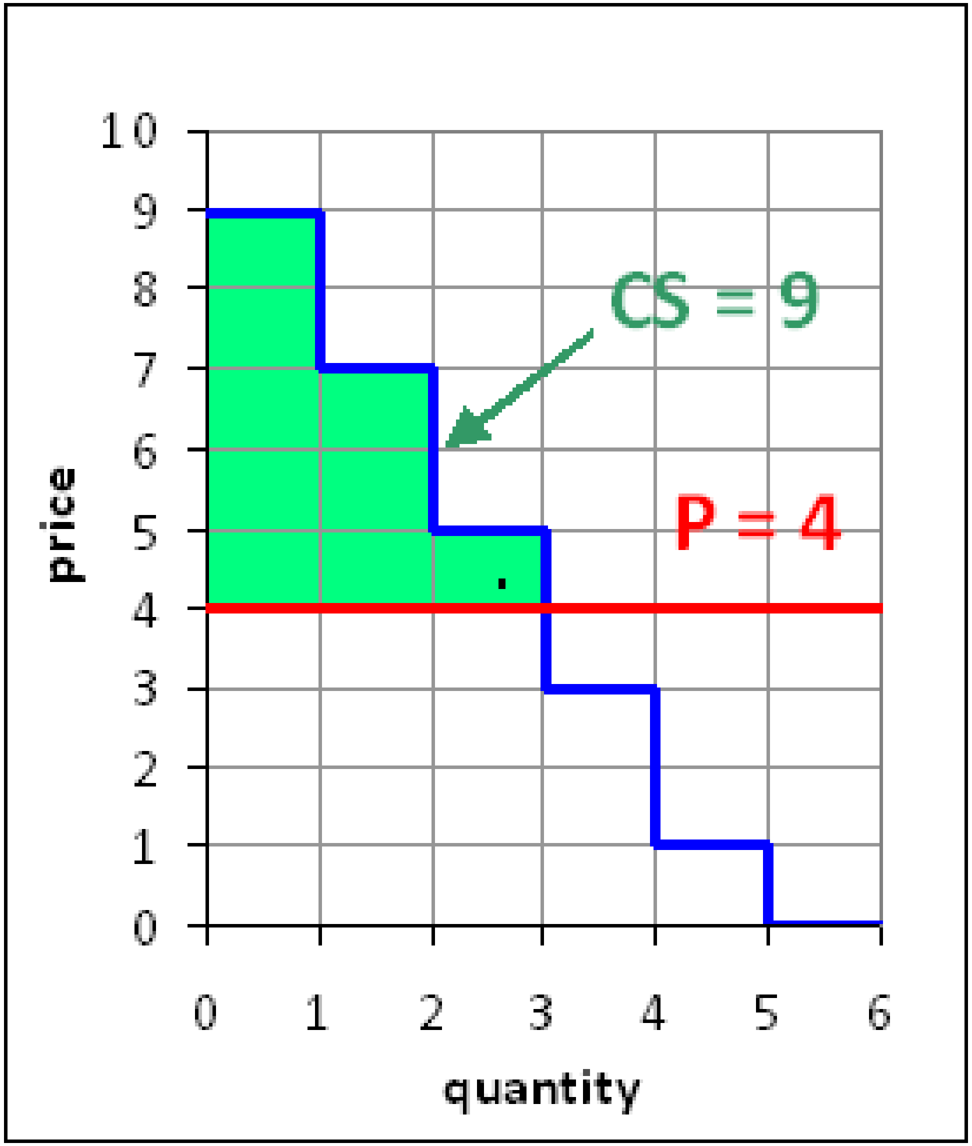
units	TB	TC	MB	MC	MB-MC	CS
1	9	4	9	4	5	5
2	16	8	7	4	3	8
3	21	12	5	4	1	9
4	24	16	3	4	-1	8
5	25	20	1	4	-3	5
6	25	24	0	4	-4	1

Recall that consumer surplus is defined as total benefit minus total cost. Suppose the price of the good is $4, and the total benefit in dollar terms is given in the second column. Then, the optimal (consumer-surplus-maximizing) consumption choice is 3, and the resulting consumer surplus itself is 9.

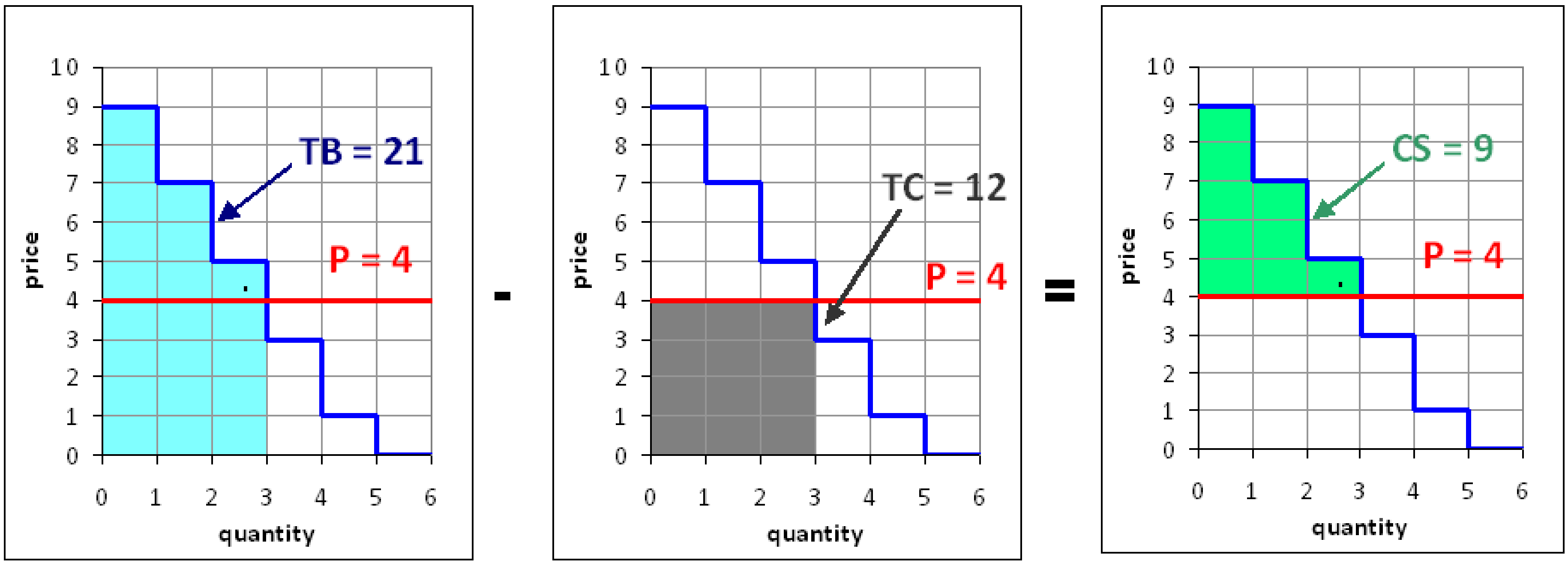
CONSUMER SURPLUS (discrete)

Note that the consumer surplus added by each unit is the difference between the marginal benefit and the price.

Total consumer surplus is the sum of these differences.



CONSUMER SURPLUS (discrete)



Consumer surplus is also total benefit (maximum willingness to pay for everything consumed) minus total cost (price times quantity).

QUESTION 3 (discrete consumer surplus)

Q	TB
1	$80
2	$120
3	$140
4	$150
5	$155

The table above shows the total benefit that a person gets out of consuming various quantities of some good.

If the price of the good is $30, and the consumer chooses their optimal quantity, then what is their consumer surplus?

A) 5 B) 20 C) 40 D) 60 E) 120

answer to question 3

Q	TB	TC	CS	MB	MC
1	$80	$30	$50	$80	$30
2	$120	$60	$60	$40	$30
3	$140	$90	$50	$20	$30
4	$150	$120	$30	$10	$30
5	$155	$150	$5	$5	$30

A) 5 B) 20 C) 40 **D) 60** E) 120

QUESTION 4 (discrete consumer surplus)

Q	TB
1	\$100
2	\$190
3	\$270
4	\$340
5	\$400
6	\$450
7	\$490

The table above shows the total benefit that a person gets out of consuming various quantities of some good.

If the price of the good is \$75, and the consumer chooses their optimal quantity, then what is their consumer surplus?

A) 45 B) 40 C) 25 D) 0 E) -35

answer to question 4

Q	TB	TC	CS	MB	MC
1	$100	$75	$25	$100	$75
2	$190	$150	$40	$90	$75
3	$270	$225	$45	$80	$75
4	$340	$300	$40	$70	$75
5	$400	$375	$25	$60	$75
6	$450	$450	$0	$50	$75
7	$490	$525	$-35	$40	$75

A) 45   B) 40   C) 25   D) 0   E) -35

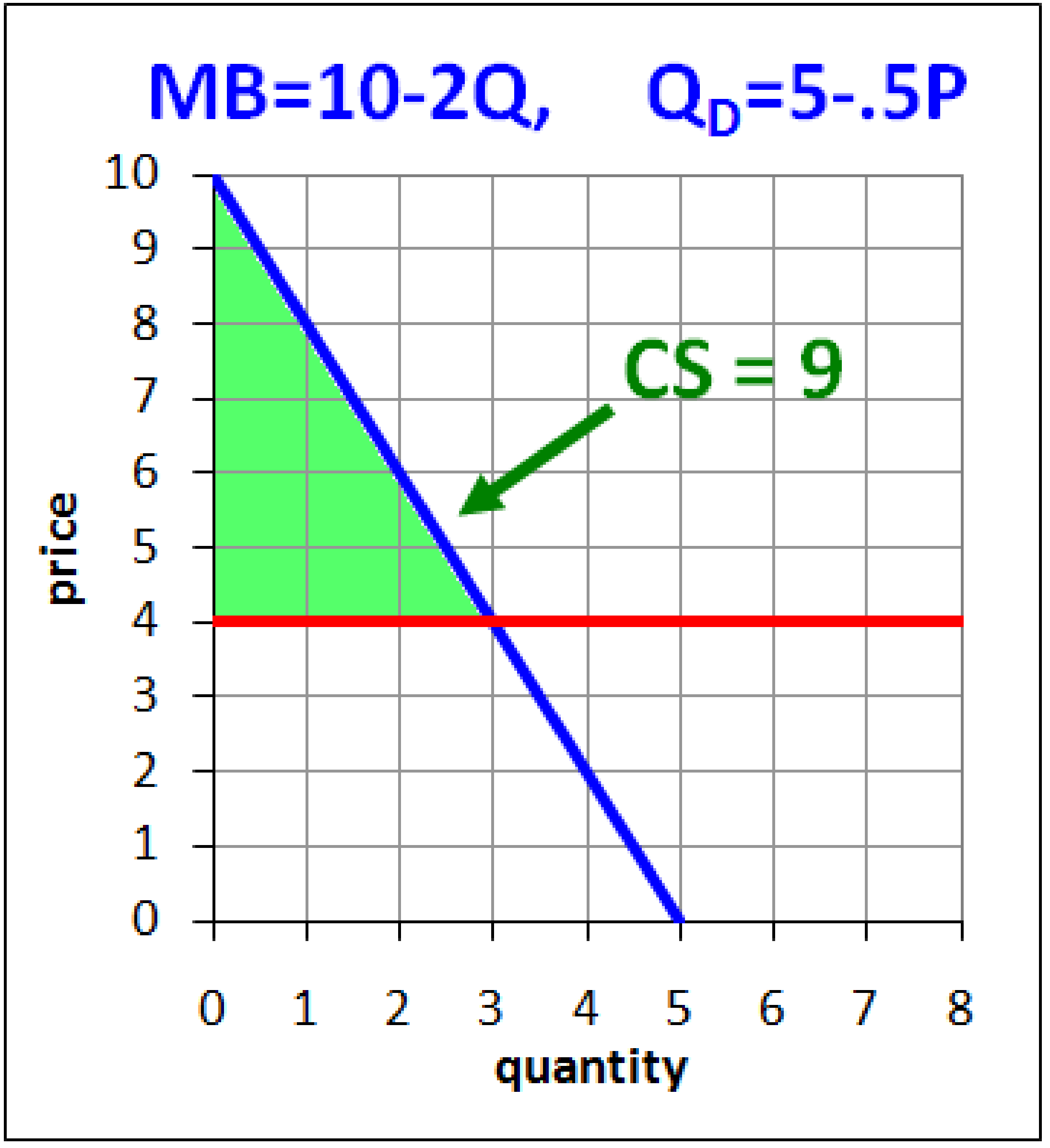
CONSUMER SURPLUS (continuous)

You can find the consumer surplus for a linear demand curve using the formula for the area of a triangle:

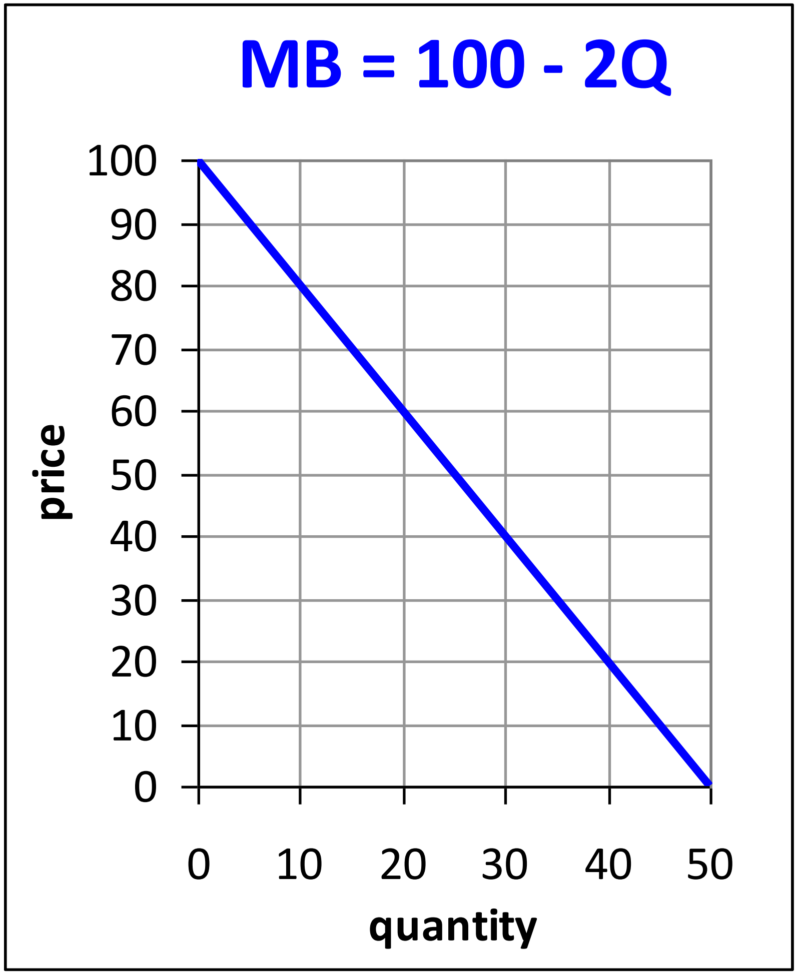
area = .5 × B × H

So, in this case,

CS = .5 × 3 × 6 = 9



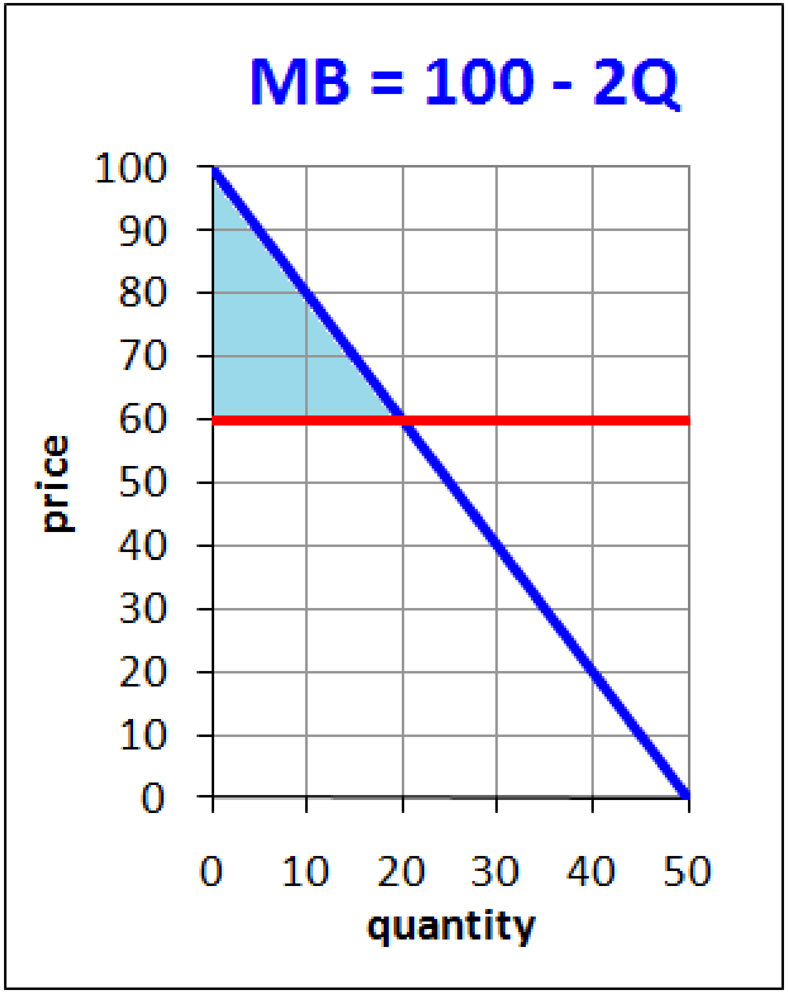
QUESTION 5 (continuous consumer surplus)



Suppose that a consumer has the marginal benefit function MB = 100 – 2Q, and that the price of the good he's buying is $60. What is the most consumer surplus that he can get? (Hint: draw a triangle using the given price, and find the area.)

A) 200 **B) 300** **C) 400** **D) 500** **E) 600**

answer to question 5



Suppose that a consumer has the marginal benefit function MB = 100 – 2Q, and that the price of the good he's buying is $60. What is the most consumer surplus that he can get? (Hint: draw a triangle using the given price, and find the area.)

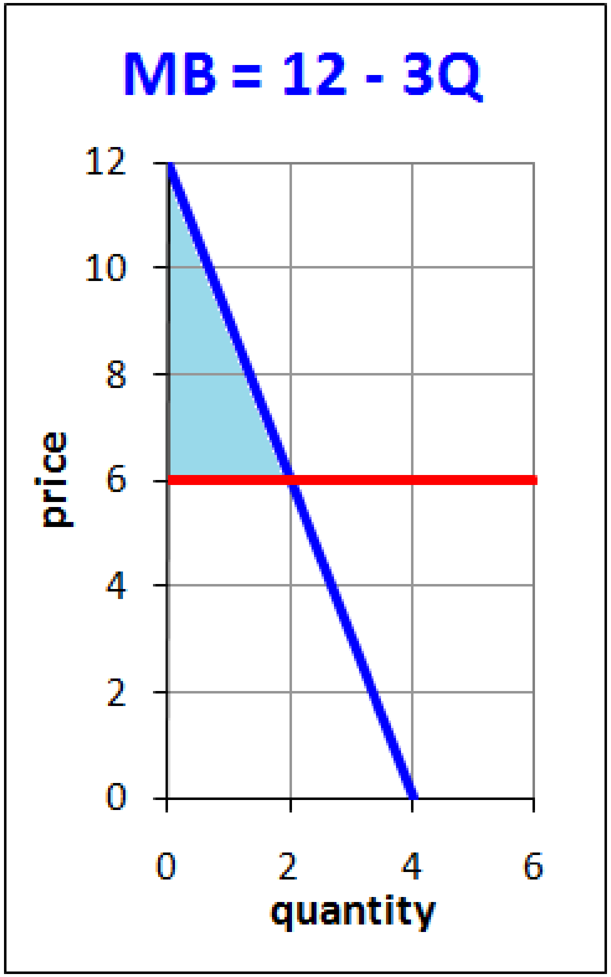
A) 200 B) 300 **C) 400** D) 500 E) 2500

QUESTION 6 (continuous consumer surplus)

Suppose that a consumer has the marginal benefit function $MB = 12 - 3Q$, and that the price of the good is \$6. What is the most consumer surplus that they can get?

A) 2 B) 4 C) 6 D) 12 E) 24

answer to question 6



Suppose that a consumer has the marginal benefit function MB = 12 – 3Q, and that the price of the good is $6. What is the most consumer surplus that they can get?

A) 2 **B) 4** **C) 6** **D) 12** **E) 24**