Schedule:

- HW 0.2 is due Tuesday, Aug 30th, 2011.
- HW 1.1-1.4 are due Friday, Sep 2nd, 2011.
- Exam 1 is Monday, Sep 26th, 5:00pm-7:00pm in CB106.

Today we will cover:

- 1.3 linear functions; linear depreciation; cost, revenue, profit
- 1.4 intersections of lines; supply and demand
In accounting, you keep track of assets (goods)

But assets are also tax liabilities (bads)

Old assets are like so whatever and are worth less

For example:

A printing machine is currently worth $100,000, but will be depreciated over five years to its scrap value of $30,000.

How much is the machine worth after two years?
For example:

A printing machine is currently worth $100,000, but will be depreciated over five years to its scrap value of $30,000.

How much is the machine worth after two years?

Over five years, it loses $70k of value

Each year it loses $70k/5 = $14k of value

After two years, it loses $14k \times 2 = $28k

It is worth $72k by the end of the second year
This is just **slope**: 

\[(x = 0, y = 100k) \text{ and } (x = 5, y = 30k)\] 
are two points on the graph. 

The slope is 

\[
\frac{100 - 30}{0 - 5} = -14 \text{ thousand dollars per year}
\]

The bunny hops down $14k every year. 

The **y-intercept** was the original $100k starting value.
To get into the lucrative cell-phone washing business, you just need about $5 in polishing rags and a winning smile.

However, each wash requires about $0.05 in disinfectant.

If you charge $0.25 per wash, how much money will you make if you wash 10 phones? 25 phones? 100?
Ch 1.3: Example 2: Cost, Revenue, Profit

- Well your costs are easy: $5 plus $0.05 per wash
  \[ C(x) = 5 + 0.05x \]

- Your revenue is easy: $0.25 per wash
  \[ R(x) = 0.25x \]

- So profit is easy, you start $5 in the hole, and make $0.20 per wash
  \[ P(x) = -5 + 0.20x \]
At 10 washes, you’ve made $2.50 but spent $5.50, so you are $3 in debt.

At 25 washes, you’ve made $6.25 but spent $6.25, so you just broke even.

At 100 washes, you’ve made $25 but spent $10, so you are $15 ahead.
Ch 1.3: Example 2: Cost, Revenue, Profit

- **Marginal cost** is $0.05 per wash

- **Marginal profit** is $0.20 per wash

- **Fixed cost** is $5

- **Break-even production** is 25 washes
Ch 1.3: Did we understand it?

- Fixed and marginal cost

- 20 cost $200, 25 cost $220, how much do 30 cost?
  
  (Left) $300

  (Right) $240

  (Both) $225
Fixed and marginal cost

20 cost $200, 25 cost $220, how much do 30 cost?

(Left) $300

(Right) $240

(Both) $225

Discuss with your neighbors, because you’ll explain it to us next.
Ch 1.3: Did we understand it?

- Fixed and marginal cost

- 20 cost $200, 25 cost $220, how much do 30 cost?

  (Left) $300

  (Right) $240

  (Both) $225

- Discuss with your neighbors, because you’ll explain it to us next

- Now explain it to us, especially someone who changed their mind.
Ch 1.3: Did we understand it?

- 20 cost $200, 25 cost $220, how much do 30 cost?

  (Left) $300 – This assumes each one costs $10,
  but then 25 should have costed $250

  (Right) $240 – 5 more costed $20 more,
  so another 5 costs another $20

  (Both) 5 more costs $5 more? Life isn’t that simple
Ch 1.3: Did we understand it?

- 20 cost $200, 25 cost $220, how much do 30 cost?

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- So **Marginal cost** is $20 per 5, or $4 each
Ch 1.3: Did we understand it?

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- So **Marginal cost** is $20 per 5, or $4 each

- So **fixed cost** is $120
50 cost $500, 100 cost $700, how much do 75 cost?

(Left) $750

(Right) $900

(Both) $600
Ch 1.3: Do we understand it now?

- 50 cost $500, 100 cost $700, how much do 75 cost?
  
  (Left) $750

  (Right) $900

  (Both) $600

- 50 more cost $200 more, so 25 more only costs $100 more
  
  (Both) $600
Ch 1.3: Do we understand it now?

- 50 cost $500, 100 cost $700, how much do 75 cost?
  
  (Left) $750
  
  (Right) $900
  
  (Both) $600

- 50 more cost $200 more, so 25 more only costs $100 more
  
  (Both) $600

- Marginal cost is $4 each
50 cost $500, 100 cost $700, how much do 75 cost?

(Left) $750

(Right) $900

(Both) $600

50 more cost $200 more, so 25 more only costs $100 more

(Both) $600

Marginal cost is $4 each

Fixed cost is $300, since $4 each for 50 is only $200, not $500
The break-even point is when the revenue equals the cost

\[ R(x) = C(x) \]

To solve \( 0.25x = 5 + 0.05x \), move the \( x \)s over to get

\[ 0.20x = 5 \quad x = 5/0.20 = 25 \]

A pessimistic phrasing is when the profit is zero

\[ P(x) = 0 \]

To solve \( -5 + 0.20x = 0 \), move the 5 over to get

\[ 0.20x = 5 \quad x = 5/0.20 = 25 \]
Ch 1.3: Example 3: Demand function

- All else being equal, more people are willing to buy at a lower price

- Hopefully everyone took a syllabus last week

- Not very many people would take it if I charged $1 per syllabus

- If 150 syllabi are taken at $0 and none are taken at $1, about how many would be taken at $0.02?
With a **linear demand** model, this is easy:

- Every extra dollar I charge, I lose 150 customers

- If I only charge two extra pennies, I lose $150 \times 0.02 = 3$ customers

- 147 pieces of paper should still circulate

Real demand **curves** are not linear, but if the change in price is small enough, then they are like lines (remember MA123; curves look like lines close up; the derivative)
All else being equal, more are willing to sell if the price is higher.

If you heard Ovid’s ran out of drinks and was paying $20 per bottle of coke, some of you might leave class to make some money.

If no one is willing to supply coke for free, but 150 are willing to supply at $100 per bottle, how many would be willing at $20 per bottle?
Ch 1.3: Example 4: Supply function

- All else being equal, more are willing to sell if the price is higher

- If you heard Ovid’s ran out of drinks and was paying $20 per bottle of coke, some of you might leave class to make some money

- If no one is willing to supply coke for free, but 150 are willing to supply at $100 per bottle, how many would be willing at $20 per bottle?

- By increasing the price $100, we got 150 more sellers

- If we only increased the price a fifth of that, $20, we would only get 30 more sellers
In a rational, free market, the demand (number of items bought) equals the supply (number of items sold).

On the exam, a problem like this requires you to:

- find the supply equation
- find the demand equation
- set them equal to each other
- solve for the equilibrium quantity
- substitute back in for the equilibrium price (or vice versa)
Ch 1.3 and 1.4 summary

- Concentrate on how the slope answers most of these questions with bunny hops

- There are also tax and temperature questions in the textbook

- The homework and exams will use words like: linear depreciation, cost function, revenue function, profit function, fixed costs, variable costs, supply equation, demand equation, market equilibrium

- Homework is due Friday, 1.1-1.4

- I am heading to the mathskeller now