Math 142 – 511, 516, 517, Spring 2010

Lecture 2.

1/21/2010

Homework #1 (Alg. Review #1)
Homework #2 (Alg. Review #2)
Homework #3 (Sections 2.2 & 2.3)
Homework #4 (Section 2.4)

are **due Thursday, Jan. 28, 11:55 PM.**

Chapter 2. **Functions and graphs**

Section 2.2 **Elementary functions: graphs and transformations**

Definition Functions whose definitions involve more than one rule are called **piecewise-defined functions** .

Example 1. Table below shows a recent state income tax schedule for individuals filing a return in the state of Kansas.

If taxable income is

over	*but not over*	*tax due is*
\$0	\$15,000	3.50% of taxable income
\$15,000	\$30,000	\$525 plus 6.25% of amount over \$15,000
\$30,000		\$1,462.50 plus 6.45% of amount over \$30,000

1. Write a piecewise definition for the tax due $T(x)$ on an income of x dollars.
2. Graph $T(x)$
3. Find the tax due on a taxable income of \$20,000. Of \$35,000.

Section 2.3 **Quadratic functions**

Break-even analysis.

Given a revenue function $R(x)$ and a cost function $C(x)$.
Break-even points are the production levels at which

$$R(x) = C(x)$$

A loss occurs if

$$R(x) < C(x)$$

and a profit occurs if

$$R(x) > C(x).$$

Example 2. The marketing research department for a company that manufactures and sells "notebook" computers established the revenue function $R(x) = 2000x - 60x^2$. Given the cost function $C(x) = 4000 + 500x$ where x is in thousands of computers, and $R(x)$ and $C(x)$ are in thousands of dollars. Both functions have domain $1 \leq x \leq 25$.

1. Sketch a graph of both functions.
2. Find the break-even points.
3. For what outputs will a loss occur? Will a profit occur?

Section 2.4 **Exponential functions.**

Definition The equation

$$f(x) = b^x, \qquad b > 0, b \neq 1$$

defines an **exponential function** for each different constant b, called the **base**. The **domain** of f is $(-\infty, \infty)$ and the **range** of f is $(0, \infty)$.

Basic properties of the graph of $f(x) = b^x$, $b > 0$, $b \neq 1$.

1. All graphs will pass through the point (0,1).
2. All graphs are continuous curves, with no holes or jumps.
3. The x axis is horisontal asymptote.
4. If $b > 1$, then b^x increases as x increases.
5. If $0 < b < 1$, then b^x decreases as x increases.

Properties of exponential functions

For a and b positive, $a \neq 1$, $b \neq 1$, and x and y real,

1. Exponent laws:

$$a^{x+y} = a^x a^y, \quad a^{x-y} = \frac{a^x}{a^y}, \quad (a^x)^y = a^{xy}, \quad (ab)^x = a^x b^x$$

2. $a^x = a^y$ if and only if $x = y$
3. For $x \neq 0$,

$$a^x = b^x \text{ if and only if } a = b$$

Example 3. Simplify each expression:

a) $(4^{3x})^{2y}$, b) $(2 \times 3^{1.2t})^3$, c) $\dfrac{4^{x-3}}{4^{x-4}}$, d) $5^{3x-1}5^{4-x}$.

Example 4. Solve each equation for x.

a) $10^{2-3x} = 10^{5x-6}$