# **Mathematics for Economists, Spring 2016**

**Essentials for the course:**

1. Students missing more than 8 classes would get F in their final grade
2. If you are more than 5 minutes late in entering the class, you would be marked absent. Late assignments would not be graded.
3. Recommended text: Essential Mathematics for Economic Analysis (Fourth Edition) by Knut Sydsaeter, Peter Hammond, Arne Strom. You should be able to do all end-of-chapter questions.
4. Weekly take-home assignments / class pop quizzes. Have a weightage of 30% towards final grade
5. Frequent tests in this course. Have a weightage of 30% towards final grade
6. Final exam has a weightage of 40% towards final grade
7. Office hours of Anuradha Saha (Room 502 Admin Block): 2 – 4 pm Monday and 2 – 4 pm Wednesday.
8. *One class (28 Jan) will be rescheduled. 25th January 9 pm we have an extra class.*

**Introductory Topic: A Crash Course**

**Mathematics: when you know the numbers (Chapter 1)**

* What are natural numbers?
* What are whole numbers?
* What are recurring or periodic decimals?
* Is 5/0 a rational number?
* Is 0.3333333.. an irrational number?

**Powers**

* an = a.a…. (n times)
* $a^{-n} =\frac{1}{a}\frac{1}{a}…(n times) $
* a is the base, n (or –n) is the exponent
* a0 = 1 if a ≠ 0
* $a^{r}a^{s}=a^{r+s}$
* $\left(a^{r}\right)^{s}=a^{rs}$
* Compound interest: $A=P\left(1+ \frac{R}{100}\right)^{T}$, where A is the amount after the principle P has been saved for T years at R percent interest rate.
* What is (-0.3)2?
* True or False:
	+ $a^{m}. b^{m} =(ab)^{2m}$
	+ $(a+b)^{m}=a^{m}+b^{m}$

**Rules of Algebra: Too rudimentary to reiterate. See book.**

* Simplify: $(x+y+z)^{2}-(x-y-z)^{2}$
* Simplify: $4a^{2}b^{3}+6a^{3}b^{2}$

**Fractions: Too rudimentary to reiterate. See book.**

* $\left(\frac{3}{2}÷\frac{2}{15}\right)∙\frac{1}{9}$
* If x = 3/7 and y = 1/14, what is x/y?
* $\frac{^{10x^{2}}/\_{\left(x^{2}-1\right)}}{^{5x}/\_{\left(x+1\right)}}$

**Fractional power**

* $a^{^{p}/\_{q}}=\sqrt[q]{a^{p}}$
* $a^{^{1}/\_{q}}=\sqrt[q]{a}$ is the qth root of a
* Simplify $(27x^{3p}y^{6q}z^{12r})^{1/3}$

**Inequalities**

* If a > b and b > c then a > c
* If a > b and c > 0 then ac > bc
* If a > b and c < 0 then ac < bc
* If a > b and c > d then a + c > b + d
* For what values of x does this hold: (x – 1)(3 – x) > 0
* Solve for x:$ 2<\frac{3x+1}{2x+4}$

**Intervals and absolute value: Too rudimentary to reiterate. See book.**

How to solve Page 31 example 2?

**Mathematics: when you do not know the numbers instead know variables (Chapter 2)**

**How to solve simple equation?**

* $\frac{x-3}{4}+2=3x$
* $\frac{3}{x-3}-\frac{2}{x+3}=\frac{9}{x^{2}-9}$
* $Y=a+bY+ \overbar{I}$ is a structural form. The constants a, b are called parameters
* $Y= \frac{a}{1-b}+\frac{1}{1-b}\overbar{I}$ is a reduced form equation. It states the explicit relation of Y in terms of $\overbar{I}$. Y is endogenous variable while $\overbar{I}$ is exogenous variable.
* Solve the equation for K: $K^{1/2}\left(\frac{1}{2}\frac{r}{w}K\right)^{1/4}=Q$
* Quadratic (or second degree) equation: $ax^{2}+bx+c=0$ where a ≠ 0. There are two values of x which solve this equation the values are

$$x=\frac{-b \pm \sqrt{b^{2} - 4ac}}{2a}$$

What if $b^{2} - 4ac<0$? What if $b^{2} - 4ac=0$? What if $b^{2} - 4ac>0?$

* Solve: $r^{2}+\left(\sqrt{3} - \sqrt{2}\right)r= √6$
* Solve: $x-3y=-25$ and $4x+5y=19$
* Solve: $x^{3}\left(1+x^{2}\right)\left(1-2x\right)=0$
* Solve: $1+ \frac{2x}{x^{2}+1}=0$
* Solve: $3\sqrt{x}+2\sqrt{y}=2$ and $2\sqrt{x}-3\sqrt{y}=1/4$

**Mathematics: in-depth (Chapter 3)**

* Expand: $\sum\_{k= -2}^{2}2\sqrt{k+2}$
* Is this equality valid: $\sum\_{i=0}^{n-1}a\_{i, j}^{2}=\sum\_{k=1}^{n}a\_{k-1, j}^{2}$
* Complete this: $\sum\_{n=0}^{N}2^{n+5}=\sum\_{j=?}^{?}32∙2^{j-1}$
* Express this as notation: $a\_{i}^{3}b\_{i+3}+a\_{i+1}^{4}b\_{i+4}+…+a\_{i+p}^{p+3}b\_{i+p+3}$
* Compute: $\sum\_{i=0}^{1}\sum\_{j=1}^{2}i∙3^{j}$
* Consider a basket of n commodities. A price index for year t with year 0 as the base year is defined as $\frac{\sum\_{i=1}^{n}p\_{t}^{\left(i\right)}q^{\left(i\right)}}{\sum\_{i=1}^{n}p\_{0}^{\left(i\right)}q^{\left(i\right)}}\*100$
	+ q(i) are for which year? If q(i) are of the base year 0, then the index is called Laspeyres index. If q(i) is of the year t, then the index is called Paasche price index.
* $\left(a+b\right)=a+b$
* $\left(a+b\right)^{2}=a^{2}+2ab+b^{2}$
* $\left(a+b\right)^{3}=a^{3}+3a^{2}b+3ab^{2}+b^{3}$
* $\left(a+b\right)^{3}=a^{3}+a^{2}b+ab^{2}+b^{3}$
* $\left(a+b\right)^{4}=a^{4}+a^{3}b+a^{2}b^{2}+ab^{3}+b^{4}$
* Propositions: Assertions or statements that are either True or False
* $P=>Q$: If P is true then Q must be true
* $∽Q=> ∽P$: If Q is not true then P must not be true
* If $P=>Q$, then P is a sufficient condition for Q. If P occurs, Q will occur.
* If $P=>Q$, then Q is a necessary condition for P. If Q has not occurred, P will not occur.
* Is the implication and its converse true?

(x – 1 )(x – 2)(x – 3) = 0 => x = 1

x = 0 and y = 0 => x2 + y2 = 0

**Set Theory: Too rudimentary to reiterate. See book.**

* A = {2, 3, 4} B = {2, 5, 6}
* A – B? B – A? A U B?

**Proof by Induction: Solve Problems**