



**DALHOUSIE
UNIVERSITY**

FACULTY OF MANAGEMENT

MASTER OF PUBLIC ADMINISTRATION

CENTRE FOR EXECUTIVE AND GRADUATE EDUCATION

MGMT 5135

**MANAGERIAL
ECONOMICS**

By

THOMAS STORRING

TABLE OF CONTENTS

WELCOME	3
ABOUT THE AUTHOR	3
ABOUT THE INSTRUCTOR.....	3
COURSE ASSISTANCE	4
COURSE OVERVIEW.....	4
GOALS FOR THE COURSE.....	4
COURSE OBJECTIVES.....	5
REQUIRED TEXTBOOKS	5
BACKGROUND PREPARATION	5
THE LESSON NOTES.....	6
COURSE ASSESSMENT	6
COURSE COMPONENTS AND DELIVERABLES AT-A-GLANCE.....	9
APPENDIX I: CLASS POLICIES	10
APPENDIX II: VIRTUAL TEAM GUIDELINES	13
APPENDIX III: RUBRIC	14
APPENDIX IV: GUIDELINES FOR CLASS PARTICIPATION.....	16
APPENDIX V: MATH TUTORIAL	17

LESSONS

LESSON 1: INTRODUCTION TO MICROECONOMICS

LESSON 2: DEMAND AND SUPPLY

LESSON 3: ELASTICITY

LESSON 4: MARKETS IN ACTION

LESSON 5: CONSUMER BEHAVIOUR

LESSON 6: PRODUCERS IN THE SHORT RUN AND THE LONG RUN

LESSON 7: COMPETITIVE MARKETS

LESSON 8: MONOPOLY, PRICE DISCRIMINATION, IMPERFECT COMPETITION

LESSON 9: STRATEGIC BEHAVIOUR AND PUBLIC POLICY

LESSON 10: FACTOR MARKETS AND CAPITAL MARKETS

LESSON 11: LABOUR MARKETS

LESSON 12: MARKET FAILURES AND GOVERNMENT INTERVENTION

LESSON 13: ENVIRONMENTAL PROTECTION

WELCOME

Welcome to the MPA (Management) Program. This Student Manual contains information regarding the course MGMT 5135. Throughout the MPA (M) Program, you will receive similar manuals specific to each course. Though each manual is based on a standardized format, each contains unique information about the content and format of the course. It is, therefore, important that you read through this information carefully. Should you have any comments or suggestions, please contact Morven Fitzgerald at morven.fitzgerald@dal.ca.

ABOUT THE AUTHOR



Thomas Storing is the Director of Economics and Statistics at the Nova Scotia Department of Finance and the author of the lecture notes. Thomas Storing has an MPhil from the University of Oxford and a BA from Acadia University. He has practiced as an economist for over 14 years (both public and private sectors), covering a range of economic issues and methods: environmental policy, forestry, taxation, fiscal transfers and macroeconomic forecasting.

ABOUT THE INSTRUCTOR



Stéphane Mechoulan holds a Ph.D. in Economics from Northwestern University, a J.D. from the University of Toronto, an M.A. in Economics from Ecole des Hautes Etudes en Sciences Sociales and a Master in Management from HEC Paris (Grand Ecole). He is a member of the Ontario Bar. Dr. Mechoulan taught in the Department of Economics at the University of Toronto before joining the School of Public Administration as an Associate Professor in July 2009. His research interests include law and economics, health economics, and policy analysis. His work has appeared in journals such as the *Journal of Human Resources*, the *Journal of Law and Economics*, the *Journal of Legal Studies*, and the *Journal of Labor Economics*. His work has been funded by e.g., the American Statistical Association, Health Canada, and the Social Science Human Research Council of Canada. His paper 'Market Structure and Communicable Diseases' received the 2008 Mundell Prize from the Canadian Economics Association.

COURSE ASSISTANCE

Throughout the duration of the course, you will frequently find it necessary to contact the course instructor either by telephone or online. Please feel free to do so at any reasonable time of the day or evening. I can be reached as follows:

Phone: (902) 494-1097

Email: S.Mechoulan@dal.ca

ONLINE SESSIONS – OFFICE HOURS

There will be Teaching Assistant led “office hours” during the semester using Live Class Collaborate. The sessions will be two weeks before the assignments are due; day and time to be announced. The sessions will be recorded and posted for student reference during the course.

COURSE OVERVIEW

GOALS AND OBJECTIVES

This course introduces the fundamental concepts of microeconomics and enhances the analytical skills of practitioners in the public sector. It provides an understanding of basic microeconomic theories and principles, keeping in mind that this course is a graduate-level course in an *interdisciplinary* program. It is also concerned with the use and application of microeconomic theory, the relevance of this theory in economic decision-making and the role of government in the economy. The course places special emphasis on the similarities as well as contradictions that exist between economic theory and observation, and the impact of government regulation and policies on the behaviour of households, firms and markets. It also provides the necessary tools to understand the relationship between economic theory and economic policy. The examples presented in this course are based primarily on evidence drawn from the Canadian economy. As well, it provides the necessary foundation for the Public Economics course (MGMT 5140).

COURSE OBJECTIVES

By the end of this course, students should be able to:

- Explain the behavior of consumers that leads to demand curves
- Explain the behavior of producers and factors of production that underlie the supply curve
- Use demand and supply analysis to find equilibrium in the market for a good or service
- Manipulate demand and supply curves to find new equilibrium after market conditions change
- Explain how equilibrium in product markets generates welfare for consumers and producers
- Show how perfectly competitive product markets generate maximum welfare
- Identify the many ways in which product markets fail to meet the standards of perfect competition
- Recommend the appropriate government policy responses to market failures: taxes, subsidies, quotas, competition policy
- Illustrate how government policy interventions distort the functioning of markets (sometimes deliberately, sometimes unintentionally)
- Justify economic policy recommendations based on microeconomic principles and evidence.
- Converse intelligently with economists about economic policy while explaining economic policy options clearly to decision-makers.

REQUIRED TEXTBOOKS

Ragan, C.T.S., Economics, Sixteenth Canadian Edition, +EconLab. Toronto: Pearson Publishers Limited, 2020.

Chapters from this book are assigned for reading on a weekly basis, as indicated in the Course Outline and Reading List. In addition, the instructor may provide additional hand-outs or suggest other readings.

BACKGROUND PREPARATION

In addition to a well-rounded undergraduate preparation, this course requires a basic understanding of certain mathematical concepts. The mathematical competencies required for

this course are (a) the ability to read and interpret graphs, and to be able to use and apply graphical methods; and (b) a basic knowledge of algebra. Knowledge of calculus is not required. A summary of the mathematical tools used in this course is provided in Chapter 2 of the Ragan text. In addition, there is a short tutorial provided in the Appendix to this Syllabus. The mathematical notes at the end of the book also provide useful additional information. If you find the mathematics challenging, please talk to the instructor as soon as possible.

THE LESSON NOTES

The Lesson Notes focus on key microeconomic issues and their relevance to the public sector from a managerial perspective. They have been designed to complement the textbook and help you understand relevant, public sector real world applications.

The Lesson Notes should serve as a partial substitute for traditional lectures and complement the readings in a significant way.

LIVE CLASSROOM “LECTURES” & “OFFICE HOURS”

An important part of the course will be the use of live classroom technology to provide “lectures” in the form of a summary of the important concepts, and illustrations of the key tools used in analyzing microeconomic problems and situations. In addition, the live classroom sessions will be used to discuss upcoming assignments and provide a review of those previously submitted, as well as providing an important opportunity for students to raise questions or concerns. The sessions will also be recorded and posted so that students can review any portions they wish at their own pace. The live classroom technology will also be used to provide optional “office hours” to be held two weeks before the assignments are due. The live classroom “lectures” will occur evenings (day tba) from 7:00 to approximately 9:00 p.m (Atlantic time) the week before an assignment is due. The teaching assistant live classroom “office hours” will occur two weeks before assignments are due, day and time TBA.

COURSE ASSESSMENT

The aim of the assignments, discussion topics, problem sets and the final examination is to assess not only your basic understanding of the principles of managerial economics, but also your ability to grasp important distinctions, such as that between economic theory and economic policy. These will assess your capacity for making sound analysis on the suitability

of alternative policies to deal with different economic problems. You will also be expected to demonstrate your ability to combine various aspects of theory, application and policy in your work. The final examination will be a blend of principles, concepts and theories, as well as an understanding of their broader application.

EVALUATION

Assignments (4)	40%
Participation	15%
Group Presentation	10%
Final Exam*	35%
Total	100%

*You must pass the exam with a minimum grade of B- to pass this course.

EVALUATION COMPONENTS

PARTICIPATION (15%)

Active participation is an important part of your learning. Participation points will be awarded based on attendance and engagement in the Live Class sessions and activity in the online Discussions.

ASSIGNMENTS (40%)

There will be four assignments for this course. The assignments will consist of a variety of problems and questions that will test your understanding of the economic theories, principles and concepts from the textbook and their application to the Canadian Economy. The assignment instructions will be posted approximately two weeks beforehand and will cover the following lessons: Assignment #1 – lessons 1-4; Assignment #2 – lessons 5-7; Assignment #3 – lessons 8 – 10 and Assignment #4 – lessons 11-13.

GROUP PRESENTATION (10%)

Students will form their own groups and will be responsible for preparing a problem based on one or more of the course topics and will lead and facilitate the problem being collectively

solved in the class during the intensive. The topics and a sign-up sheet will be posted at the mid-to-late-February on Brightspace.

ASSIGNMENT EXTENSIONS

Assignments must be submitted by the assignment due date. Dalhousie University will only consider documented exceptions to this rule, such as serious medical emergencies or problems of a similar nature. In exceptional circumstances, an extension of up to one week **may** be granted at the professor's discretion, if requested in advance of the due date.

Late submissions will be assessed at a penalty of TEN percent. Assignments will not normally be accepted seven days or more after the due date; in such cases the student will receive a grade of zero.

INTENSIVES

The mandatory Intensive sessions for this course will be held April 23 – 23 (Atlantic) and April 25 – 27 (Eastern). You will be expected to be available and on line for two full days and the sessions will conclude at approximately 12:30 following the exam on the morning of the third day.

An itinerary and other relevant information will be posted on the site in advance of the intensive. There will be group submissions required for the intensive with details to be published in March.

COURSE OUTLINE *			
Dates	Topic	On-line	Assignments
January 4 - 10	Lesson 1: Intro	➤ Discussion Post: A bit about You	
January 11 - 17	Lesson 2: Supply & Demand	➤ Discussion Post (Jan 17)	
January 18 - 24	Lesson 3: Elasticity	➤ Discussion Post (Jan 24) ➤ Live Class with TA (TBA)	➤ Assignment 1 posted this week
January 25 - 31	Lesson 4: Markets in Action	➤ Discussion Post (Jan 31) ➤ Live Class with Dr. Mechoulan (TBA)	
February 1 - 7	Lesson 5: Consumers	➤ Discussion Post (Feb 7)	Assignment 1 Due (Feb 7)
February 8 - 14	Lesson 6: Producers	➤ Discussion Post (Feb 14) ➤ Live Class with TA (TBA) ➤ Midterm Course Evaluation available Feb 10 - 16	➤ Assignment 2 posted this week
February 15 - 21	Reading Week		
February 22 - 28	Lesson 7: Competitive Markets	➤ Discussion Post (Feb 28) ➤ Live Class with Dr. Mechoulan (TBA) ➤ Sign up sheet and topics for Intensive will be available this week	
March 1 - 7	Lesson 8: Monopoly & Imperfect Competition	➤ Discussion Post (Mar 7)	➤ Assignment 2 Due (Mar 7)
March 8 - 14	Lesson 9: Economic Efficiency & Public Policy	➤ Discussion Post (Mar 14) ➤ Live Class with TA (TBA)	➤ Assignment 3 posted this week
March 15 - 21	Lesson 10: Factor Markets	➤ Discussion Post (Mar 21) ➤ Live Class with Dr Mechoulan (TBA)	
March 22 - 28	Lesson 11: Market Failure	➤ Discussion Post (Mar 28)	➤ Assignment 3 Due (Mar 28) ➤ Assignment 4 posted this week
March 29 – April 4	Lesson 12: Environment	➤ Discussion Post (Apr 4) ➤ Live Class with TA (TBA)	
April 5 - 11	Lesson 13: Taxation	➤ Discussion Post (Apr 11) ➤ Live Class with Dr. Mechoulan (TBA)	➤ Assignment 4 Due (Apr 11)
April 21 - 23	Atlantic Intensive	➤ Overall Course Review, Group Presentations and Exam ➤ Student Ratings of Instruction Apr 22 - 28	
April 25 - 27	Eastern intensive	➤ Overall Course Review, Group Presentations and Exam ➤ Student Ratings of Instruction Apr 26 – May 2	

*Note that a week starts on Monday and ends on Sunday.
All dates will be available in your course site calendar

APPENDIX I: CLASS POLICIES

Extended absence from class

- Emergencies
 - ❑ Contact the course instructor
- Illness
 - ❑ Contact your instructor as soon as possible to inform him or her of your illness.
 - ❑ All absences due to illness must be supported by a physician's note to be submitted to the course instructor.

Late penalties for assignments

Assignments must be submitted by the assignment due date. Dalhousie University will only consider documented exceptions to this rule, such as serious medical emergencies or problems of a similar nature. In exceptional circumstances, an extension of up to one week **may** be granted at the professor's discretion, if requested in advance of the due date.

Late submissions will be assessed at a penalty of TEN percent. Assignments will not normally be accepted seven days or more after the due date; in such cases the student will receive a grade of zero.

ACCOMMODATION POLICY FOR STUDENTS

Students may request accommodation as a result of barriers related to disability, religious obligation, or any characteristic under the Nova Scotia Human Rights Act. Students who require academic accommodation for either classroom participation or the writing of tests and exams should make their request to the Advising and Access Services Center (AASC) prior to or at the outset of the regular academic year. Please visit www.dal.ca/access for more information and to obtain the Request for Accommodation – Form A. A note taker may be required as part of a student's accommodation. There is an honorarium of \$75/course/term (with some exceptions). If you are interested, please contact AASC at 494-2836 for more information. Please note that your classroom may contain specialized accessible furniture and

equipment. It is important that these items remain in the classroom, untouched, so that students who require their usage will be able to participate in the class.

ACADEMIC INTEGRITY

In general:

The commitment of the Faculty of Management is to graduate future leaders of business, government and civil society who manage with integrity and get things done. This is non-negotiable in our community and it starts with your first class at Dalhousie University. So when you submit any work for evaluation in this course or any other, please ensure that you are familiar with your obligations under the Faculty of Management's Academic Integrity Policies and that you understand where to go for help and advice in living up to our standards. You should be familiar with the Faculty of Management Professor and Student Contract on Academic Integrity, and it is your responsibility to ask questions if there is anything you do not understand.

Dalhousie offers many ways to learn about academic writing and presentations so that all members of the University community may acknowledge the intellectual property of others. Knowing how to find, evaluate, select, synthesize and cite information for use in assignments is called being "information literate." Information literacy is taught by Dalhousie University Librarians in classes and through Dalhousie Libraries' online [Citing & Writing](#) tutorials.

Do not plagiarize any materials for this course. For further guidance on what constitutes plagiarism, how to avoid it, and proper methods for attributing sources, please consult the University Secretariat's [Academic Integrity](#) page.

Please note that Dalhousie subscribes to plagiarism detection software that checks for originality in submitted papers. Any paper submitted by a student at Dalhousie University may be checked for originality to confirm that the student has not plagiarized from other sources. Plagiarism is considered a very serious academic offence that may lead to loss of credit, suspension or expulsion from the University, or even the revocation of a degree. It is essential that there be correct attribution of authorities from which facts and opinions have been derived. At Dalhousie, there are University Regulations which deal with plagiarism and, prior to submitting any paper in a course; students should read the Policy on [Intellectual Honesty](#) contained in the Calendar.

Furthermore, the University's Senate has affirmed the right of any instructor to require that student assignments be submitted in both written and computer readable format, e.g.: a text file or as an email attachment, and to submit any paper to a check such as that performed by the plagiarism detection software. As a student in this class, you are to keep an electronic copy of any paper you submit, and the course instructor may require you to submit that electronic copy on demand. Use of third-party originality checking software does not preclude instructor use of alternate means to identify lapses in originality and attribution. The result of such assessment may be used as evidence in any disciplinary action taken by the Senate.

Finally:

If you suspect cheating by colleagues or lapses in standards by a professor, you may use the confidential email: managementintegrity@dal.ca which is read only by the Assistant Academic Integrity Officer.

FACULTY OF MANAGEMENT CLARIFICATION ON PLAGIARISM VERSUS COLLABORATION

There are many forms of plagiarism, for instance, copying on exams and assignments. There is a clear line between group work on assignments when explicitly authorised by the professor and copying solutions from others. It is permissible to work on assignments with your friends but only when the professor gives you permission in the specific context of the assignment. University rules clearly stipulate that all assignments should be undertaken individually unless specifically authorised.

Specific examples of plagiarism include, but are not limited to, the following:

- Copying a computer file from another student, and using it as a template for your own solution
- Copying text written by another student
- Submitting the work of someone else, including that of a tutor as your own

An example of acceptable collaboration includes the following:

When authorised by the professor, discussing the issues and underlying factors of a case with fellow students, and then each of the students writing up their submissions individually, from start to finish.

APPENDIX II: VIRTUAL TEAM GUIDELINES

- **Access your Learning Management System consistently, frequently** to check for updates and news – approach it as part of your social media routine
- **Determine how often team members will check in** with each other and stick to this communication schedule. At this time, determine if there will be any time zone challenges for team meetings and deadlines; discuss solutions.
- **Explore** the architecture of Brightspace. Consider using Brightspace's **e-Portfolio** as a team – This is right beside your Brightspace Calendar and it is a place to record and reflect on your learning experience.
- **Develop and follow a team charter** with your virtual team to establish roles and responsibilities. This is when you want to determine exactly what digital tools the team will be using (Brightspace?/Googledocs?/Facebook?/Office 365?)
- **Appoint and refer to a team records manager.** If you are unable to locate shared work, this person could help you find what you are looking for.
- **Connect during “live office hours”** to communicate with your instructor.
- **Stay present and visible online.** Communicate regularly with your peers via the designated forum.
- **own submissions individually, from start to finish.**

APPENDIX III: RUBRIC: BRIEFING NOTES AND EXAM ANSWERS

A mark of A+ is rare, only awarded to students who demonstrate flawless, professional-calibre work.

80-90	Answers that meet <u>all or almost all</u> of the following criteria relevant to the question:
	<ul style="list-style-type: none"> Clearly state the issue Coherently present relevant data and empirical evidence, with judicious use of visuals Cite references to relevant published literature Accurately describe the rationale and policy options for government intervention in the economy Analyze the range of potential impacts that government intervention has on the economy Consider assumptions, uncertainties, ambiguities and conflicts about government interventions in the economy Are concise, few superfluous arguments or evidence Make clear recommendations; justify them based on theory, literature, analysis and uncertainties
70-80	Answers that meet <u>some</u> of the following criteria relevant to the question:
	<ul style="list-style-type: none"> Clearly state the issue Coherently present relevant data and empirical evidence, with judicious use of visuals Cite references to relevant published literature Accurately describe the rationale and policy options for government intervention in the economy Analyze the range of potential impacts that government intervention has on the economy Consider assumptions, uncertainties, ambiguities and conflicts about government interventions in the economy Are concise, few superfluous arguments or evidence Make clear recommendations; justify them based on theory, literature, analysis and uncertainties
60-70	Answers that exhibit <u>some</u> of the following flaws:
	<ul style="list-style-type: none"> Present unclear statement of issue, focus on irrelevant details, solve “non-problems” Contain incoherent or irrelevant data/visuals Make no reference to relevant literature or reference to irrelevant/biased literature Ignore or misinterpret the rationale for government intervention, consider few or irrelevant policy options Understate or exaggerate the impacts that government intervention has on the economy Rely on conjecture and personal value judgments instead of evidence Ignore assumptions, uncertainties ambiguities and conflicts about government interventions in the economy Are verbose, with superfluous arguments or evidence Offer unclear recommendations for action on economic policy issues Present recommendations not consistent with theory, literature, analysis and uncertainties/ambiguities
<60	Answers that exhibit <u>all or almost all</u> of the following flaws:
	<ul style="list-style-type: none"> Present unclear statement of issue, focus on irrelevant details, solve “non-problems”

- Contain incoherent or irrelevant data/visuals
- Make no reference to relevant literature or reference to irrelevant/biased literature
- Ignore or misinterpret the rationale for government intervention, consider few or irrelevant policy options
- Understate or exaggerate the impacts that government intervention has on the economy
- Rely on conjecture and personal value judgments instead of evidence
- Ignore assumptions, uncertainties ambiguities and conflicts about government interventions in the economy
- Are verbose, with superfluous arguments or evidence
- Offer unclear recommendations for action on economic policy issues
- Present recommendations not consistent with theory, literature, analysis and uncertainties/ambiguities

<60 Answers that exhibit any of the following flaws:

- Completely ignore the substance of the issue
- Misrepresent or fabricate evidence
- Plagiarize the work of others

APPENDIX IV: GUIDELINE: CLASS PARTICIPATION

Although class participation is not part of the formal evaluation, it is vital for your own development and adds to the learning experience of your peers. Frankly, it's a good way to demonstrate your understanding of the material and good practice for your career in the public service.

Here are some guidelines to good class participation:

- Speak up! Offer your perspective and insight to lectures and discussions
- Ask relevant and probing questions
- Answer questions posed by instructor and classmates
- Engage in discussion or debate
- Make reference to readings and other relevant literature or evidence
- Make compelling challenges to arguments
- Listen to other arguments and contribute respectfully

Conversely, the following behaviours make for poor class participation

- Failure to participate
- Distract from discussions with irrelevant and confusing arguments
- Are unwilling to attempt answers to questions posed by instructor and classmates
- Are unwilling to engage in discussion or debate
- Ask irrelevant questions
- Rely on conjecture and personal value judgments instead of theory, literature and empirical evidence
- Accept given wisdom without question or challenge
- Speak "just to be heard"
- Ignore other arguments

And these behaviours are completely unacceptable and won't be tolerated:

- Use offensive or disrespectful language
- Plagiarize the work of others
- Argue using personal attacks

Graphing an Equation

Example: the cost of pizza based on the number of toppings, where a plain pizza with no toppings is priced at \$7. As you add each new topping, the cost goes up by 75 cents. An equation that relates the total price of a pizza to the number of toppings on the pizza could be $y = 7.00 + .75x$. Now let's look at how you can draw a graph that illustrates this relationship. The procedure for doing this is:

Generate a list of points for the relationship.

The first step in the process is to generate a list of points to graph. You do this by selecting several values for the x coordinate. It might be good to make sure you find *three* points to graph. Once you have selected *three* values for x , use the equation to calculate their corresponding y values. It might be easier to display your results in a table, as we've done below.

In the pizza example, the equation is $y = 7.00 + .75x$. It may be useful to look at the equation at this point and remember that a typical equation is written in the form

$$y = a + bx$$

where a is the y intercept and b is the slope. So, in a graph, the line representing this equation would begin at 7 on the y axis. It will then increase in increments by 0.75 (the slope).

In order to plot the line, you first need to select some values of x . You then substitute these values into the equation and solve for their corresponding y values. Your list of points may be kept in a table like the one below. For our pizza example, the table may start out this way:

x Number of Toppings	y Final Cost
0	7.00
1	7.75
2	
3	
4	

In the table below, for each given x value you can see the calculation of the y value.

	x Number of Toppings	y Final Cost
Let $x = 0$: $y = 7.00 + .75(0)$ $y = 7.00 + 0$ $y = 7.00$	0	7.00
Let $x = 1$: $y = 7.00 + .75(1)$	1	7.75

	$y = 7.00 + .75$ $y = 7.75$		
Let $x = 2$:	$y = 7.00 + .75 (2)$ $y = 7.00 + 1.50$ $y = 8.50$	2	8.50
Let $x = 3$:	$y = 7.00 + .75 (3)$ $y = 7.00 + 2.25$ $y = 9.25$	3	9.25
Let $x = 4$:	$y = 7.00 + .75 (4)$ $y = 7.00 + 3.00$ $y = 10.00$	4	10.00

As you get more used to doing these calculations, you'll find you can skip some steps fairly easily. After you have completed your table, you should end up with the following list of points:

(0, 7.00), (1, 7.75), (2, 8.50), (3, 9.25), (4, 10.00)

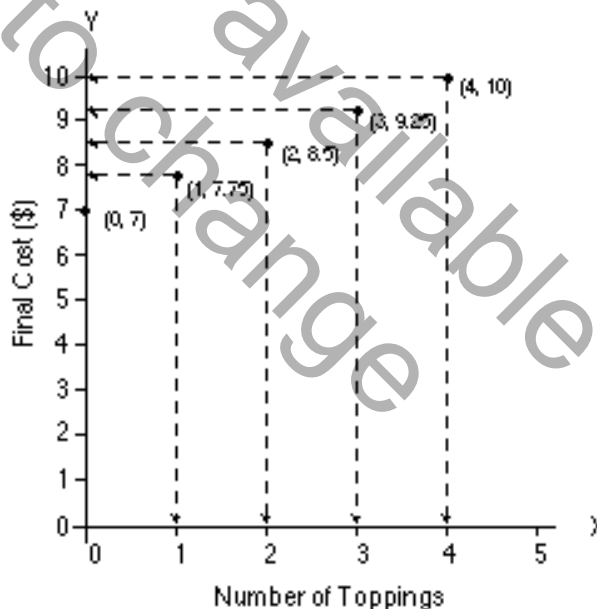
Notice they are written using the (x, y) notation. You are now ready to create the graph of these points on a set of axes.

Draw a set of axes, define the scale, then plot the points.

Once you have your list of points you are ready to plot them on a graph. The first step in drawing the graph is setting up the axes and determining the scale. The points you have to plot are:

(0, 7.00), (1, 7.75), (2, 8.50), (3, 9.25), (4, 10.00)

Notice that the x values range from 0 to 4 and the y values go from 7 to 10. The scale of the two axes must include all the points. Below is a set of axes drawn to do just that. Notice that the distance between the points must be equal on each axis but does not have to be the same for both axes. The x -axis goes up to 5 on this diagram, and the y -axis up to 10; the scale on each axis can be different.



Independent variable: plotted on the *horizontal axis* of a graph, the *x axis* is commonly the *independent variable*. Unfortunately, in the case of economics however, price (P), the independent variable is normally shown on the vertical axis. It's by convention – you just have to get used to it! An independent variable is one that is unaffected by changes in the dependent variable.

Dependent variable: The dependent variable (e.g. Q or quantity) is dependent upon changes in the independent variable (price).

Calculating Slope

If you have at least two points on a line, it is possible to calculate the slope of the line. In order to do this, you use the equation $\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}$

Using the above example (the pizza and toppings), if you were supplied with the graph only, you would be able to calculate the slope by subbing in the points into the equation and solving.

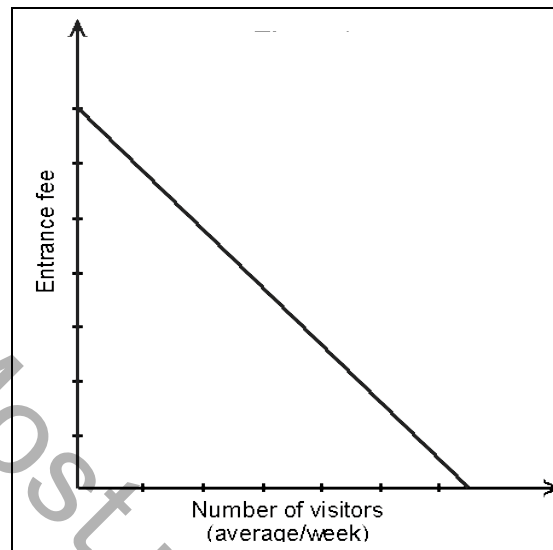
E.g. (0, 7), (4, 10)

$$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10 - 7}{4 - 0} = \frac{3}{4} = 0.75$$

Doing this you can see that the slope is 0.75, which is reaffirmed by looking at the equation provided earlier in the example.

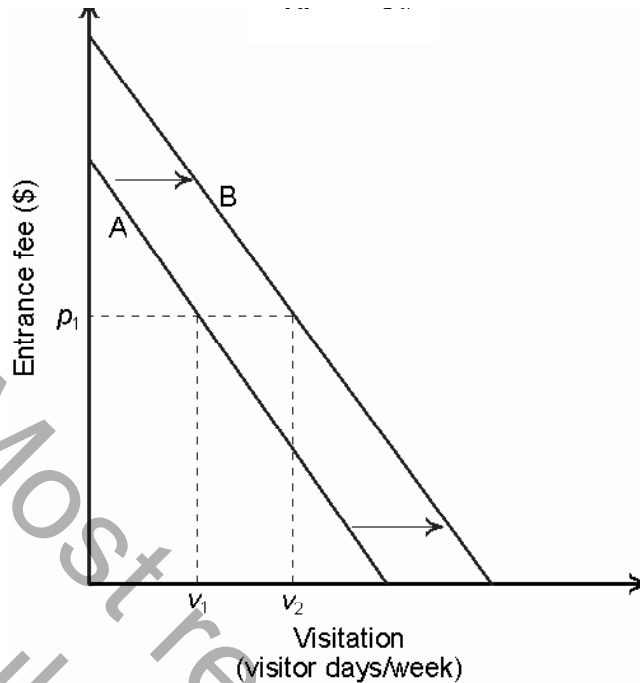
Understanding & Interpreting Graphs

Suppose, for example, we are interested in the relationship between the entrance fee to a public park and the amount of people who visit that park. We might expect that as the entrance fee increases, the amount of visitors would decrease. This is a negative or inverse relationship, and can be seen on the graph below – which is a negatively-sloped straight line. What the curve means is that the two variables have an inverse relationship, i.e., with an increase in the independent variable, the dependent variable decreases.



As mentioned above, a graph depicts the relationship between the variables indicated on the axes. Of course, there are normally other variables that affect the typical dependent variable. Thinking back to the park visitation function, for example, we know that other things besides the entrance fee affects visit rates: for example, weather, or changes in transportation costs (say a new road). All of these other factors are assumed to be constant when we move up and down a particular function between entrance fee and visitation. However, these variables can play a role by causing shifts in the existing curve/relationship between entrance fees and the number of visitors.

Consider the graph below. It shows the relationship between entrance fee and visitation at a public park. Function A is the original relationship. According to this, for example, an entrance fee of P_1 would lead to a visitation rate of V_1 . Now suppose there is a change in another variable affecting visitation, for example, the weather (e.g., it is a sunny day). This in effect will increase the likelihood of visitors to the park. But weather is not one of the variables on the two axes of the graph, instead, what the weather variable does is cause the whole entrance fee/visitation function to shift to the right (outwards) because it means with nice weather, more people will visit the park at every fee level. The new relationship between our graphed variables is labeled B, and it lies to the right of the old relationship. Now an entrance fee of P_1 , for example, will lead to a visitation of V_2 , which is higher than the old one.



Manipulating Equations

In certain situations, in order to graph equations (e.g., supply and demand curves), and solve for an equilibrium point (equilibrium P & Q), you need to set the equations equal to Q_S (for the supply equation) and Q_D (for the demand curve). See below for an example. In doing this, it is important to remember you are trying to isolate the Q, and whatever you do to one side of the equation you must do to the other side.

$$P = 1/5 Q_S - 8 \quad (\text{supply equation})$$

$$P = 40 - 1/5 Q_D \quad (\text{demand equation})$$

$$P = 1/5 Q_S - 8 \quad (\text{supply equation})$$

$P + 8 = 1/5 Q_S - 8 + 8 \rightarrow$ in this part we are trying to get rid of 8 on the right side of the equation in order to isolate Q. We do this by adding 8 to the negative 8, giving 0. However we must do the same to the other side of the equation, leaving us with the following:

$$P + 8 = 1/5 Q_S$$

$5(P + 8) = 5(1/5 Q_S) \rightarrow$ Because there is a fraction before the Q_S we can multiply by the denominator to make it equal to 1, so in this case we must multiply all numbers on both sides of the equation by 5. By doing this we end up with:

$5P + 40 = 1Q_S$, which is the same as $5P + 40 = Q_S$ so we are finished and now have an equation for the supply curve

Moving on to the demand equation, we will do more or less the same thing:

$$P = 40 - 1/5 Q_D \quad (\text{demand equation})$$

$$P - 40 = 40 - 40 - 1/5 Q_D$$

$$P - 40 = -1/5 Q_D$$

$$5(P) - 5(40) = 5(-1/5 Q_D)$$

$5P - 200 = -1 Q_D \rightarrow$ At this point in order to isolate Q_D we need to divide the entire equation, both sides by -1 to make it a positive number.

$$\frac{5P}{-1} - \frac{200}{-1} = \frac{-1 Q_D}{-1}$$

$-5P + 200 = Q_D$ rewriting this equation, it can be written as $Q_D = 200 - 5P$.

At this stage, it is possible to solve for the equilibrium quantity and price. Remember that the equilibrium quantity and price is the point at which the supply and demand curves intersect each other. This means that it is the amount that people want at a certain price, and the amount producers are willing to supply at this price. Knowing this, we can set the two equations equal to one and other, and solve for P and Q. Remember that you can ONLY do this once you have manipulated the equations to be equal to Q_S and Q_D .

$$Q_S = 5P + 40$$

$$Q_D = 200 - 5P$$

$$Q_S = Q_D$$

$$5P + 40 = 200 - 5P$$

$$5P + 40 - 40 = 200 - 40 - 5P$$

$$5P = 160 - 5P$$

$$5P + 5P = 160 - 5P + 5P$$

$$\frac{10P}{10} = \frac{160}{10}$$

$$P = 16$$

At this point we can sub P back into the original equation for either Q_S or Q_D to solve for Q. Remember you can use either equation because at the equilibrium point, the quantity demanded and supplied will be the same. See below.

$$Q_S = 5P + 40$$

$$Q_S = 5(16) + 40$$

$$Q_S = 80 + 40$$

$$Q_S = 120$$

$$Q_D = 200 - 5P$$

$$Q_D = 200 - 5(16)$$

$$Q_D = 200 - 80$$

$$Q_D = 120$$

Finally, it is ALWAYS a good idea to check to see if you've done this right. The original equations were:

$$P = 1/5 Q_S - 8 \text{ (supply equation)}$$

$$P = 40 - 1/5 Q_D \text{ (demand equation)}$$

Our answers are $P = 16$ and $Q = 120$. Do they work?

Supply equation: $16 = 1/5 (120) - 8 = 24 - 8 = 16$ yes!

Demand equation: $16 = 40 - 1/5 (120) = 40 - 24 = 16$ yes!

If you want more practice solving these equations, a quick google search will serve up loads of examples to try.

However, you could also try the Discussion Questions #2 and #3 on 3.26 of the Lesson Notes. Parts (a) and (b) of both questions give you a chance to practice this. Then you can get into the more interesting questions!

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