

# Mathematics in first year at UBC

Richard Anstee  
UBC, Vancouver

Jumpstart, August 20, 2010

# Introduction

I'm Richard Anstee, a Professor of Mathematics. My research area is Discrete Mathematics and this summer I am working with one second year undergraduate student and one Ph.D. student on research. I have taught first year calculus, a section of Math 184, for three years but this year I'll be teaching a third year, fourth year, and a graduate course.

I am sharing duties this year as 'Chief advisor' in the Math department; this is mostly about giving advice to advisors.

An interesting question posed to me as a topic for this talk was  
**What is the nature of a Mathematics course at University?**  
It will likely be quite different from your High School experiences.

The course will consist of lectures perhaps 36 1hr lectures (actually 50 minutes as you've been told) or 24 1.5 hr lectures depending on the section. Students are expected to attend the lectures but unless told otherwise it is not mandatory. You are adults. Lectures are rather formal affairs and your class may be large say 200 or small say 60. The instructor will attempt to communicate the main points, providing motivation and news.

The course will consist of lectures perhaps 36 1hr lectures (actually 50 minutes as you've been told) or 24 1.5 hr lectures depending on the section. Students are expected to attend the lectures but unless told otherwise it is not mandatory. You are adults. Lectures are rather formal affairs and your class may be large say 200 or small say 60. The instructor will attempt to communicate the main points, providing motivation and news. You should:

The course will consist of lectures perhaps 36 1hr lectures (actually 50 minutes as you've been told) or 24 1.5 hr lectures depending on the section. Students are expected to attend the lectures but unless told otherwise it is not mandatory. You are adults. Lectures are rather formal affairs and your class may be large say 200 or small say 60. The instructor will attempt to communicate the main points, providing motivation and news. You should:

Arrive on time.

The course will consist of lectures perhaps 36 1hr lectures (actually 50 minutes as you've been told) or 24 1.5 hr lectures depending on the section. Students are expected to attend the lectures but unless told otherwise it is not mandatory. You are adults. Lectures are rather formal affairs and your class may be large say 200 or small say 60. The instructor will attempt to communicate the main points, providing motivation and news. You should:

Arrive on time.

Laugh at instructors jokes.

The course will consist of lectures perhaps 36 1hr lectures (actually 50 minutes as you've been told) or 24 1.5 hr lectures depending on the section. Students are expected to attend the lectures but unless told otherwise it is not mandatory. You are adults. Lectures are rather formal affairs and your class may be large say 200 or small say 60. The instructor will attempt to communicate the main points, providing motivation and news. You should:

Arrive on time.

Laugh at instructors jokes.

Take notes if you find that helpful (most do).



The course will consist of lectures perhaps 36 1hr lectures (actually 50 minutes as you've been told) or 24 1.5 hr lectures depending on the section. Students are expected to attend the lectures but unless told otherwise it is not mandatory. You are adults. Lectures are rather formal affairs and your class may be large say 200 or small say 60. The instructor will attempt to communicate the main points, providing motivation and news. You should:

Arrive on time.

Laugh at instructors jokes.

Take notes if you find that helpful (most do).

Review material after class. This is your chance to understand parts of the lecture that you missed first time around.

The course will consist of lectures perhaps 36 1hr lectures (actually 50 minutes as you've been told) or 24 1.5 hr lectures depending on the section. Students are expected to attend the lectures but unless told otherwise it is not mandatory. You are adults. Lectures are rather formal affairs and your class may be large say 200 or small say 60. The instructor will attempt to communicate the main points, providing motivation and news. You should:

Arrive on time.

Laugh at instructors jokes.

Take notes if you find that helpful (most do).

Review material after class. This is your chance to understand parts of the lecture that you missed first time around.

Preview material before class.

The instructor may ask questions or have short questions to perform in class. Try to do participate in these activities. They perform more than one function. A break from one activity to another somehow refreshes the brain and allows for more learning.

The instructor may ask questions or have short questions to perform in class. Try to do participate in these activities. They perform more than one function. A break from one activity to another somehow refreshes the brain and allows for more learning.

Don't disturb your fellow students. No **snoring**, have **cellphones** turned off (Yes, **no texting**), no using **laptop** in any but the last row (it disturbs other students) and not at all if told that. Keep **quiet** unless in a specified group activity or asking a question. The instructor will remind you if the class is making too much noise. This is not for the instructors benefit, who can hear themselves, but so that fellow students can hear.

# Special Activities

The class may have some associated activities such as workshops in MATH 180,184 or 110. Attend religiously. Students quickly appreciate these activities as helpful to their learning.

# Homework

Instructors will assign **homework** to varying degrees. Apart from any marks awarded, assignments are crucial to learning the material. **Mathematics has to be done to be learned.** The instructor will usually give you a useful set of exercises. Doing all the textbook exercises may well be excessive. Boring repetitive exercises may not be helpful after the first few. If you need extra problems, try some other instructor's webpage.

# Homework

Instructors will assign **homework** to varying degrees. Apart from any marks awarded, assignments are crucial to learning the material. **Mathematics has to be done to be learned.** The instructor will usually give you a useful set of exercises. Doing all the textbook exercises may well be excessive. Boring repetitive exercises may not be helpful after the first few. If you need extra problems, try some other instructor's webpage.

Hand in easily readable assignments that are stapled and with name and student number.

# Midterms

Instructors will set some number of **midterms**. Really a better word would be term tests. When I taught MATH 184 I gave 4 midterms; some would say that is a mathematical impossibility! Often the midterms are coordinated between sections. Midterms may be new in character for you. They have a fixed time limit and ought to have 'hard' problems to prepare you for the final exam. They often require a certain speed, I am sorry to say. The instructor will provide some limited guidance on the nature of the test. You may be in a section where the instructor can post sample midterms which is a helpful study aid.



# Midterms

You'll probably find midterms the biggest change from High School. They are way harder than the tests you are used to. Also cheating is found and acted upon. After you get your midterm back listen carefully to the instructor for general feedback (if the average has turned out to be 20 and you got 24 it might make you feel better). Read your midterm to find what you have done wrong. You could engage your instructor concerning the nature of your errors.

The **final exam** will no doubt have practice exams posted for studying. The questions will be a mix of standard problems and harder problems. You have to know your stuff but the overall results are quite reasonable, maybe a failure rate overall of 15% some of which can be explained by students not working. You won't be one of those. We employ some scaling and so if your exam seemed very difficult you may take some comfort if others agree with you. Its only an exam anyway.

# Are you in the Appropriate Course?

I believe a general problem for some international students is to figure out what level of course is appropriate

- a high level advanced course (e.g. MATH 120),
- a regular course (e.g. MATH 100 or MATH 180),
- a course that runs for a full year allowing time to review (MATH 110).

# Algebra, Algebra, Algebra

Long experience teaching Calculus and examining student exams has confirmed that **algebra skills are crucial to success**. They will be assumed in most calculus courses so you may have to be the one who decides to do some review.

# Algebra, Algebra, Algebra

Long experience teaching Calculus and examining student exams has confirmed that **algebra skills are crucial to success**. They will be assumed in most calculus courses so you may have to be the one who decides to do some review. Certain students will be asked to write the **Basic Skills Test**, one sitting will be Thursday Sept 2 the last week before classes and one sitting will be the first week of classes Thursday Sept 9. You choose. If you score high enough then you can take one of the one term Differential Calculus courses.

# Algebra, Algebra, Algebra

Long experience teaching Calculus and examining student exams has confirmed that **algebra skills are crucial to success**. They will be assumed in most calculus courses so you may have to be the one who decides to do some review. Certain students will be asked to write the **Basic Skills Test**, one sitting will be Thursday Sept 2 the last week before classes and one sitting will be the first week of classes Thursday Sept 9. You choose. If you score high enough then you can take one of the one term Differential Calculus courses. Transferring sections can be a challenge and will involve compromises. I'd completely recommend the test September 2 to allow more time for course shuffling if necessary. For those who need to be forced into MATH 110 this can be awkward since it is a year long course. But visit the Math department during one of its registration sessions for help.

For what values of  $x$  is  $x^2 < 2x + 8$  ?

For what values of  $k$  is  $-x^2 < kx + 4$  for all  $x$ ?



The product of two numbers is 64. If one number is  $x$ , express the sum of the two numbers as a function of  $x$ .

# What is Calculus about

The first year Calculus is split into two parts Differential Calculus and Integral Calculus.

The main topic is that of **rate of change** or **derivative**. You learn various ways to think of this concept, various ways to compute the quantities involved and various ways to apply the concept. Some say that **Calculus** is the **greatest intellectual accomplishment of Mankind**. There are some amazing concepts here. Fortunately we don't ask you to invent them.

# What is Calculus about

The first year Calculus is split into two parts Differential Calculus and Integral Calculus.

The main topic is that of **rate of change** or **derivative**. You learn various ways to think of this concept, various ways to compute the quantities involved and various ways to apply the concept. Some say that **Calculus** is the **greatest intellectual accomplishment of Mankind**. There are some amazing concepts here. Fortunately we don't ask you to invent them.

**first example:** **speed** is the rate of change of your position with respect to time.

# What is Calculus about

The first year Calculus is split into two parts Differential Calculus and Integral Calculus.

The main topic is that of **rate of change** or **derivative**. You learn various ways to think of this concept, various ways to compute the quantities involved and various ways to apply the concept. Some say that **Calculus** is the **greatest intellectual accomplishment of Mankind**. There are some amazing concepts here. Fortunately we don't ask you to invent them.

**first example:** **speed** is the rate of change of your position with respect to time.

**second example:** **inflation rate** is rate of change of prices (consumer price index) with respect to time divided by prices. This is called a relative derivative.

# What is Calculus about

The first year Calculus is split into two parts Differential Calculus and Integral Calculus.

The main topic is that of **rate of change** or **derivative**. You learn various ways to think of this concept, various ways to compute the quantities involved and various ways to apply the concept. Some say that **Calculus** is the **greatest intellectual accomplishment of Mankind**. There are some amazing concepts here. Fortunately we don't ask you to invent them.

**first example:** **speed** is the rate of change of your position with respect to time.

**second example:** **inflation rate** is rate of change of prices (consumer price index) with respect to time divided by prices. This is called a relative derivative.

**third example:** perhaps you measure a population of say horses and compute the **rate of change** of weight with respect to height

# Richard's Balloon Problem

You are planning on building balloons and selling their surface area for advertising. Apparently there is sufficient air travel to sell even the top surface of your balloons. You estimate the net value of a square meter of balloon surface is worth \$100 (you have computed expected revenue minus cost of balloon fabric). The cost of helium to fill your balloon is \$5 per cubic meter. You might like to remember that the surface area of a balloon of radius  $r$  meters is  $4\pi r^2$  square meters and the volume is  $\frac{4}{3}\pi r^3$  cubic meters. What is the optimal radius for your balloon?

# Richard's Balloon Problem

You are planning on building balloons and selling their surface area for advertising. Apparently there is sufficient air travel to sell even the top surface of your balloons. You estimate the net value of a square meter of balloon surface is worth \$100 (you have computed expected revenue minus cost of balloon fabric). The cost of helium to fill your balloon is \$5 per cubic meter. You might like to remember that the surface area of a balloon of radius  $r$  meters is  $4\pi r^2$  square meters and the volume is  $\frac{4}{3}\pi r^3$  cubic meters.

What is the optimal radius for your balloon?

Cost of helium:  $5 \cdot \frac{4}{3}\pi r^3$ .

Value of balloon after subtracting cost of fabric:  $100 \cdot 4\pi r^2$

Profit:  $100 \cdot 4\pi r^2 - 5 \cdot \frac{4}{3}\pi r^3$ .

When you are having trouble in a course for mathematical reasons then here is a list of things you can do. Not all students take action quickly enough when a course has become difficult for them.



When you are having trouble in a course for mathematical reasons then here is a list of things you can do. Not all students take action quickly enough when a course has become difficult for them.

1. Attend **lectures**. Ask questions in lecture. If you don't understand something then probably half the class doesn't either.

When you are having trouble in a course for mathematical reasons then here is a list of things you can do. Not all students take action quickly enough when a course has become difficult for them.

1. Attend [lectures](#). Ask questions in lecture. If you don't understand something then probably half the class doesn't either.
2. If in MATH 110,180 or 184 then attend [workshops](#).

# Getting Help

When you are having trouble in a course for mathematical reasons then here is a list of things you can do. Not all students take action quickly enough when a course has become difficult for them.

1. Attend **lectures**. Ask questions in lecture. If you don't understand something then probably half the class doesn't either.
2. If in MATH 110,180 or 184 then attend **workshops**.
3. Visit your **instructor** during their **office hours**; they are lonely. Ask questions. Overcome your fears and visit the instructor. Don't worry, we won't remember your name; there are too many of you.

# Getting Help

When you are having trouble in a course for mathematical reasons then here is a list of things you can do. Not all students take action quickly enough when a course has become difficult for them.

# Getting Help

When you are having trouble in a course for mathematical reasons then here is a list of things you can do. Not all students take action quickly enough when a course has become difficult for them.

4. Ask questions of **fellow students**. This may work for your motivation and provide access to help at odd hours.

# Getting Help

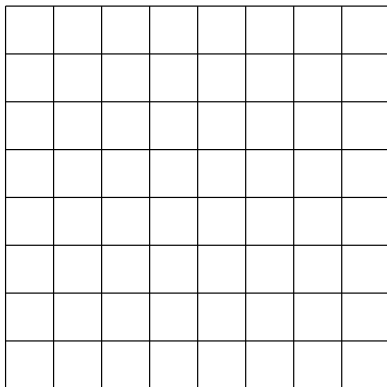
When you are having trouble in a course for mathematical reasons then here is a list of things you can do. Not all students take action quickly enough when a course has become difficult for them.

4. Ask questions of [fellow students](#). This may work for your motivation and provide access to help at odd hours.
5. Use [Tutorial hours](#) of Mathematics department Tutorial Centre (typically in Ike Barber) and your instructor will have access to a schedule or try AMS tutoring. While some students have success using tutors please make sure you are using a tutor in the right way. The goal is to learn the material and the mathematical techniques and not to get the homework done.

# Getting Help

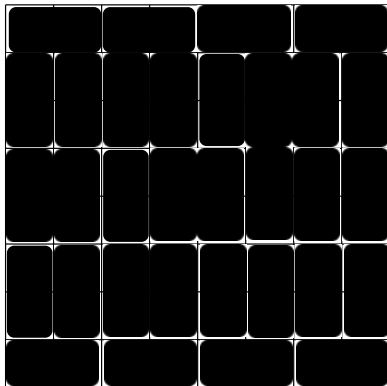
When you are having trouble in a course for mathematical reasons then here is a list of things you can do. Not all students take action quickly enough when a course has become difficult for them.

4. Ask questions of [fellow students](#). This may work for your motivation and provide access to help at odd hours.
5. Use [Tutorial hours](#) of Mathematics department Tutorial Centre (typically in Ike Barber) and your instructor will have access to a schedule or try AMS tutoring. While some students have success using tutors please make sure you are using a tutor in the right way. The goal is to learn the material and the mathematical techniques and not to get the homework done.
6. The [textbook](#) and online resources may help. Don't get hooked on online tools and videos unless you are sure they are good for you. You don't learn math by watching.

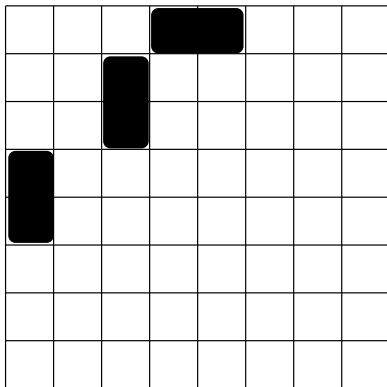


The checkerboard

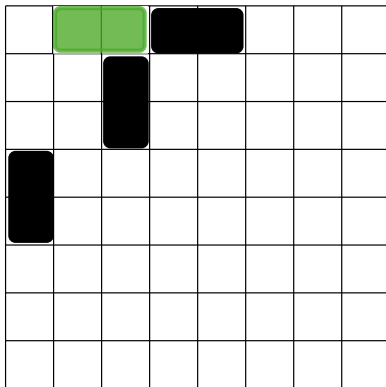




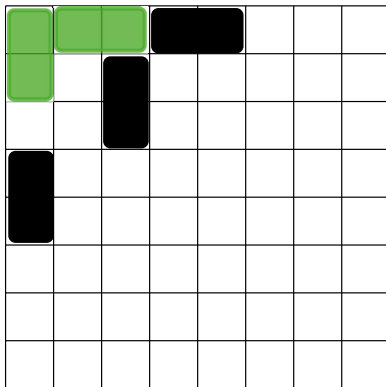
The checkerboard covered by dominoes



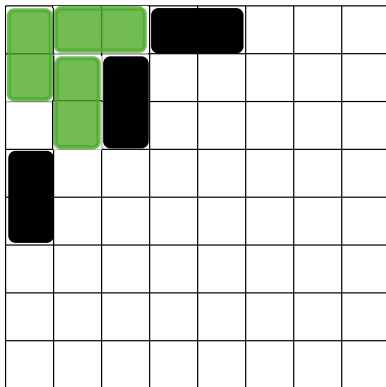
Black dominoes fixed in position. Can you complete?



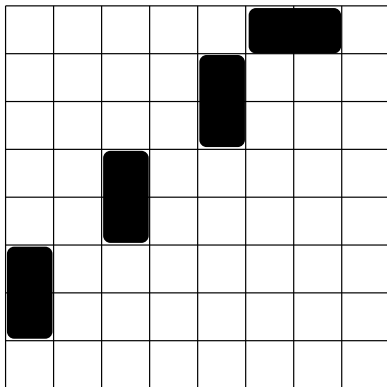
Black dominoes fixed in position. Can you complete?



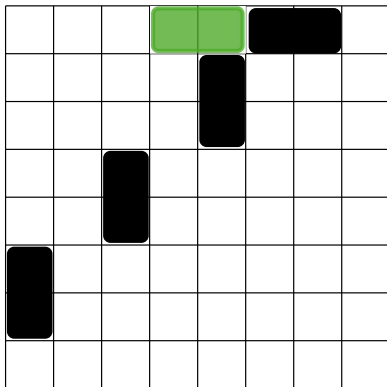
Black dominoes fixed in position. Can you complete?



Black dominoes fixed in position. You can't complete.



Black dominoes fixed in position. Can you complete?



Black dominoes fixed in position. Can you complete?

B	W	B	W	B			
W	B	W	B				
B	W	B	W				
W	B						
B	W						

Black dominoes fixed in position. You can't complete.



Have a great year at UBC!