

Subject: Re: Changes to Math and Pre-Med Students

Date: Monday, April 24, 2023 at 2:38:16 PM Eastern Daylight Time

From: Henry Towsner <htowsner@math.upenn.edu>

To: Hagan, Carol A <chagan@upenn.edu>

CC: Pemantle, Robin <pemantle@math.upenn.edu>, Mcglone, Molly Jean <mmcglone@sas.upenn.edu>, Gressman, Philip <gressman@math.upenn.edu>, Pallanti, Monica Dalin <pallant@math.upenn.edu>, Dunn, Richard E <dunnr@sas.upenn.edu>, Howell, Ricardo O. <rohowell@sas.upenn.edu>, Jung, Tanya A <jungt@sas.upenn.edu>, Urena, Carolyn <curena@sas.upenn.edu>

I'm attaching below the list of topics covered in math 1080.

Best,
Henry

Integration in more than one variable
Multivariate functions
Plots: surface, contour, intensity
Integration over rectangular regions

Writing and interpreting multivariate integrals
General regions
Applications: spatial totals, averages, and joint probabilities

Linear algebra 1: vectors and matrices
Vectors
Matrices
Linear maps

Derivatives in more than one variable
Partial derivatives
Chain rule

Multivariate graphing and optimization
Graphing in three dimensions
Critical points

Calculus on curves and surfaces
Two variables
Three dimensions and higher

Linear algebra 2: equations and determinants
Solving linear equations
Determinants

Constrained optimization
Optimizing over regions with boundary
Lagrange multipliers

The Multivariable Second Derivative Test

Introduction to differential equations
Modeling with differential equations
Slope fields
Euler iteration

Exact solutions to differential equations
 $f'=kf$ and exponential trajectories
Separable equations
Integrating factors and first order linear equations

Equilibria of differential equations
The logistic equation
Autonomous equations
Systems of equations
Vector fields

Autonomous Systems of Differential Equations
Qualitative behavior for autonomous systems
Determining the Behavior of Linear Autonomous Systems
Inhomogeneous Equations
Approximating Non-Linear Differential Equations

On Mon, Apr 24, 2023 at 9:34 AM Hagan, Carol A <chagan@upenn.edu> wrote:

Wonderful, thank you Robin.

Once I have the forthcoming syllabus for 1070 and a syllabus and/or description of 1080, I will send them to the schools.

When is an answer needed on this to support pre-major advisors and advising staff this summer?

Many thanks,

Carol

From: Pemantle, Robin <pemantle@math.upenn.edu>

Date: Friday, April 21, 2023 at 11:46 AM

To: Hagan, Carol A <chagan@upenn.edu>, Mcglone, Molly Jean <mmcglone@sas.upenn.edu>, Gressman, Philip <gressman@math.upenn.edu>, Pallanti, Monica Dalin <pallant@math.upenn.edu>,

Dunn, Richard E <dunnr@sas.upenn.edu>, Howell, Ricardo O. <rohowell@sas.upenn.edu>, Jung, Tanya A <jungt@sas.upenn.edu>, Urena, Carolyn <curena@sas.upenn.edu>
Cc: Towsner, Henry Piers <htowsner@math.upenn.edu>
Subject: Re: Changes to Math and Pre-Med Students

Carol,

We have an upcoming meeting May 1 to make an updated syllabus for all sections of 1070. Meanwhile, content for 1070-1080 is described in several documents, as follows.

For 1070, the educational objectives are attached and the day by day content is given below.

For 1080, Henry Towsner (copied) will be able to provide the most recent table of contents, syllabus, etc., where were updated last summer.

Robin

Math 1070 content by day:

Units, proportionality, word problems, inverse functions

Exponentials and logarithms

Limits

Continuity and computing limits

Derivatives: concept, definition, modeling

First and second derivatives, and sketching

Tools for computing derivatives

Proofs of rules / practice differentiating

differentiating f^{-1} , related rates, exponentials

time constants, tangent lines, MVT / mini-catch-up

L'Hôpital's rule

Orders of growth
Maxima and minima
Computing extrema, and applications
Applied optimization
catch-up day
Sequences and series
Infinite series and applications
Area, Riemann sums, definite integral
Interpretations, estimating integrals, estimating sums
Fundamental theorem of calculus
Integration techniques: substitution, integrating by parts
Improper integrals
Probability densities
Taylor polynomials
Computing Taylor polynomials
MVT and Taylor's theorem with remainder

From: "Hagan, Carol A" <chagan@upenn.edu>

Date: Friday, April 21, 2023 at 2:40 PM

To: "Mcglone, Molly Jean" <mmcglone@sas.upenn.edu>, "Pemantle, Robin" <pemantle@math.upenn.edu>, "Gressman, Philip" <gressman@math.upenn.edu>

Cc: Monica Pallanti <pallant@math.upenn.edu>, "Dunn, Richard E" <dunnr@sas.upenn.edu>, "Howell, Ricardo O." <rohowell@sas.upenn.edu>, "Jung, Tanya A" <jungt@sas.upenn.edu>, "Urena, Carolyn" <curena@sas.upenn.edu>

Subject: Re: Changes to Math and Pre-Med Students

Hi Molly,

I have reviewed this – not a surprise.

Do we have syllabi for 1070 and 1080? If we do not have syllabi yet, may I have the most recent/finished documents describing the courses (would be useful in addition to the syllabi, too)?

I would like to show it to Johns Hopkins and Wash U so we can advise with confidence. This will make it much easier to advise students.

Thanks for reaching out –

Carol

From: Mcglone, Molly Jean <mmcglone@sas.upenn.edu>

Date: Friday, April 21, 2023 at 9:21 AM

To: Pemantle, Robin <pemantle@math.upenn.edu>, Hagan, Carol A <chagan@upenn.edu>, Gressman, Philip <gressman@math.upenn.edu>

Cc: Pallanti, Monica Dalin <pallant@math.upenn.edu>, Dunn, Richard E <dunnr@sas.upenn.edu>, Howell, Ricardo O. <rohowell@sas.upenn.edu>, Jung, Tanya A <jungt@sas.upenn.edu>, Urena, Carolyn <curena@sas.upenn.edu>

Subject: Re: Changes to Math and Pre-Med Students

Hi Carol,

I am writing to check in again since there has been so much movement and we are trying to get ready for summer advising. Have you had a chance to look over the Math 1070/1080 sequence with the pre-med curriculum in mind?

I understand that Math has been in touch with you recently so hopefully this email is not a surprise. Please let us know your thoughts.

Thanks!

Molly

--

Molly McGlone

Associate Dean and Director of Academic Affairs

College of Arts & Sciences

University of Pennsylvania

215-898-6341

For virtual and in-person appointments, please use my calendly link:

https://calendly.com/mollymcglone_upenn

From: Pemantle, Robin <pemantle@math.upenn.edu>

Date: Monday, January 30, 2023 at 11:47 AM

To: Hagan, Carol A <chagan@upenn.edu>, Gressman, Philip <gressman@math.upenn.edu>

Cc: Mcglone, Molly Jean <mmcglone@sas.upenn.edu>, Pallanti, Monica Dalin <pallant@math.upenn.edu>, Dunn, Richard E <dunnr@sas.upenn.edu>, Howell, Ricardo O. <rohowell@sas.upenn.edu>

Subject: Re: Changes to Math and Pre-Med Students

Carol,

Thanks for providing this information. It looks to me as if the mathematical points explicitly addressed in "**Knowledge of Scientific Concepts and Principles**" section of your link

- Identifying the relationships between different representations of concepts (e.g., written, symbolic, graphic).
- Using given mathematical equations to solve problems
- Identifying a graph that illustrates the relationship between educational attainment and life expectancy.

as well as some of the math involved in the examples such as scientific notation, graphing and the "**General Mathematical Concepts and Techniques**" on page 20 of the MCAT document are in fact among those pre-calculus issues that are specifically reinforced in Math 1070. So that's good news for pre-meds interested in 1070-1080.

Robin

From: "Hagan, Carol A" <chagan@upenn.edu>
Date: Monday, January 30, 2023 at 11:33 AM
To: "Pemantle, Robin" <pemantle@math.upenn.edu>, "Gressman, Philip" <gressman@math.upenn.edu>
Cc: "Mcglone, Molly Jean" <mmcglone@sas.upenn.edu>, Monica Pallanti <pallant@math.upenn.edu>, "Dunn, Richard E" <dunnr@sas.upenn.edu>, "Howell, Ricardo O." <rohowell@sas.upenn.edu>
Subject: Re: Changes to Math and Pre-Med Students

Hello Robin,

There is no calculus on the MCAT. "Data-based and statistical reasoning" is required and mathematical concepts found at the links below.

General description of concepts tested on the MCAT are here: <https://students-residents.aamc.org/media/9261/download>

Detailed descriptions of mathematical concepts needed for the MCAT:

<https://students-residents.aamc.org/media/8981/download>

See page 3 for "General Mathematical Concepts & Techniques" needed for the Chem/Phys Section of the MCAT

<https://students-residents.aamc.org/media/8716/download?attachment>

See page 3 for "General Mathematical Concepts & Techniques" needed for the "Bio" Section of the MCAT

<https://students-residents.aamc.org/media/9036/download>

See page 3 for "General Mathematical Concepts & Techniques" needed for the "Psych/Soc" Section of the MCAT

The Critical Reading & Analysis Section does not require math skills.

Best,

Carol

From: Pemantle, Robin <pemantle@math.upenn.edu>
Sent: Monday, January 30, 2023 11:02 AM
To: Hagan, Carol A <chagan@upenn.edu>; Gressman, Philip <gressman@math.upenn.edu>
Cc: Mcglone, Molly Jean <mmcglone@sas.upenn.edu>; Pallanti, Monica Dalin <pallant@math.upenn.edu>;
Dunn, Richard E <dunnr@sas.upenn.edu>; Howell, Ricardo O. <rohowell@sas.upenn.edu>
Subject: Re: Changes to Math and Pre-Med Students

Carol,

Are there specific calculus requirements for the MCAT?

My understanding is that no, the MCAT math requirements don't include calculus.

If this is wrong, we probably still cover what's needed, but we should be made aware of the specifics.

Robin

From: "Hagan, Carol A" <chagan@upenn.edu>
Date: Monday, January 30, 2023 at 10:21 AM
To: "Gressman, Philip" <gressman@math.upenn.edu>
Cc: "Mcglone, Molly Jean" <mmcglone@sas.upenn.edu>, "Pemantle, Robin" <pemantle@math.upenn.edu>, "Monica Pallanti" <pallant@math.upenn.edu>, "Dunn, Richard E" <dunnr@sas.upenn.edu>, "Howell, Ricardo O." <rohowell@sas.upenn.edu>
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If the question is whether one or both courses would satisfy a calculus requirement at a medical school, I would have to run the course description/syllabus by the medical school.

There are about 50 medical schools with some kind of math requirement. There are only three that specifically mention calculus: Johns Hopkins, Washington University, and UC Riverside.

Hopkins is 2 math: calculus and/or statistics (strongly rec stat)

Wash U is 2 calculus or 1 calculus/1 statistics

UC Riverside is 2 math: calculus and/or statistics

They all accept AP credit for calculus.

Med school requirements can, and do, change all the time, but I don't see med schools adding calculus requirements in the future.

We should send a syllabus to Wash U and JHU to get it approved for their calculus requirements. This way we can say "any school that requires calculus will accept this course."

We have promoted calculus as a core med school requirement because it was required for Penn's general chemistry sequence in the past. My understanding is that now only the newer, more introductory, general chemistry track requires a calculus course (1300). I do not know if the chemistry department is going to stick with this going forward. ??? This is a separate conversation, which could lead to more nuanced advising about math requirements for medical school. This, I imagine, would affect course selection.

Let me know if I can clarify anything or if you would like me to send something along to Wash U/JHU. We should have those schools look at it. We have very few, if any, people apply to UC Riverside, but I could ask them as well.

All the best,

Carol

From: Philip Gressman <gressman@sas.upenn.edu>

Sent: Friday, January 20, 2023 2:39 PM

To: Hagan, Carol A <chagan@upenn.edu>

Cc: Mcglone, Molly Jean <mmcglone@sas.upenn.edu>; Pemantle, Robin <pemantle@math.upenn.edu>; Pallanti, Monica Dalin <pallant@math.upenn.edu>; Dunn, Richard E <dunnr@sas.upenn.edu>; Howell, Ricardo O. <rohowell@sas.upenn.edu>

Subject: Re: Changes to Math and Pre-Med Students

Hi Carol,

It's nice to meet you! I'm the Math Undergrad Chair. The courses in question are:

MATH 1070 Mathematics of change, Part I

Limits, orders of magnitude, differential and integral calculus; Taylor polynomials; estimating and bounding; probability densities. Mathematical modeling and applications to the social, economic and information sciences.

MATH 1080 Mathematics of change, Part II

Multivariate calculus; optimization; multivariate probability densities. Introduction to linear algebra; introduction to differential equations. Mathematical modeling and applications to the social, economic and information sciences.

The rough idea of these courses has been to create a calculus track which is more responsive to the needs of students outside the hard sciences. What this means is that much of the content covered in the 1300-1400-1410 sequence is condensed into the 2-semester sequence 1070-1080 with the *missing* material being primarily related to hand computation skills (doing tons of integrals by hand) and physical vector calculus theorems (no Green's/Gauss/Stokes' Theorems). One big advantage of repackaging things in this way is that we have a new "entry-level" calculus course which reaches 1400-level material much quicker than would be the case if a student took 1300+1400. Currently Wharton has adopted 1070 as satisfying its calculus requirement (which can alternatively still be satisfied by 1400), and the Econ Department is in the process of transitioning towards using these courses as well.

I have attached a few documents: Proposal-1070-1080.pdf is an excerpt (lightly edited by me just a few minutes ago for clarity and minor updates) from a report presented to the math department in spring 2021 concerning the rationale for create these new courses; Topics-1070.pdf and Topics-1080.pdf are captures of the table of contents of the e-texts our instructors have written for the courses.

Let me pause here for the moment to allow for some digestion and to allow Robin Pemantle, who has been the chief architect of this project, to add to or revise what I've said so far.

Best, Phil

On Fri, Jan 20, 2023 at 9:48 AM Hagan, Carol A <chagan@upenn.edu> wrote:

Good morning Molly,

Thank you for reaching out.

I gather the question is whether these proposed courses would satisfy requirements for medical schools with math/calc/stat requirements. Correct?

I am happy to look at whatever is in the works and talk to any and all about it.

When it comes to what is acceptable to med schools, the course name matters in addition to the content of the course.

Also wondering if students will be able to use an AP score to earn credit for either or both of these.

Tell me more – sounds like an interesting addition to the curriculum!

Best,

Carol

Carol Hagan, PhD

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From: Mcglone, Molly Jean <mmcglone@sas.upenn.edu>

Sent: Friday, January 20, 2023 8:59 AM

To: Hagan, Carol A <chagan@upenn.edu>; Gressman, Philip <gressman@math.upenn.edu>; Pemantle, Robin <pemantle@math.upenn.edu>; Pallanti, Monica Dalin <pallant@math.upenn.edu>

Cc: Dunn, Richard E <dunnr@sas.upenn.edu>; Howell, Ricardo O. <rohowell@sas.upenn.edu>

Subject: Changes to Math and Pre-Med Students

Dear Carol,

We are working with the Math department right now on a new sequence, Math 1070-1080 that aims to work with social science majors like Econ. We wondered how we could get these courses evaluated alongside the current Math 1300-1400-1410 sequence that is required for students applying to medical school.

Can you help us get this conversation started?

Phil and Robin, is there a document you can share with Carol?

Thank you so much in advance,

Molly

--

Henry Towsner
Associate Professor
Department of Mathematics
University of Pennsylvania
<http://www.math.upenn.edu/~htowsner>