

Engineering Mathematics 2: Multivariable Calculus (22M:032)

eVersion and updates posted at: <http://www.math.uiowa.edu/~stroyan/Syllabi/> Open cells on the eVersion for details.

- **Fall 2009** **Prof.: Keith Stroyan, eMail: keith-stroyan@uiowa.edu**
- **Main Text:** *Interactive Multivariable Calculus* by Keith Stroyan
- **Class Locations & Times**
- **Goals & Objectives**
- **Help Hours - in room 310 MacLean Hall (south room of the Math Tutorial Lab)**
- **General University Business**
- **Weekly Syllabus (details with assigned work in each weekly eSection)**
- **Week #1: 23-29 Aug - Graphs of $z = f[x, y]$**

- **Mon: Explicit, Implicit, Parametric Graphs**

Homework from the print text:

Section 1.1 Exercise 1(b); 2(b), (c), (g); 3(a); Section 1.2 Ex.1(c),(d); 2(b); 3(c); 4(b);

Section 1.3 Exercise 1 part (b) = Ex1.3.1(b); Ex.1.3.3(c)

- **Wed: Sliding & Stretching Graphs, Explicit Plots in 3D**

Homework for discussion tomorrow, collection Tuesday: Ex.1.4.1(b), (d), (f); 2(b), (d), (f); 4; 5

- **Thu: Discuss Wednesday's homework**
- **Fri: Contour Graphs in 2D & Graphs with *Mathematica* & iMultiCalc**

Homework for discussion Tuesday, collection Thursday: Ex.1.6.1(b); 2(b); 3(a), (b), (c)

- **Week #2: 30 Aug - 5 Sep - Vector Geometry**

- **Mon: Graphing in 3D**
- **Tue: Meet in 1245 SC - Computer Lab instead of regular discussion room**

Instead of going to your regular Discussion Section room, go to 1245 SC

Additional help with *Mathematica*: Open *Mathematica* on a lab machine and then follow along with:
<http://www.wolfram.com/broadcast/screencasts/handsonstart/>

- **Wed: Position and Displacement Vectors, Sums, Differences, Scalar Multiples**

Homework for discussion tomorrow, collection Tuesday:

Ex.2.1.1(B), (F); 2; 4 (b); Ex.2.2.1; 3; Ex.2.3.1; 3; 5 (b); Ex.2.4.1; 3 (3D only); 4

Thu:



- **Fri: Angles, Perpendicular, Projection**



Homework for discussion Tuesday, collection Thursday: Ex.2.5.1; 3 (b), (d); 4; 5; 6; 8



- **Week #3: 6 - 12 Sep - Linear Functions $z = \lambda[x, y]$**



- **Mon= Labor Day**



- **Tue: The Projection Formula**



- **Wed: Cross Product & The Algebra \Leftrightarrow Geometry Lexicon**



Ex.2.6.1 (AxC only); 2; 4; Ex.2.7.5; 14



- **Thu: Wrap up vector geometry discussion. Be sure to discuss Ex.2.7.14**



- **Fri: Vector Algebra**



Ex. 2.8.1 (b); 2 (b); 5;



- **Week #4: 13 - 19 Sep - Tangent Planes, Partial, Total, and Directional Derivatives**



- **Mon: Explicit Linear Functions $z = \lambda[x, y]$**



Ex.3.1.1; 2; 5; 6; 7; 11; 13; 14



- **Tue: Computer Lab 1245 SC at regular times eLab2=Ch3L1 submit to ICON's dropbox Thu**



- **Wed: Linear Approximation and the Tangent Plane**



Ex.3.3.1 (b), (f); 2 (a); 3 (c); 5



- **Thu:**



- **Fri: Partial Differentiation Skills**



Ex.3.4.2 (Print this computer assignment to hand in and work Ex. 1 by hand, too, but do not hand it in.)



- **Week #5: 20 - 26 Sep - Gradients & Level Sets in 2D**



- **Mon: Directional Derivatives and the Nonlinear Gradient**



Ex.3.5.1(b), (d), (f); 2 (b); 3 (b);



- **Tue:**



- **Wed: Differential Approximation and a Contour Tangent**

Ex.3.7.2; 3; Ex.4.1.1 (b), (c); 2; 3; 4

- **Thu:**

- **Fri: Nonlinear Gradients and Contours**

Ex.4.2.1 (c); 2 (c); 3; 4 (c); 6

- **Week #6: 27 Sep - 3 Oct - Critical Points & Integration in Cartesian Coordinates**

- **Fri: Implicit Surfaces & Critical Points**

Ex.4.4.1; 2; 3; Ex.4.5.1; 2

Ex.4.2.9, 10, 13; Ex.6.1.1(b); Ex.7.2.8

- **Tue Computer Lab 1245 SC at regular times eLab3=Ch43 submit to ICON's dropbox Thu**

- **Wed Integration in 1D and Extension to 2D**

Ex.8.1.1, 2(d); Ex.8.2.1, 2(a), (f) (See eLab5 due next week.)

- **Thu**

- **Fri Integration over Rectangles**

Ex.8.2.2 (c), (i); 3(b); 4, 5, 7(a)

- **Week #7: 4 - 10 Oct - Integration in Polar Coordinates**

- **Mon Integration over Non-Rectangular Regions**

Ex.8.3.1(a), (b), (c); 2(function i regions A, B, C); 3(A&B); 5

- **Tue eLab5 = 5Ch8Lab1.nb on your own. Submit to ICON dropbox Thu**

- **Wed More Integration by Slicing**

Ex.8.3.2 (vi region C); 6(c); 7; 9; 10; 12 eLab5 = 5Ch8Lab1.nb

- **Thu**

- **Fri Polar Coordinates**

Ex.13.2.1, 2, 3(a), (b), (e); 4

■ **Week #8: 11 - 17 Oct - Area-weighted Integration Concluded & Exam#1**

■ **Mon Integration Concluded**

Ex. 13.2.6, 8, 9

■ **Tue**

■ **Wed Review for Exam#1**

Review exams are at www.engineering.uiowa.edu/~engmath2/

■ **Thu 5:30 - 7:00 Thu *** Exam#1 *** 5:30 - 7:00 pm in 100 PH**

■ **Fri No lecture to make up for exam - work eExam
Submit to ICON dropbox by Monday 23:59:59**

eLab4 = eExam#1= 4Chapter4Lab2.nb in version 6 eLabs on EngMath2

<http://www.engineering.uiowa.edu/%7Eengmath2/examples/v6Labs/>

■ **Week #9: 18-24 Oct - Parametric Curves in Space**

■ **Mon Lines and Circles in 2D, Parametric Curves with Mathematica**

Ex.9.1.1(b - 3D & b-2D); 2(b-3D & b-2D); 3(b-3D & b-2D); 4; 5(b); Ex.9.2.1

■ **Tue Computer Lab 1245 SC at regular times eLab6=Ch9L1 Submit to ICON dropbox Thu**

■ **Wed Curves in 3D**

Ex.9.4.1, 2, 3, 4, 5

■ **Thu**

■ **Fri Parametric Tangents**

Ex.9.6.1(b); 3 (b); 4; 5; 6;

■ **Week #10: 25-31 Oct - Motion in Space**

■ **Mon Parametrization, Chain Rule, and Arclength**

Ex.9.6.7, 9; Ex. 9.7.1(b), (e), (h); 2(b); 3

■ **Tue**

■ **Wed Curvature and Product Rules**

Ex.9.8.1(b), (e), (h); 3; 5; 8; 9(b)

Thu

■ **Fri Velocity, Acceleration, and The eExam Lab on Motion**

Ex.10.1.1, 2, 3, 4, 5 (b); 6 (b); 7; 9; 10 (b)

eLab7 = eExam#2 = <http://www.engineering.uiowa.edu/%7Eengmath2/examples/v6Labs/>
HELP: Esp. see Example 9.5.6 & Ex.10.2.1

Submit to the ICON Dropbox by 23:59:59 Tue

■ **Week #11: 1 - 7 Nov - Vector Fields in 2D**

■ **Mon Sketching Basic Vector Fields**

Ex. 10.1.15, 16, 17; Ex.11.1.1, 2, 3

■ **Tue**

■ **Wed Flow Along and Across boundaries**

Ex.11.4.1, 2, 3, 4 (b), (c); 5 (b), (c);

■ **Thu Go to the regular discussion, ON-YOUR-OWN do eLab8 = 8Ch11Lab1.nb Submit to the ICON dropbox next Tue.**

■ **Fri The Chain Rule and Independence of Path**

Ex.11.5.1, 2, 3, 4, 5

■ **Week #12: 8 -14 Nov - Green's Theorem**

■ **Mon Green's Theorems for Flow around and across**

Ex.12.1.2 (fct B only), 3, 4, 5, 7, 10

■ **Tue**

■ **Wed The "curl" test for a conservative vector field**

Ex.12.3.1, 2, 3, 4, 6

■ **Thu**

■ **Fri Global vs Local: W is not conservative!**

Ex.12.3.7, 8, 9

■ **Week #13: 15-21 Nov- Conservation of Energy & Exam#2**

■ **Mon Applications of Divergence and Swirl**

Ex.12.3.10, 11

■ **Tue**

■ **Wed *** Exam#2 *** 5:30 - 7:00 pm in 100 PH (<http://www.uiowa.edu/%7Emaps/p/ph1.htm>)**

Review exams are at www.engineering.uiowa.edu/~engmath2/

■ **Thu**

■ **Fri no lecture for exam time**

■ **Thanksgiving Break 22-28 Nov**

■ **Week #14: 29 Nov - 5 Dec - Series Approximation**

■ **Mon Geometric Series**

Ex.22.1.1, 3

■ **Tue**

■ **Wed Weierstrass' test & the classic series (Exp, Sin, Cos, Log, ArcTan)**

Ex.22.3.1, 3, 4

■ **Thu eLab 9 = eExam#3 = Ex. 22.2.3 = 9Ch22Lab1 submit to ICON's dropbox on Tue**

■ **Fri Convergence tests (radius of convergence)**

Ex.22.4.1, 2, 4

■ **Week #15: 6 - 12 Dec - Power Series**

■ **Mon Taylor series in general**

Ex.22.5.1, 3, 9, 12

■ **Tue eExam #3 is submit to ICON's dropbox by 23:59:59**

■ **Wed Review**

■ **Thu**

- Fri Review



- **Final Exam - Noon (12:00) Thu 17 Dec** (room to be announced)

