Calculus III (Math 2574)

Fall 2015

Dr. Ashley K. Wheeler

University of Arkansas

last updated: December 9, 2015

Table of Contents

Mon 24 Aug

- `http://comp.uark.edu/~ashleykw/Cal3Fall2015/cal3f15.html`
  - Email me (`ashleykw@uark.edu`) if you did not get a message from me on Friday.
  - ?s about the syllabus
- Attendance is taken using clickers. For today, a sign-in sheet is traversing the room.

Tips for Success

- Read. The. Textbook.
- "Suggested" book problems are ALL of them.
  - We may do examples in class, if there is time.
  - It's in your best interest to work problems that are not in the MLP homework, then bring the ones you struggle with to drill.
  - In the text, oftentimes there is an example, along with a list of problems covering the same concept.
- Play with the applets on MLP. This course has a lot of beautiful visuals.
- Come to office hours! Help with topics from lecture, checking solutions to worked problems, etc.

Wed 26 Aug

- `http://comp.uark.edu/~ashleykw/Cal3Fall2015/cal3f15.html`
  - Email me (`ashleykw@uark.edu`) if you did not get a message from me on Friday.
  - ?s about the syllabus
- Attendance is taken using clickers. For today, a sign-in sheet is traversing the room.
- Office hours: In general, I come in between 9-10a on MWF. However, if you need to meet earlier than that let me know in advance.

- Drill section 5:30-6:20 in Ozark Hall: cancelled. You are responsible for enrolling in a different one. In the meantime, attend one of the following:

Tue, Thu 4:30 PM - 5:20 PM	SCEN0402	Rachel Lehman
Tue, Thu 9:30 AM - 10:20 AM	SCEN0322	Muhenned Abdulsahib
Tue, Thu 4:30 PM - 5:20 PM	SCEN0501	Clark Scholz

- first MLP due Monday
- missing lecture or drill... (transferred) Email me so you're excused. You're responsible for the deadlines on the MLP homework.

Fri 28 Aug

- `http://comp.uark.edu/~ashleykw/Cal3Fall2015/cal3f15.html`
  - Email me (`ashleykw@uark.edu`) if you did not get a message from me on Friday.
  - ?s about the syllabus
- Attendance is taken using clickers STARTING MONDAY. For today, a sign-in sheet is traversing the room.

- first MLP due Monday
- missing lecture or drill... (transferred) Email me so you're excused. You're responsible for the deadlines on the MLP homework.
- 1st Quiz: next week, likely Tuesday. Anything from the first four sections of Chapter 11 is game.

Mon 31 Aug

- `http://comp.uark.edu/~ashleykw/Cal3Fall2015/cal3f15.html`
  - The instructions for MLP are in the syllabus.
  - The first homework is due tonight. Don't wait until the last minute.
- Attendance is now taken using clickers.
- Quiz 1 tomorrow (Tuesday) in drill, 10 minutes. Need to know definition of orthogonal.

Wed 2 Sep

- Tips on HW
  - Print and do the MLP assignment before going to book problems.
  - Areas to review:
    - setting up and solving equations, degrees of freedom
    - completing the square and other algebra
    - collinear points, planar geometry
    - Chapter 10

Fri 4 Sep

- Clickers next week.
- Quiz 2 on Tuesday, a little longer than Quiz 1.
- First Exam on Friday 18 Sep. Covers Chapter 11. There is a chance we will skip 11.9.
- MLP troubles: Use the list of instructions on the syllabus, or else visit the MRTC help page.

- Tips on HW
  - Print and do the MLP assignment before going to book problems.
  - Areas to review:
    - setting up and solving equations, degrees of freedom
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    - Chapter 10

Note-Taker Needed for 12:55 Section

From the CEA Office:

> *A student in this class requires a note-taker. If you are willing to upload your notes and plan to attend class on a REGULAR basis, please sign up via the CEA Online Services on the Center for Educational Access (CEA) website* `http://cea.uark.edu`. *On the CEA Online Services login screen, click on "Sign Up as a Note-taker". At the end of the semester you will receive verification of 48 community service hours OR a $50 gift card for providing class notes. All interested students are encouraged to sign up; preference may be given to volunteers seeking community service in an effort engage U of A students in community service opportunities. Please contact the Center for Educational Access at* `ceanotes@uark.edu` *if you have any questions.*

Wed 9 Sep *(Wheeler absent)*

- Read the textbook ahead of time!
- Blackboard?
- You may attend the other (Wheeler) section as long as your attendance is documented. See the webpage/syllabus for the time and location.
- Excused absences: Please email me if you know you'll be absent and why. If relevant, provide documentation such as a doctor's note.
- First Exam on Friday 18 Sep. Covers Chapter 11. There is a chance we will skip 11.9.
- MLP troubles: Use the list of instructions on the syllabus, or else visit the MRTC help page.

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Fri 11 Sep

- Clickers: Channel 41
- Blackboard?
- First Exam on Friday 18 Sep.
  - Covers up to 11.8.
  - No calculators.
  - Stay tuned: A list of suggested book problems will be posted on the course webpage.
- Quiz 3 on Tuesday, up to 11.8 is game (emphasis on curves, parametrizions, arc length).

Attendance Questions

- Excused absences: Please email me if you know you'll be absent and why. If relevant, provide documentation such as a doctor's note.
- You may attend the other (Wheeler) section as long as your attendance is documented. See the webpage/syllabus for the time and location. BUT...

Attendance Questions (cont.)

- Alternate Drills: Please do everything you can to attend your *scheduled* drill.
  - If you don't like your scheduled drill, change it in ISIS.
  - If you cannot change your drill then you *must* have permission from the instructor to attend a different drill. If the instructor says no, then they say no (so work out the arrangement ahead of time). You are responsible for your attendance being documented.
  - Since there are no makeups allowed for quizzes, you are allowed to attend an alternate drill to take a quiz. *Again,* you must have permission from the drill instructor (so work out the arrangement ahead of time).

Homework Questions

- MLP troubles: Use the list of instructions on the syllabus, or else visit the MRTC help page.
- Read the textbook ahead of time – before lecture! Then start the homework after lecture, the same day.
- Print the MLP assignment so you're not limited to working at a computer.
- The problems are chosen and assigned by the Coordinator. Expect one set per section covered. You are responsible for meeting the deadlines.

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Mon 14 Sep

- Clickers: Channel 41
- Exam this Friday 18 Sep
  - Covers up to 11.8.
  - No calculators.
  - A list of suggested book problems is posted on the course webpage. Don't worry about 11.9.
- Quiz 3 tomorrow (Tuesday), up to 11.8. Be sure to study 11.7 as well (e.g., do the MLP).

Attendance Questions

- Excused absences: Please email me if you know you'll be absent and why. If relevant, provide documentation such as a doctor's note.
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Wed 16 Sep

- Clickers: Channel 41
- Exam this Friday 18 Sep
  - Covers up to 11.8.
  - No calculators.
  - A list of suggested book problems is posted on the course webpage. Don't worry about 11.9.
  - Includes an "open-ended" portion... Compare to the rigor of Quiz 3. Likely to be take-home.
  - Graded exams won't be returned until at least Monday 28 Sep.
- Quiz 1-3 solutions posted on MLP

General Study Tips

- Hopefully, you've been doing those book problems.
- Review MLP problems. If there was a problem you got wrong the first time, do it again until you get it perfect.
- When doing problems, write up the answers nicely. You don't need as much detail as Quiz 3, BUT if you were to look at your work one year from now, you should have written enough to be able to follow it.
- Redo quizzes, too. Only one version of each of the first two quizzes is posted, so practice with the other versions.

General Study Tips (cont.)

- Review notes from class and reread (but not too slowly) the text. If necessary, get notes from a friend on days you missed or else reread those sections more carefully.
- Look at pictures in the book, especially any of the applets in MLP.
- Know the special triangles.
- Correct any lingering algebra, trig, geometry, Cal I rustiness.

General Study Tips (cont.)

- Definitions
  - Know "vocabulary words", not in order to recite the definitions, but so that you can understand what a question is asking.

Example (s)

1. Given $\overrightarrow{r}(t)$, find the **tangent vector**.
2. **smooth** vs. **differentiable** (in Cal I and in Cal III)
3. "Parametrize..." or "Eliminate the parameter"

General Study Tips (cont.)

- Formulas
  - Memorize them all...
  - OR know a few key formulas. Many of the others you can figure out from the context of the problem.
  - Some suggested key formulas:
    - distance and midpoint between two given points
    - equations for spheres and balls
    - simple (parallel to those given by the coordinates) planes and lines
    - both dot product formulas (and when one is more useful than the other)
    - both projection formulas (and when one is more useful than the other)

General Study Tips (cont.)

- cross product formula and the formula for its magnitude
- parametrized line in $\mathbb{R}^3$
- normalization of a vector
- arc length

- Physics formulas (**boldface** indicates a vector quantity):
  - Work = **Force** • **displacement**
  - **torque** = **radial force** × **applied force**
  - **magnetic force** = (charge)**velocity** × **magnetic field**
  - Newton no. 2: **total force** = (mass)**acceleration**

General Study Tips (cont.)

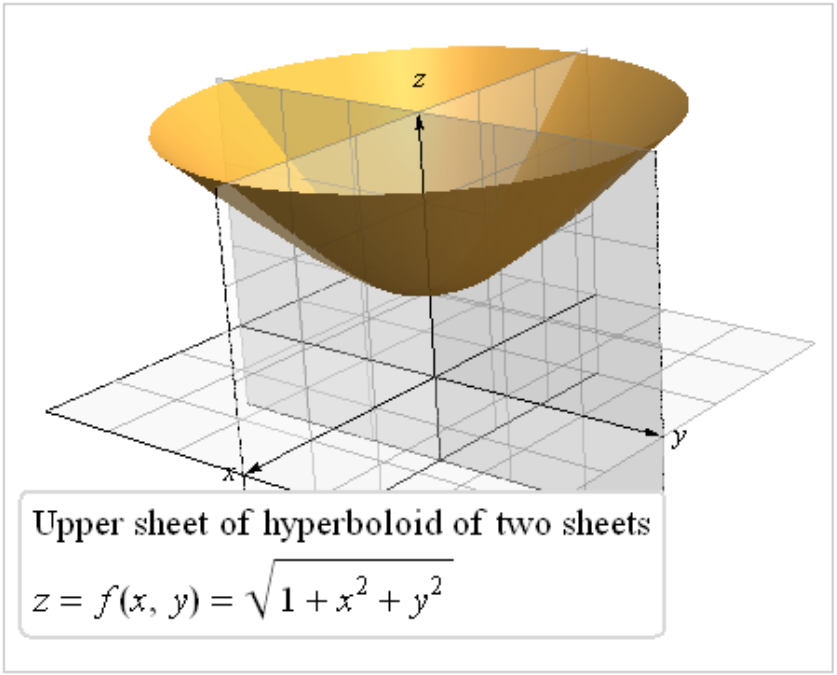
- Recognize key pictures: planes, lines, circles, helices.
- Know how to do calculus on vectors – derivative rules, integrals, limits, continuity, story problems, etc.

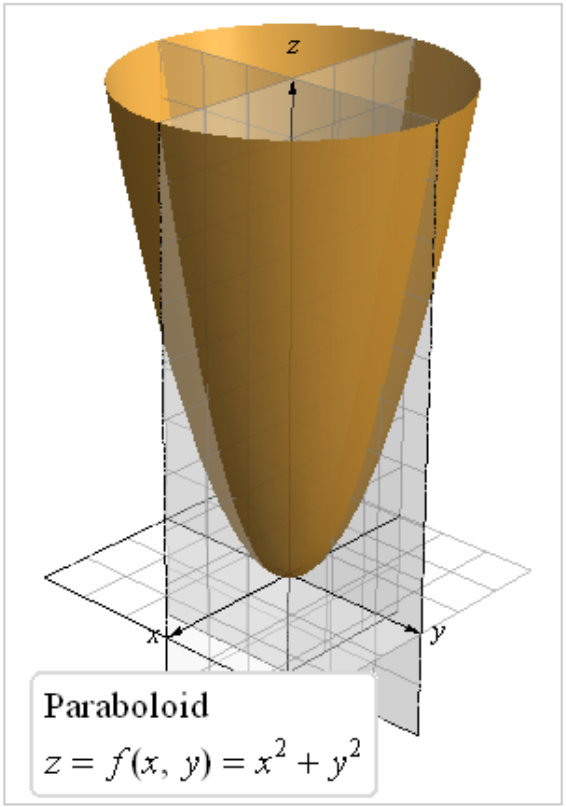
Mon 21 Sep

- About the exam...
- MLP stay tuned
- Quiz tomorrow, probably

Pictures!

Graphs of functions of two variables:

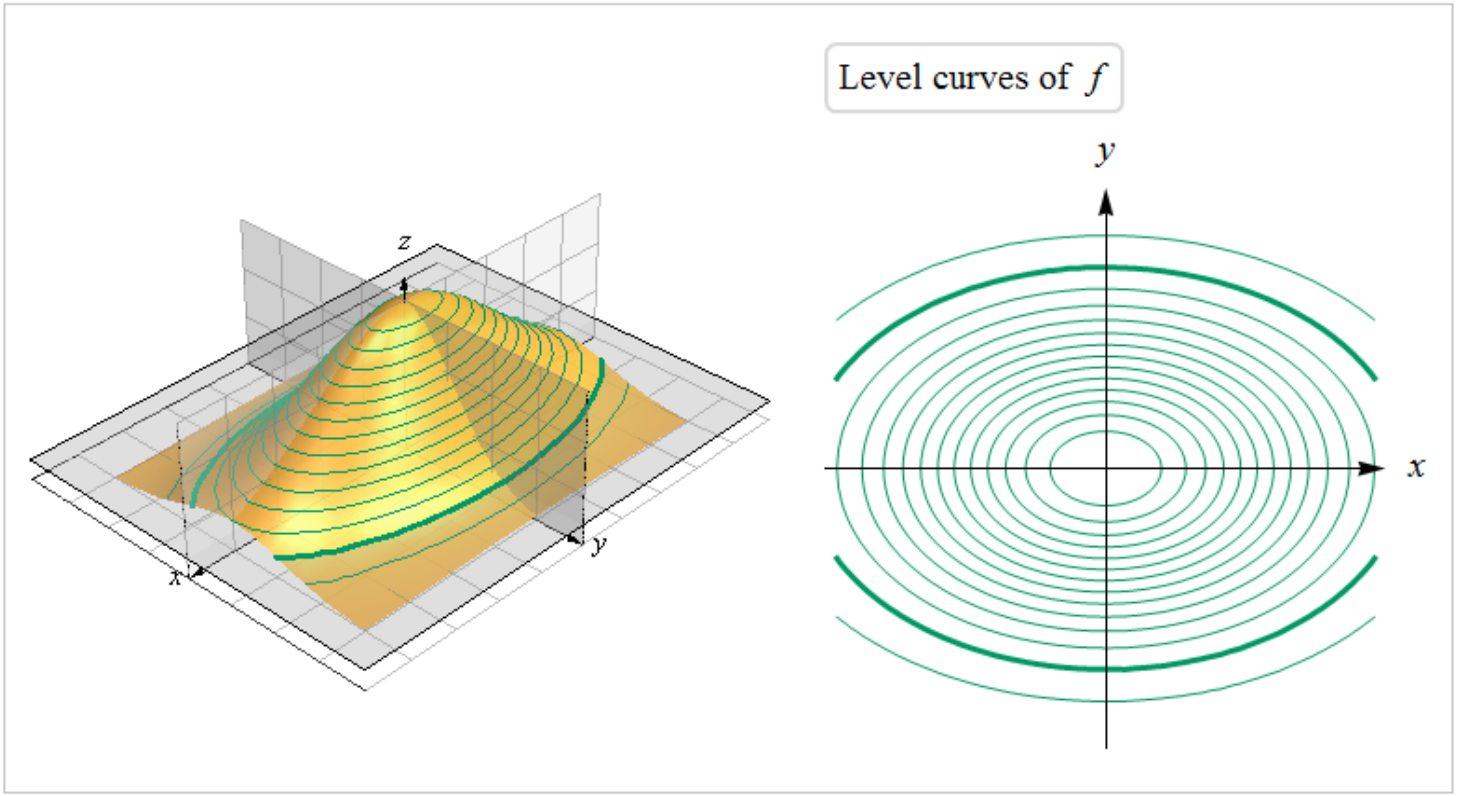




(See the interactive pictures in MLP.)

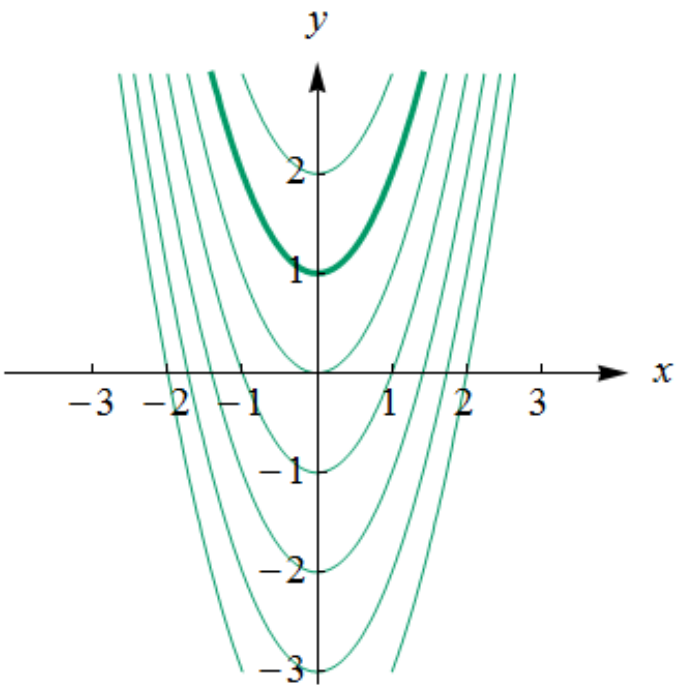
Pictures! (cont.)

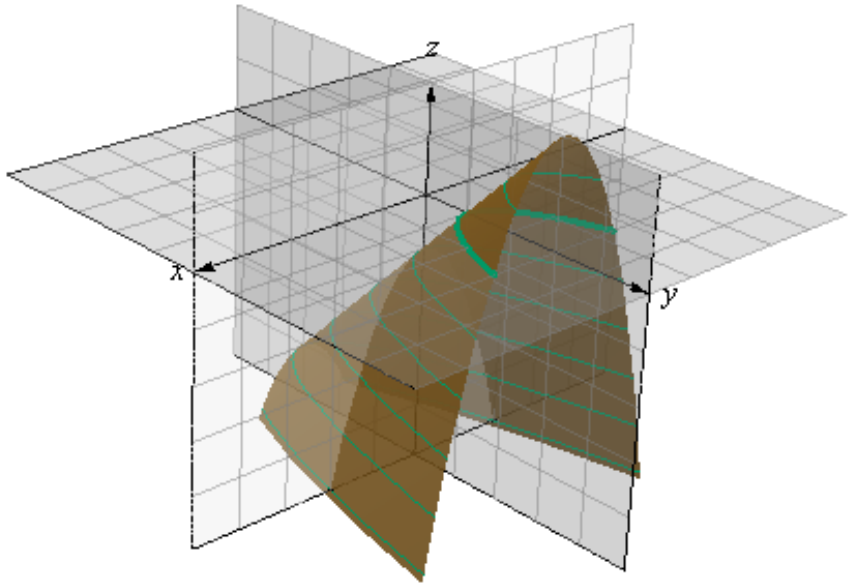
Level Curves v. Contour Curves



Pictures! (cont.)

Level curves of $z = y - x^2 - 1$

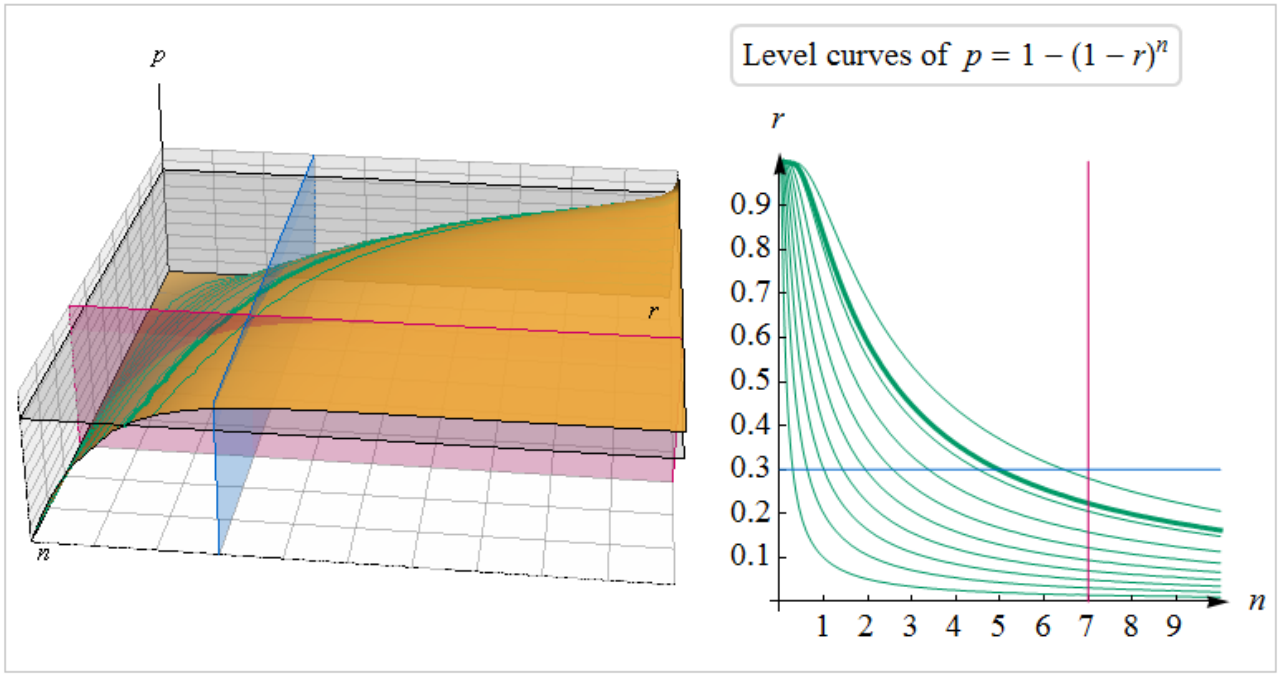




Contour curves formed by the intersection of surface $z = y - x^2 - 1$ and planes $z = z_0$.

Pictures! (cont.)

Application:



r = fraction of sick students who took the Exam last Friday

n = number of tests Wheeler has graded so far

$p(n, r)$ = probability Wheeler graded an infected test

Wed 23 Sep

- Preliminary exam feedback.
- MLP homeworks for Chapter 12 are posted.
- Exam 2 is in 3 weeks.
  - Be proactive! Read ahead, do the homework as soon as possible. DON'T SKIP CLASS.
  - Follow instructions. On Quizzes, on the Exam, etc.
  - Fix your algebra, trig, Cal I-II.

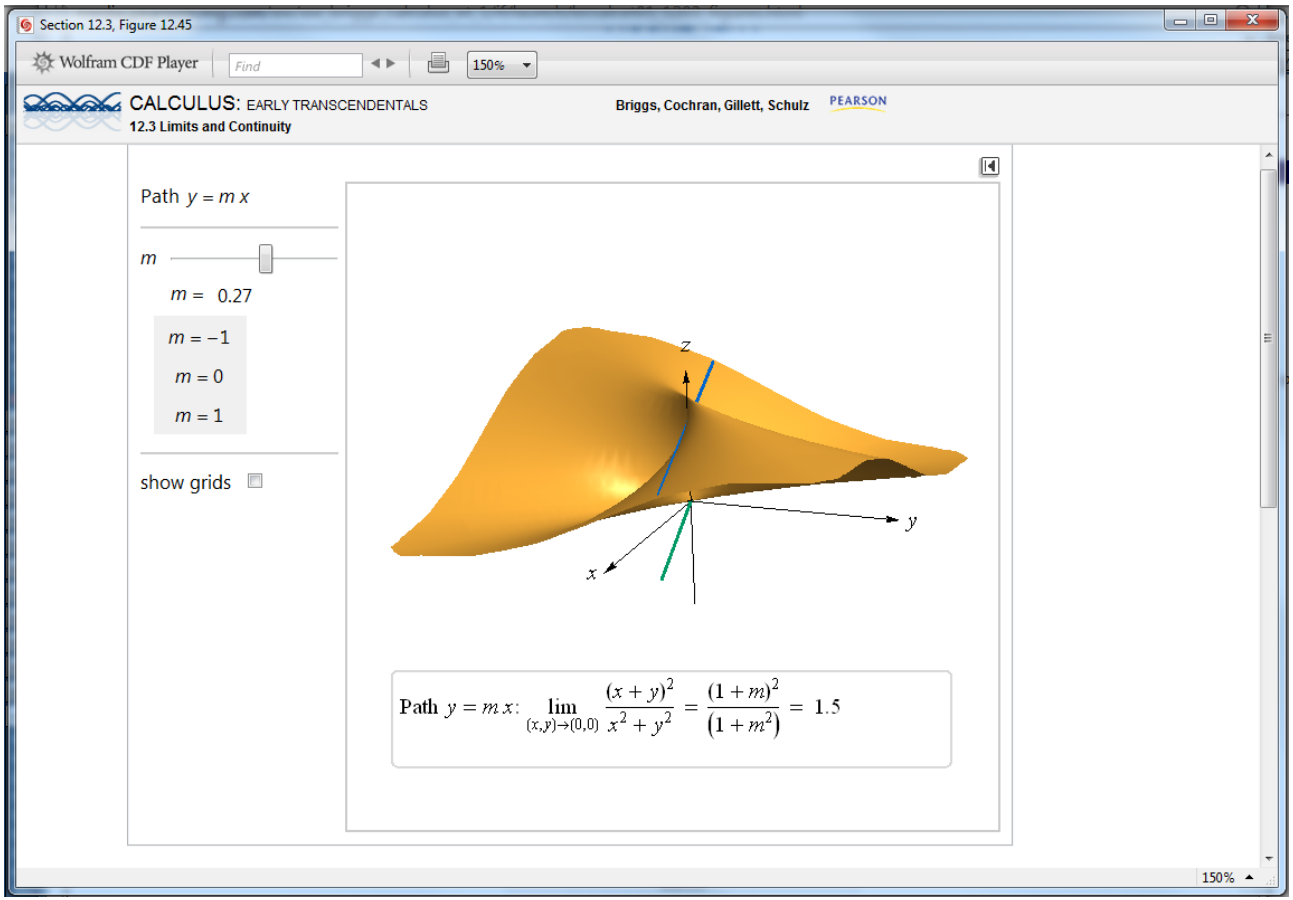
Running out of time on the Exam

Budget your time. Here is a strategy that worked for me:

1. Count the problems. Exam 1 had 7 problems. With 50 minutes, each problem should take no more than 7 minutes.
2. If there is an obivously easy problem, do it first. Otherwise, go through the entire exam, spending up to 3 minutes per problem. Some problems you will finish, some you won't.
3. Of the problems you didn't finish, go back and prioritize according to those you think you know how to answer.
4. When you get to the point where you are still stumped, check your work on the problems you did answer.
5. Repeat Step 3.

Picture!

Example of Two-Path Test:



Fri 25 Sep

- Quiz on Tuesday, probably.
- Exam feedback:

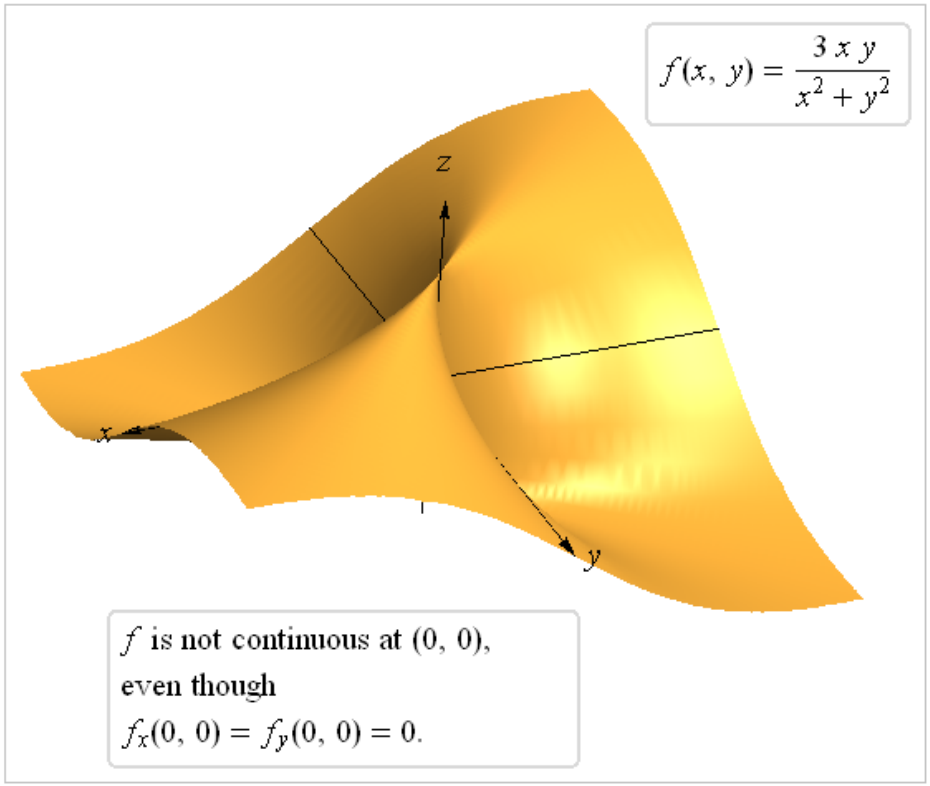
		Problem							
	Total	1	2	3	4	5	6	7	TH
out of	100	15	15	10	10	10	15	15	10
Median	61	12	12	7	5	4	11	5	8

  - Curve: TBD. Wheeler average was 6 points lower than VHM (Coordinator).

- Exam 2 is Wed 14 Oct.
  - Be proactive! Read ahead, do the homework as soon as possible. DON'T SKIP CLASS.
  - Follow instructions. On Quizzes, on the Exam, etc.
  - Fix your algebra, trig, Cal I-II.
  - Drill: Don't let the drill instructor choose problems for you. Bring questions to ask at the beginning of class. If the problem is a little different from MLP, email them in advance (or go to office hours).
  - Shortcuts on problems/showing work: Bring your practice problems to office hours.

Picture!

f is not continuous nor differentiable at $(0,0)$... but both partial derivatives exist!



Mon 28 Sep

- Quiz on Tuesday, probably. Up to 12.4 is game.
- Exam feedback:

		Problem							
	Total	1	2	3	4	5	6	7	TH
out of	100	15	15	10	10	10	15	15	10
Median	61	12	12	7	5	4	11	5	8

  - Curve: TBD. Wheeler average was 6 points lower than VHM (Coordinator).

- Exam 2 is Wed 14 Oct.
  - Be proactive! Read ahead, do the homework as soon as possible. DON'T SKIP CLASS.
  - Follow instructions. On Quizzes, on the Exam, etc.
  - Fix your algebra, trig, Cal I-II.
  - Drill: Don't let the drill instructor choose problems for you. Bring questions to ask at the beginning of class. If the problem is a little different from MLP, email them in advance (or go to office hours).
  - Shortcuts on problems/showing work: Bring your practice problems to office hours.

Wed 30 Sep

- Quiz next week (on Tuesday), covers 12.4-12.6.
- Exam 1 Curve: Everyone gets 6 more points.
- MLP: up to 12.5 is now posted...

- Exam 2 is Wed 14 Oct.
  - Be proactive! Read ahead, do the homework as soon as possible. DON'T SKIP CLASS.
  - Follow instructions. On Quizzes, on the Exam, etc.
  - Fix your algebra, trig, Cal I-II.
  - Drill: Don't let the drill instructor choose problems for you. Bring questions to ask at the beginning of class. If the problem is a little different from MLP, email them in advance (or go to office hours).
  - Shortcuts on problems/showing work: Bring your practice problems to office hours.

Fri 2 Oct

- Quiz next week (on Tuesday), covers 12.4-12.6.
- Exam 1 Curve: Everyone gets 6 more points. Stay tuned for solutions.
- MLP will be fixed by the end of the day today.

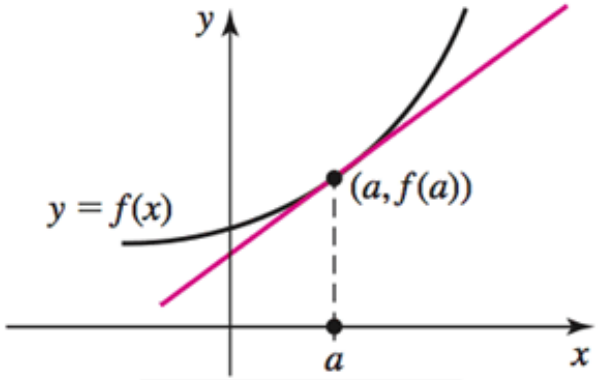
- Exam 2 is Wed 14 Oct.
  - Be proactive! Read ahead, do the homework as soon as possible. DON'T SKIP CLASS.
  - Follow instructions. On Quizzes, on the Exam, etc.
  - Fix your algebra, trig, Cal I-II.
  - Drill: Don't let the drill instructor choose problems for you. Bring questions to ask at the beginning of class. If the problem is a little different from MLP, email them in advance (or go to office hours).
  - Shortcuts on problems/showing work: Bring your practice problems to office hours.

Mon 5 Oct

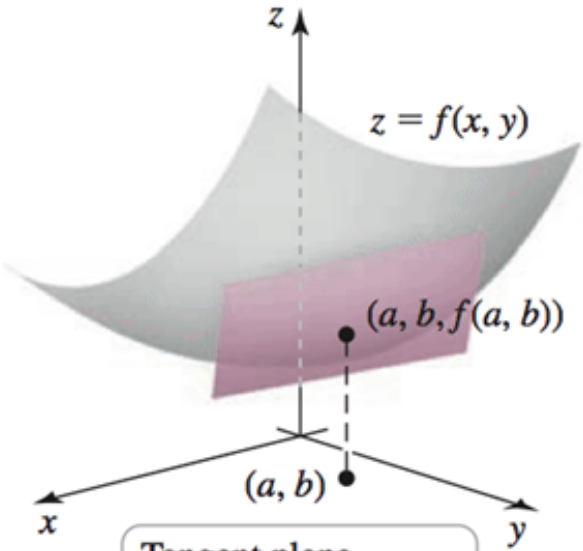
- Quiz tomorrow 12.4-12.6.
- Exam 1 Solutions posted to MLP. Top right corner under "Doc Sharing".
- MLP should be fixed now.
- Exam 2 is next week.

Pictures! and Links!

Linear Approximation: Cal I v. Cal III



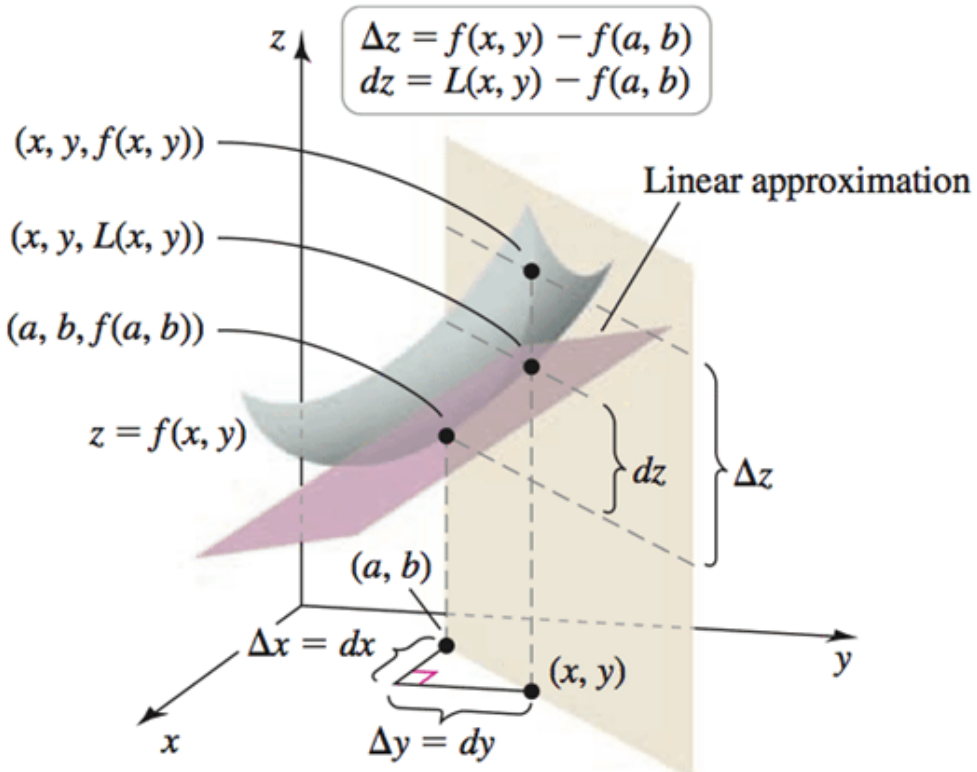
Tangent line
linear approximation
at $(a, f(a))$



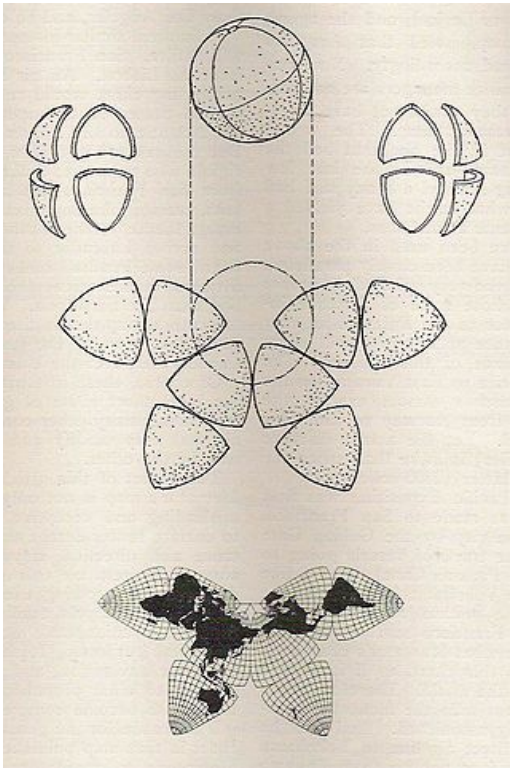
Tangent plane
linear approximation
at $(a, b, f(a, b))$

Pictures! and Links! (cont.)

Differentials

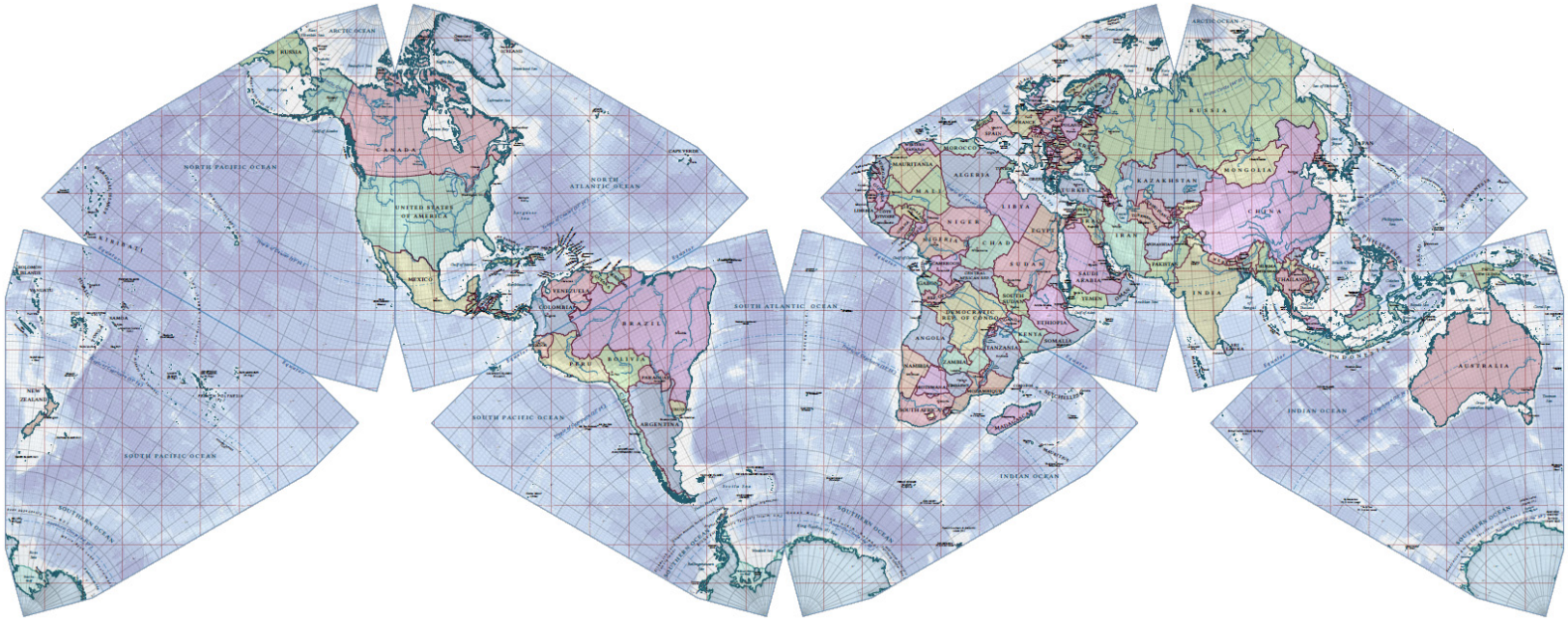


Pictures! and Links! (cont.)



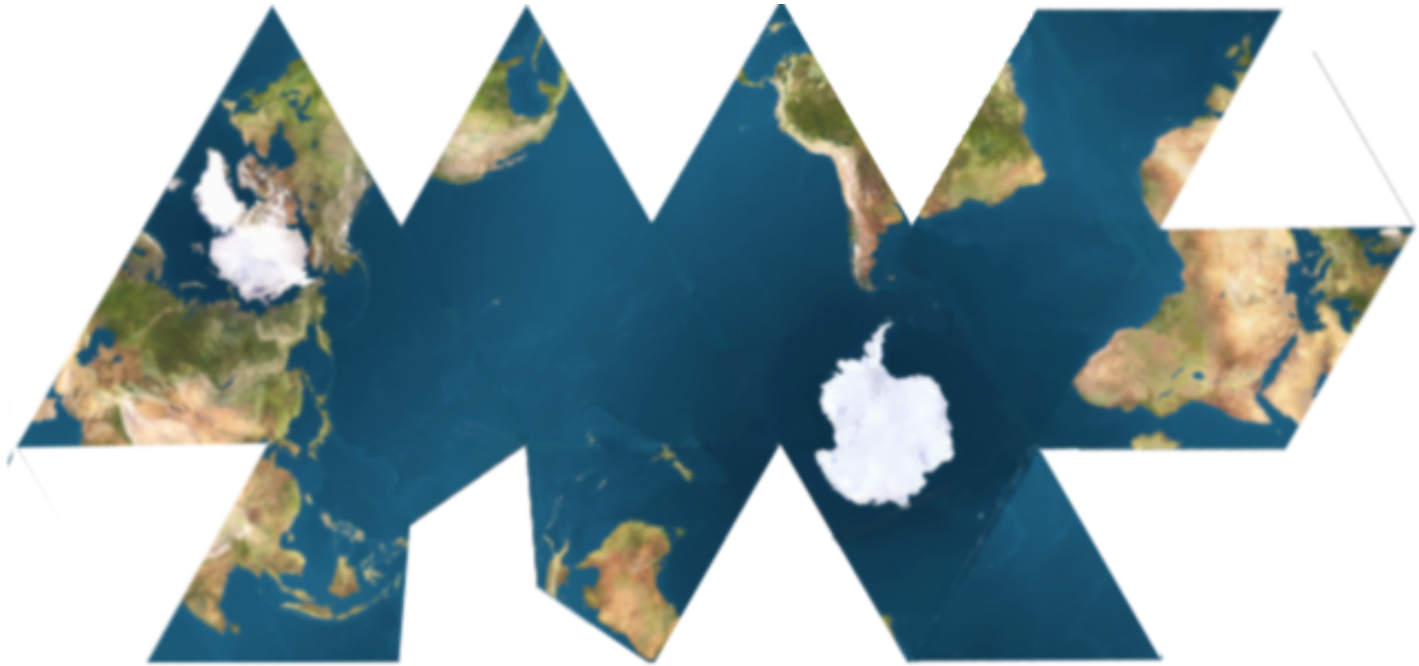
Cahill Butterfly Map.
Image licensed under Public Domain via Commons.

Pictures! and Links! (cont.)



"World Map, Political, 2012, Cahill-Keyes Projection" by Duncan Webb - Provided by author via e-mail.. Licensed under CC BY 1.0 via Commons

Pictures! and Links! (cont.)



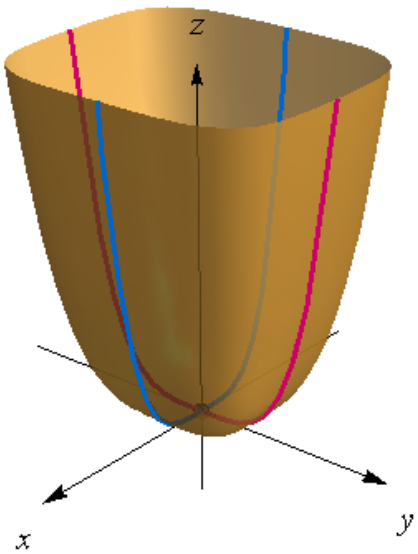
"Dymaxion map ocean2" by Based on en:File:Dymaxion_map_unfolded.png.
Licensed under CC BY 2.5 via Commons

Wed 7 Oct

- Quiz tomorrow 12.4-12.6. No quiz next week but there is one the Thursday after Fall Break.
- Exam 2 is next week.
  - $\sim$7 questions
  - Get comfortable with "gnarly" computations. The best way is to show work while practicing. See Exam 1 solutions for other shortcuts in work.
  - No calculators.
  - Takehome in drill on Tuesday, covers $\oint$12.9.
  - Expect a list of book problems this weekend.

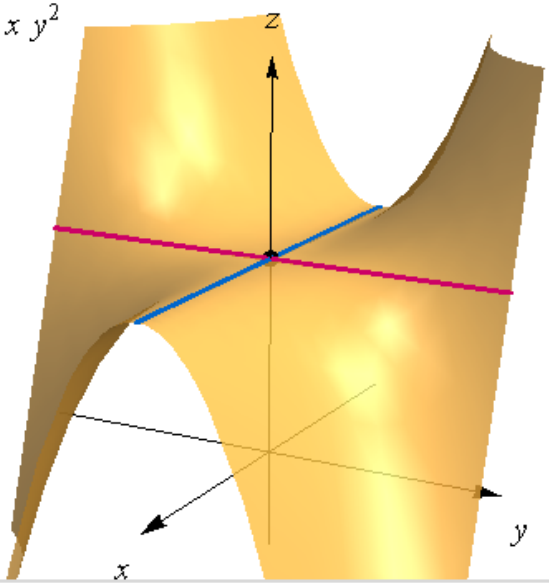
Pictures!

$z = 2x^4 + y^4$



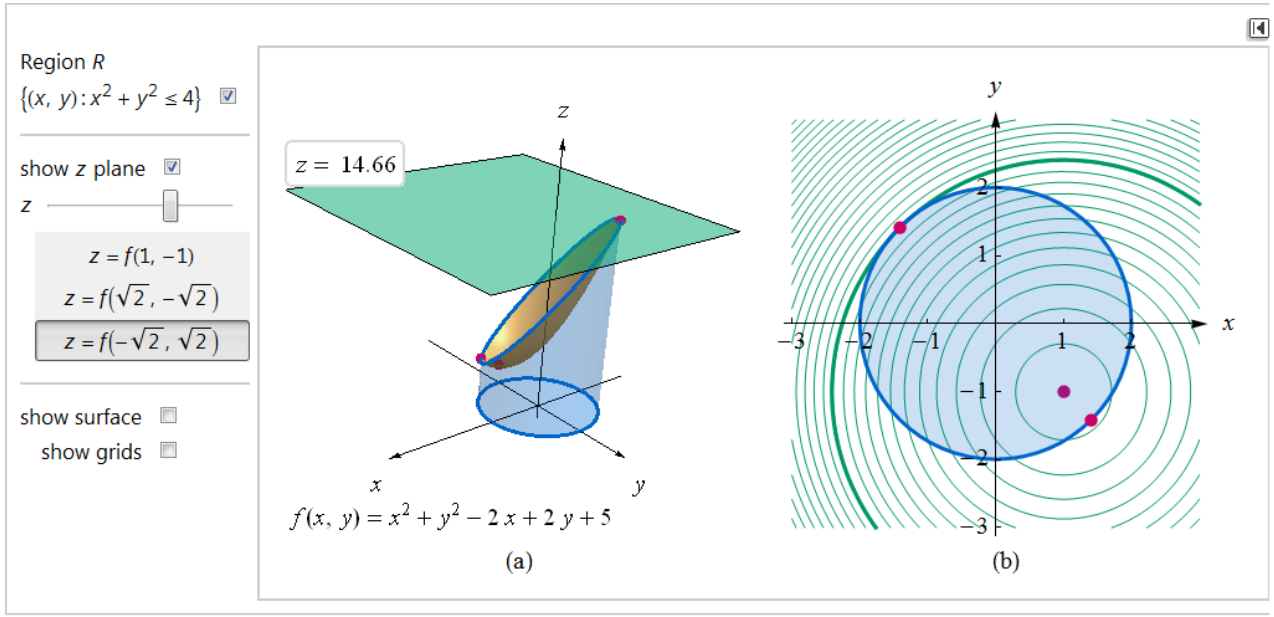
Local minimum at (0, 0), but the Second Derivative Test is inconclusive.

$z = 2 - x\,y^2$



Second derivative test fails to detect saddle point at (0, 0).

Pictures! (cont.)



Question

What is the parametrization for the boundary?

Fri 9 Oct

- No quiz next week but there is one the Thursday after Fall Break.
- Exam 2 is next week.
  - $\sim$7 questions
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  - No calculators.
  - Takehome in drill on Tuesday, covers $\oint$12.9.
  - Expect a list of book problems today. And look for solutions to Quiz 6.

JYH67

Fri 16 Oct

- Quiz next week on Thursday.
- Expect Chapter 13 MLP homeworks posted sometime during Fall Break.

Wed 21 Oct

- Quiz tomorrow: Lagrange multipliers
- Exam 2 back in drill tomorrow
- MLP homeworks posted to-nite sometime
- Friday: 10.2-10.3; Monday: 13.3
- Final is comprehensive (see syllabus)

Fri 23 Oct

- TakeHome Problem...
- Exam 2 Medians

		Problem															
	Total	1(a)	(b)	2(a)	(b)	(c)	(d)	3(a)	(b)	4	5(a)	(b)	6(a)	(b)	7(a)	(b)	TH
out of	100	6	4	4	4	4	4	8	8	10	5	5	6	6	8	8	10
Median	64	3	1	4	4	4	0	6	2	8	5	4	4	0	5.5	4	9.5

- MLP homeworks posted
- Monday: 13.3
- Exam 3 Fri 6 Nov (in 2 weeks) covers Chapter 13
- Final is comprehensive (see syllabus)

Mon 26 Oct

- Quiz tomorrow... likely on 13.1-2-1
- stay tuned for Exam 2 solutions
- Exam 3 Fri 6 Nov (in 2 weeks) covers Chapter 13
- Final is comprehensive (see syllabus)

Fri 30 Oct

- Exam 2 Medians (curve TBD)

		Problem															
	Total	1(a)	(b)	2(a)	(b)	(c)	(d)	3(a)	(b)	4	5(a)	(b)	6(a)	(b)	7(a)	(b)	TH
out of	100	6	4	4	4	4	4	8	8	10	5	5	6	6	8	8	10
Median	64	3	1	4	4	4	0	6	2	8	5	4	4	0	5.5	4	9.5

- MLP homeworks posted – no 13.6
- Exam 3 Fri 6 Nov (in 1 week) covers Chapter 13
- Practice Problems are posted
- Quiz next week is 13.7-heavy.
- Final is comprehensive (see syllabus)

Mon 2 Nov

- Quiz tomorrow is 13.7-heavy; 13.7 MLP is available
- points for MLP 13.1, 13.2, 10.2-3: attempt the new version
- Exam 3 Fri 6 Nov
- Practice Problems are posted on Wheeler-page
- Quiz and Exam 2 solutions to come

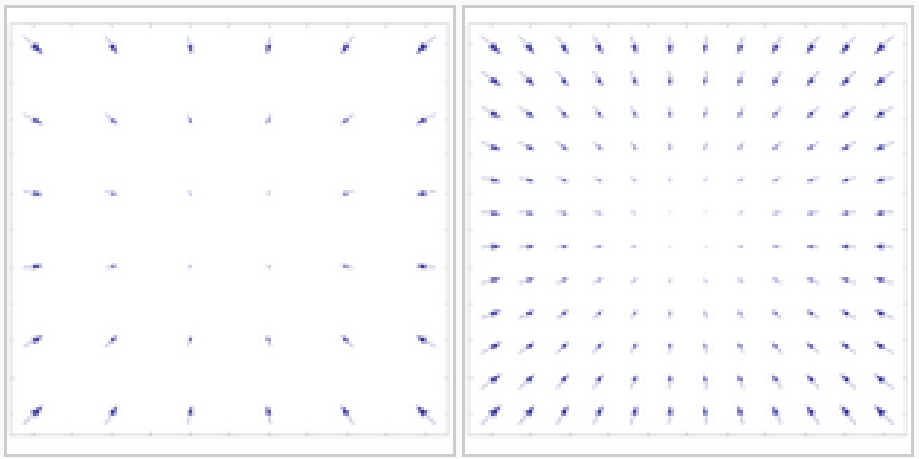
Wed 4 Nov

- Practice Problems are posted on Wheeler-page
- Quiz and Exam 2 solutions are now posted on MLP

Mon 9 Nov

- Quiz tomorrow... prepare up to 14.1
- Exams are being graded

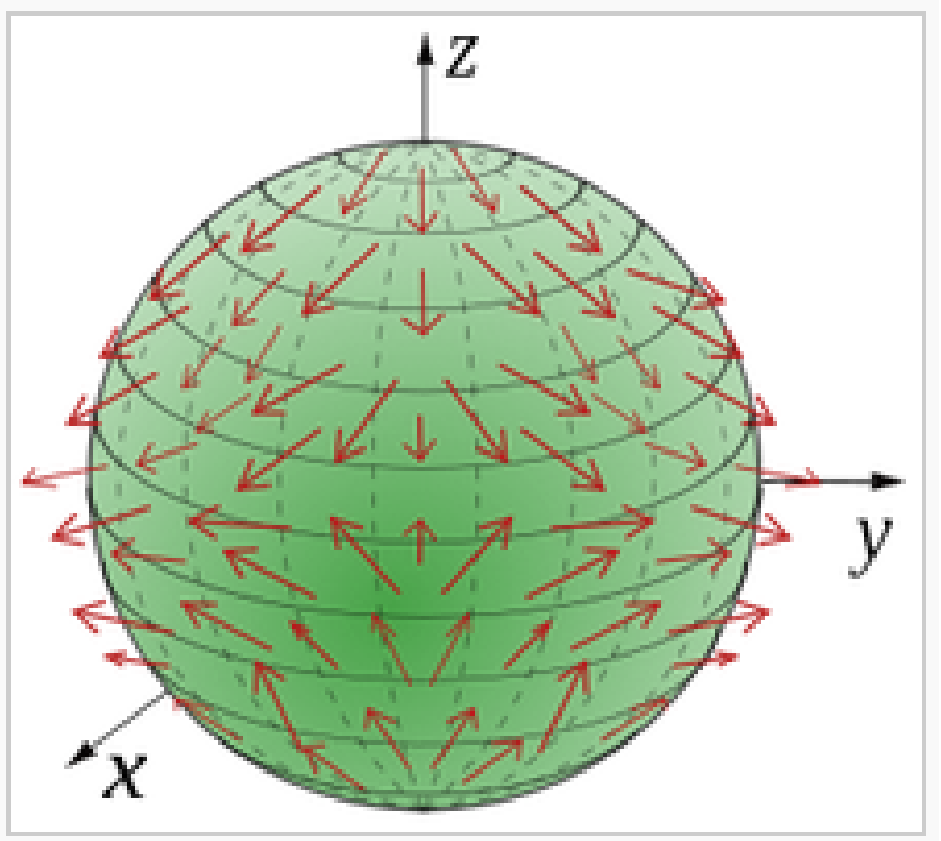
Pictures!



Two representations of the same vector field: $\mathbf{v}(x, y) = -\mathbf{r}$. The arrows depict the field at discrete points, however, the field exists everywhere.

by Connor Glosser - generated with Mathematica 7.0. Licensed under Public Domain via Commons

Pictures! (cont.)



"Vector sphere" by I, Cronholm144. Licensed under CC BY-SA 3.0 via Commons

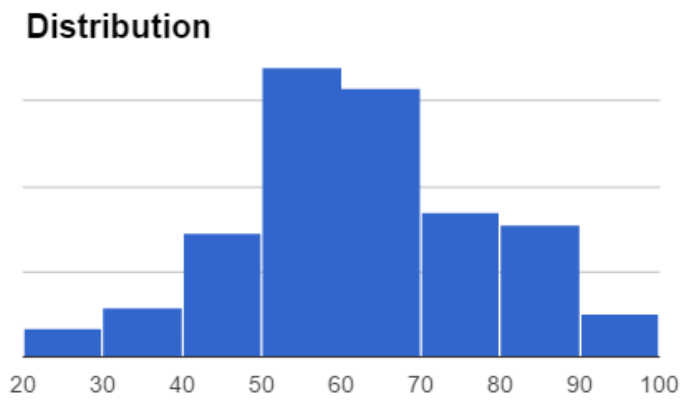
Wed 11 Nov

- Exam 3 medians: stay tuned... test returned in drill tomorrow

Fri 13 Nov

- MakeUp Exams: stay tuned for grading
- Grading Decisions
- Exam 3 medians

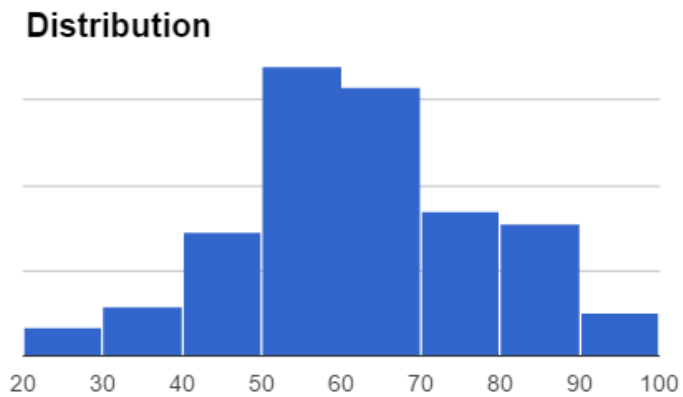
		Problem									
	Total	1	2	3	4 (a)	(b)	(c)	(d)	(e)	5	6
out of	100	20	10	10	4	2	9	7	3	20	15
Median	64	16	10	7	4	0	2	4	0	11	10



Mon 16 Nov

- Quiz tomorrow... prepare up to 14.4
- MakeUp Exams returned in drill tomorrow
- Grading Decisions
- Exam 3 medians

		Problem									
	Total	1	2	3	4 (a)	(b)	(c)	(d)	(e)	5	6
out of	100	20	10	10	4	2	9	7	3	20	15
Median	64	16	10	7	4	0	2	4	0	11	10



Wed 18 Nov

- Quiz 11 Thursday 14.2, 14.3
- Quiz 12 Tuesday 14.4, 14.5
- Curves are here!
  - Exam 2: New Score $= \frac{7}{8}(\text{Original} - 62) + 72$
  - Exam 3: New Score $= \frac{26}{33}(\text{Original} - 65) + 74$
  - NO curve in the course.
- Grading Beefs: Resolve in office hours.
- Grades are updated. Except for attendance.
- Final: Half Chapter 14, half everything else.

Fri 20 Nov

- Quiz 11... study 14.2, 14.3
- Quiz 12 TBA 14.4, 14.5
- Curves are here!
  - Exam 2: New Score $= \frac{7}{8}(\text{Original} - 62) + 72$
  - Exam 3: New Score $= \frac{26}{33}(\text{Original} - 65) + 74$
  - NO curve in the course.
- Grading Beefs: Resolve in office hours.

Mon 23 Nov

- Quiz 11 tomorrow
- Quiz 12 Tuesday 14.4, 14.5
- Exam 3 modified curve:
  New Score $= \frac{26}{33}(\text{Original} - 64) + 74$

Mon 30 Nov

- Quiz 12 tomorrow 14.4, 14.5: heavier on 14.4
- Exam 3 modified curve:
  New Score $= \frac{26}{33}(\text{Original} - 64) + 74$
- Practice Problems and Formula Sheet are posted

Wed 2 Dec

- MLP assignment due dates from the break will be pushed back, stay tuned...
- Remainder of the course: 14.7, 14.8. Read ahead!
- Tomorrow's drill: sample questions on Stokes' Theorem (14.7)
- Quiz 13 on Tuesday, covers Divergence Theorem (14.8)
- Start studying the Practice Problems and Formula Sheet now!

This is Calculus

Fundamental Theorem of Calculus

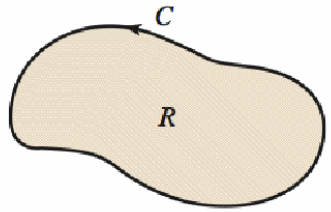
$$\int_a^b f'(x)\,dx = f(b) - f(a)$$

Fundamental Theorem of Line Integrals

$$\int_C \nabla f \cdot d\mathbf{r} = f(B) - f(A)$$

Green's Theorem (Circulation form)

$$\iint_R (g_x - f_y)\,dA = \oint_C f\,dx + g\,dy$$



Stokes' Theorem

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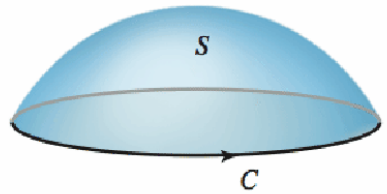
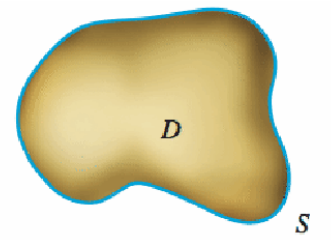


Divergence Theorem

$$\iiint_D \nabla \cdot \mathbf{F}\,dV = \iint_S \mathbf{F} \cdot \mathbf{n}\,dS$$



Fri 4 Dec

- MLP assignments from the break – you won't be punished for late submissions from the original due dates
- Remainder of the course: 14.7, 14.8. Read.
- Quiz 13 on Tuesday, covers Divergence Theorem (14.8) and Stokes' Theorem (14.7)
- Start studying the Practice Problems and Formula Sheet now!

For use in computing surface integrals.

	Explicit Description $z = g(x, y)$		Parametric Description	
Surface	**Equation**	**Normal** $\mathbf{n} = \pm\langle -z_x, -z_y, 1\rangle$	**Equation**	**Normal** $\mathbf{n} = \mathbf{t}_u \times \mathbf{t}_v$
Cylinder	$x^2 + y^2 = a^2$, $0 \le z \le h$	$\mathbf{n} = \langle x, y, 0\rangle$, $\lvert\mathbf{n}\rvert = a$	$\mathbf{r} = \langle a\cos u, a\sin u, v\rangle$, $0 \le u \le 2\pi$, $0 \le v \le h$	$\mathbf{n} = \langle a\cos u, a\sin u, 0\rangle$, $\lvert\mathbf{n}\rvert = a$
Cone	$z^2 = x^2 + y^2$, $0 \le z \le h$	$\mathbf{n} = \langle x/z, y/z, -1\rangle$, $\lvert\mathbf{n}\rvert = \sqrt{2}$	$\mathbf{r} = \langle v\cos u, v\sin u, v\rangle$, $0 \le u \le 2\pi$, $0 \le v \le h$	$\mathbf{n} = \langle v\cos u, v\sin u, -v\rangle$, $\lvert\mathbf{n}\rvert = \sqrt{2}\, v$
Sphere	$x^2 + y^2 + z^2 = a^2$	$\mathbf{n} = \langle x/z, y/z, 1\rangle$, $\lvert\mathbf{n}\rvert = a/z$	$\mathbf{r} = \langle a\sin u\cos v, a\sin u\sin v, a\cos u\rangle$, $0 \le u \le \pi$, $0 \le v \le 2\pi$	$\mathbf{n} = \langle a^2\sin^2 u\cos v, a^2\sin^2 u\sin v, a^2\sin u\cos u\rangle$, $\lvert\mathbf{n}\rvert = a^2\sin u$
Paraboloid	$z = x^2 + y^2$, $0 \le z \le h$	$\mathbf{n} = \langle 2x, 2y, -1\rangle$, $\lvert\mathbf{n}\rvert = \sqrt{1 + 4(x^2 + y^2)}$	$\mathbf{r} = \langle v\cos u, v\sin u, v^2\rangle$, $0 \le u \le 2\pi$, $0 \le v \le \sqrt{h}$	$\mathbf{n} = \langle 2v^2\cos u, 2v^2\sin u, -v\rangle$, $\lvert\mathbf{n}\rvert = v\sqrt{1 + 4v^2}$

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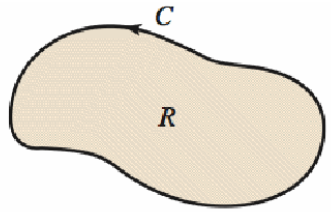

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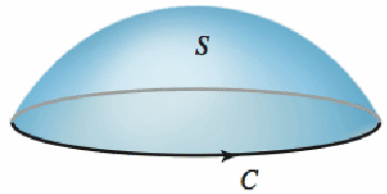

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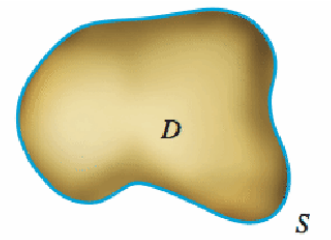

Mon 7 Dec

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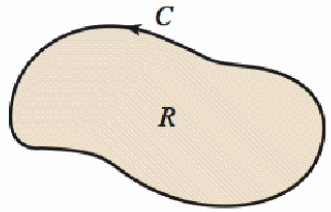

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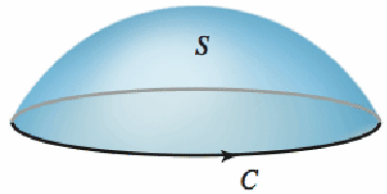

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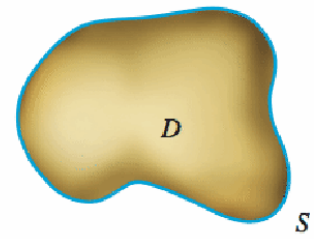

Wed 9 Dec

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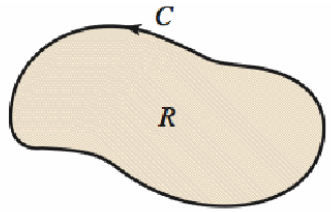

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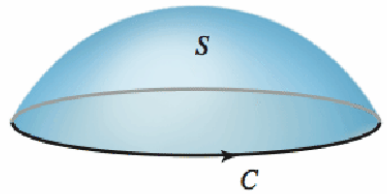

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