MAT 21B: Integral Calculus

Temple, Winter Term 2021

Class: MAT-21B: F01-F07, 30473-30479, MWF 3:10-4:00pm (Online)

Instructor: Professor Blake Temple
Research Interests: General Relativity, Shock-Wave Theory, PDE
Webpage: https://www.math.ucdavis.edu/ temple/Math21B
Office Hours: MWF 11:15-12:15pm (by email)
Lead TA: Matthew Corbelli, mdcorbelli@ucdavis.edu

Textbook: Calculus, Early Transcendentals: Thomas, Weir, Hass 14th Ed. Addison Wesley Publishers.

Prerequisites: Math 21A (C- or above); or Math 17A (B or above).

Midterm 1: Wednesday, February 3
Midterm 2: Monday, March 1
Final Exam: 8-10 AM, Tuesday, March 16.
Exams will cover Sections in book according to Syllabus.

HOMEWORK: Problems/Solutions Posted Online:
https://www.math.ucdavis.edu/ temple/MAT21D
Homework will *not be collected*. A weekly homework quiz given in discussion section will test the homework from the preceding week. I will use the homework score to (at most) adjust a grade by + or − according to my judgement. **No makeup** of homework or exams.

Subject: In Calculus, the problem of computing areas is expressed in terms of the Riemann integral, which employs the notation of *functions*. At the start we can only compute the area of rectangles, $area = base \times height$, and the Riemann integral is simply the area under the graph of a function, as obtained by taking the limit of the area of smaller and smaller approximating rectangles. Then comes the true miracle of Calculus–discovered independently by Newton and Leibniz in the 17'th century–and called by some the greatest discovery of the modern scientific era–that the problem of computing areas is intimately connected to the problem of computing derivatives (subject of Math 21A), even though at the start, both appear to arise from completely separate notions. The answer is formulated in what we now call the **Fundamental Theorem of Calculus:** You can compute the Riemann integral of a function by simply finding an anti-derivative of that function, and evaluating it's change between the endpoints. In this class we establish the Fundamental Theorem of Calculus, and begin the study of its enormous impact on Mathematics and Science.

Syllabus:

DAY	Topic
MO – Jan 4 :	Section 4.8 : Antiderivatives
WE – Jan 6 :	Section 5.1 : Area estimation by finite sums
FR – Jan 8 :	Section 5.2 : Sigma notation/Limits of finite sums
MO – Jan 11 :	Section 5.3 : The definite integral
WE – Jan 13 :	Section 5.4 : The Fundamental Theorem of Calculus $**$
FR – Jan 15 :	Section 5.4/5.5 : FTC/Indefinite integrals/Substitution
MO – Jan 18 :	**Martin Luther King Day**
WE – Jan 20 :	Section 5.6 : Substitution/Area between curves
FR – Jan 22 :	Section 6.1 : Volume by cross sections
MO – Jan 25 :	Section 6.1/6.2 : Cross sections/Cylindrical shells
WE – Jan 27 :	Section 6.3 : Arclength
FR – Jan 29 :	Section 6.4 : Surfaces of Revolution
MO – Feb 1 :	Section 6.5 : Work/Fluid forces
WE – Feb 3 :	**Midterm I**
FR – Feb 5 :	Section 6.6 : Moments/Centers of mass
MO – Feb 8 :	Section 7.1 : Logarithm as an integral
WE – Feb 10 :	Section 7.1 – 7.2 : Exponential as inverse of log
FR – Feb 12 :	Section 7.2 : Separable ODE′s
MO – Feb 15 :	**President′s Day**
WE – Feb 17 :	Section 7.2 : Exponential growth
FR – Feb 19 :	Section 7.3 : Hyperbolic Trig functions
MO – Feb 22 :	Section 8.1 – 8.2 : Integration by parts
WE – Feb 24 :	Section 8.3 – 8.4 : Trig Integrals and Trig substitutions
FR – Feb 26 :	Section 8.5 : Integration of rational functions
MO – Mar 1 :	**Midterm II**
WE – Mar 3 :	Section 8.7 : Numerical integration
FR – Mar 5 :	Section 8.8 : Improper integrals
MO – Mar 8 :	Section 11.1 : Curves in the plane
WE – Mar 10 :	Section 11.2 : Calculus of curves
FR – Mar 12 :	Section 11.3/11.4 : Polar coordinates

Homework Assignment:

Section	Assigned Problems
Section 4.8 :	$2, 5, 8, 11, 15, 20, 21, 23, 26, 34, 36, 39, 46, 50, 51, 69, 78, 80, 83, , 90, 96, 105, 120, 125$
Section 5.1 :	$1, 3, 6, 10, 12, 19$
Section 5.2 :	$2, 3, 4, 5, 7, 8, 11, 12, 16, 17, 20, 23, 25, 28, 29, 30, 33$
Section 5.3 :	$10, 11, 13, 16, 18, 19, 20, 22, 24, 53, 73, 75, 76, 79//55, 58, 61$
Section 5.4 :	$1, 7, 9, 12, 13, 16, 20, 22, 26, 32, 34, 35, 36, 39, 43, 45, 47, 50, 52, 56, 58, 61, 77, 78, 84$
Section 5.5 :	$3, 5, 6, 7, 10, 11, 12, 14, 15, 17, 23, 24, 25, 28, 29, 31, 32, 33, 36, 40, 42, 43, 51, 55, 59, 71$
Section 5.6 :	$2, 4, 7, 12, 16, 22, 24, 31, 35, 37, 39, 40, 41, 47, 53, 54, 55, 63, 66, 68, 73, 99, 102, 116$
Section 6.1 :	$1, 2, 6, 7, 10, 11, 15, 16, 29, 21, 22, 25, 30, 32, 40, 43, 47, 56$
Section 6.2 :	$2, 3, 4, 6, 8, 10, 12, 13, 15, 18, 22, 27, 29, 30, 32, 36, 43, 47$
Section 6.3 :	$1, 2, 3, 4, 8, 10, 11, 23a, 24a, 35$
Section 6.4 :	$9, 13, 14, 17, 20, 24a, 25, 29, 32$
Section 6.5 :	$1, 2, 4, 7, 8, 9, 11, 13a, 14a, 19, 24//37a, 38, 44$
Section 6.6 :	$1, 2, 3, 6, 9, 12, 15, 16, 21, 29, , 39, 42, 45$
Section 7.1 :	$2, 3, 5, 6, 7, 8, 9, 12, 13, 15, 20, 22, 24, 25, 26, 28, 32, 36, 45, 49, 51, 53, 55, 70b$
Section 7.2 :	$1, 2, 3, 7, 10, 11, 12, 13, 16, 17, 20, 26, 30, 38, 45, 47$
Section 8.1 :	$1, 2, 3, 4, 5, 6, 9, 10, 13, 14, 19, 21, 25, 26, 29, 39, 34, 40, 48, 49$
Section 8.2 :	$1, 4, 5, 8, 9, 11, 12, 13, 15, 23, 26, 31, 34, 35, 37, 44, 45, 58a, 64, 65, 66$
Section 8.3 :	$1, 2, 3, 5, 6, 7, 10, 11, 14, 15, 17, 19, 20, 25, 28, 33, 35, 36, 41, 46, 54, 55, 64, 71$
Section 8.4 :	$1, 4, 5, 8, 11, 13, 17, 18, 20, 28, 29, 38, 45$
Section 8.7 :	$4, 7, 15, 17, 32, 38$
Section 8.8 :	$1, 4, 6, 9, 14, 15, 20, 21, 25, 30, 41, 42, 53, 59, 67, 70$
Section 11.1 :	$1, 4, 5, 6, 8, 10, 11, 12, 14, 16, 19, s21, 24, 27, 28, 33$
Section 11.2 :	$1, 5, 6, 9, 11, 13, 15, 19, 20, 23, 26, 31, 32, 38, 48$
Section 11.3 :	$1, 6, 7, 8, 9, 11, 27, 32, 36, 38, 40, 42, 44, 47, 49, 53 - 57, 62,$
Section 11.4 :	$1, 6, 7, 10, 21b, 22a, 23b, 24a, 27, 28$