Mathematics 121 (4 credits) **Honours Integral Calculus**   Term 2 (2012/13)

Math 121 is the honours version of Math 101/103/105, covering mostly the same core topics with greater foundational depth, more applications and harder problems. It will provide a student with stronger preparation for related higher-level Math, Science and Engineering courses.

Prerequisites: Mathematics 120 with a grade of at least 68% or a grade of at least 80% in one of Math 100, 102, 104, 180 or 184, or a grade of 5 on AP Calculus AB or BC or permission of the Head of Department.

Instructor: George Bluman, Math Annex 1112, bluman@math.ubc.ca; office hours are open but it is best to make an appointment.

Location and times: MTWF 2:00pm, Room: Math 104

Texts (all optional): Adams and Essex, Calculus Single Variable, (or Calculus: A Complete Course) seventh edition or any earlier edition. The earlier editions have Adams as sole author; Bluman, Problem Book for First Year Calculus; Stewart, Calculus Early Transcendentals, seventh edition or any earlier edition.

Problem Assignments: due each week *at the beginning* of the Tuesday class. Tuesday will start off as a problem day going over the handed in assignment.

Assignments/solutions will be sent to you each week via e-mail.

Midterms: There will be three in-class midterms tentatively scheduled to be held on Wednesdays: Jan 23 (based on weeks 1-3), Feb 27 (based on weeks 4-7), Mar 20 (based on weeks 8-10).

Grading: 45% from the three midterms + homework assignments; 55% from the Final Exam. ***No notes, books, or calculators will be allowed for in-class midterms or the Final Exam.*** If you miss a midterm with a valid reason, then your term mark (45%) will be based on the other two midterms + homework assignments.

COURSE OUTLINE
I.   Polar Coordinates and Conic Sections
1. **Week of January 2:** graphs of polar equations.
   Reading: Adams pp. 482-489; Stewart pp. 656-664
   Bluman: Solved Probs: VIII.9.1-9.4
           Supp Probs: VIII.9.1, 9.2, 9.4
2. **Week of January 7:** conic sections
   Reading: Adams pp. 457-467; Stewart pp. 670-685
   Bluman: Supp Probs: VIII.9.3, 1.16

II.   Integration
2. **Week of January 7 cont'd:** area under a curve, fundamental theorem of calculus
    Reading: Adams pp. 311-316; Stewart pp.385-397
   Bluman: Solved Probs: I.17(b), V.5, II.4, VI.5, VII.15, VIII.2.7, 11.4
           Supp Probs: I.23, VI.15, VIII.2.19-2.22, 11.15-11.21
3. **Week of January 14:** indefinite integral, basic integration formulas, properties of definite integrals, elementary substitutions (scaling, translation)
   Reading: Adams pp.148-150, 305-307; Bluman pp. 95-96, 101-104; Stewart pp.398-399, 379

Bluman: Solved Probs: III.1-5, 13, VIII.5.1-5.2, 5.5-5.7, 2.8-2.9, 5.10, 4.1
        Supp Probs: III.1-6, VIII.5.2, 5.5-5.7, 5.13, 2.23-2.25, VI.51, VIII.5.1, 5.15

4. **Week of January 21:** *midterm,* Riemann sums, numerical integration (trapezoidal, Simpson's rules)
Reading: Adams pp. 299-305, 368-379; Bluman pp. 196-197, 202-203; Stewart pp. 371-379, 506-519
Bluman: Solved Probs: VII.14, VIII.10.8, IV.20, VI.9,10
        Supp Probs: VII.26, VIII.10.7, IV.25, VI.24-31, VII.33

III.   Applications of Integration

5. **Week of January 28:** area between two curves, area in polar coordinates, area for parametrised curves, distance, volume by cross-sections
Reading: Adams pp. 324-328, 491-493, 480-482; Bluman pp. 260-264, 280-282, 35-36, 71-81; Stewart pp. 422-428, 665-667, 647, 430-432
Bluman: Solved Probs: VIII.7.1-7.7, 9.5-9.7, III.31, VIII.8.8, III.3-4, II.33-40
        Supp Probs: VIII.7.1-7.15, 7.17, 13.3, 9.5-9.16, 8.11-8.12, 8.17, III.1, 3, 11, II.88-100

6. **Week of February 4:** volume of a solid of revolution (cylindrical shells), arc length
Reading: Adams pp.391-403, 403-407; Bluman pp. 264-268; Stewart pp. 432-446, 538-545
Bluman: Solved Probs: VIII.7.8-7.12, 7.15, 8.9-8.11, 9.8
        Supp Probs: VIII.7.20-7.33, 7.36, VII.30, VIII.7.37-7.38, 7.41, 8.13-8.17, 13.4

7. **Week of February 12:** surface area, centre of mass, centroid, moment of inertia
Reading: Adams pp. 407-422; Bluman pp. 127-129, 97-101, 112-115; Stewart pp. 545-551, 554-563
Bluman: Solved Probs: VIII.7.16, III.34, III.15-17, 18
        Supp Probs: VIII.7.40, 7.42-7.43, 9.17, III.58, VIII.7.39, III.24-31

8. **Week of February 25:** *midterm,* pressure, work, separable differential equation, logistic growth
Reading: Adams pp. 422-429, 445-453; Bluman pp. 100-101, 116-118, 173-174, 180-187; Stewart pp. 552-554, 446-451, 594-616
Bluman: Solved Probs: III.19-29, IV.8, VII.23, VIII.12.3-12.4, 12.7, V.6-9, 11
        Supp Probs: III.32-49, 53-54, 57, IV.34, VIII.12.1, 12.3-12.8, III.7, V.9-14, 23, 15-22

IV.   Methods of Integration

9. **Week of March 4:** integration by various substitutions, integration by parts, reduction formulas
Reading: Adams pp. 316-324, 331-337, 346-353; Bluman pp. 248-250; Stewart pp. 407-415, 464-484
Bluman: Solved Probs: VIII.4.1-4.7, 4.12-4.13, 5.3-5.4, 5.8, 7.13, 12.1, VII.16, VIII.7.8, 7.10
        Supp Probs: VII.28-29, VIII.4.1-4.6, 5.3-5.4, 12.2, 5.8, 5.14, 5.16

10. **Week of March 11:** partial fractions, improper integrals
Reading: Adams pp. 337-345, 359-367; Bluman pp. 250-254, 258-260; Stewart pp. 484-500, 519-535
Bluman: Solved Probs: VIII.4.3, 4.8-4.12, 5.9, 6.1-6.7, 7.14

Supp Probs: VIII.4.7-4.18, 5.9-5.11, 13.1, 6.1-6.10, 7.34-7.35, V.26

V.   Taylor Series and Applications

11. Week of March 18: *midterm,* Taylor's formula with remainder, Taylor polynomials, infinite series, Taylor and Maclaurin series, applications of Taylor series to integration

Reading: Adams pp. 272-280, 536-548; Bluman pp. 197-198, 203-207, 288-289; Stewart pp. 256-257, 753-784

Bluman: Solved Probs: VI.11-13, VII.18, VIII.10.12-10.14, VI.14-16, VIII.10.16

Supp Probs: VI.32-33, 36, VIII.10.12-10.15, VI.34-35, 37, VIII.10.16, 10.18, 10.23

12. Week of March 25: applications of Taylor series to integration (cont'd), sequences and series, tests for convergence

Reading: Adams pp. 495-535; Bluman pp. 205-208; Stewart pp. 690-741

Bluman: Solved Probs: VI.14, 17-19, 22-23, VIII.10.17(a)-(c), 11.15, V.10

Supp Probs: VI.38-45, 50, VIII.10.17, 11.22, 11.26, 11.27(c), 11.28-11.30, 13.7

13. Week of April 2: series (cont'd), uniform convergence

Bluman: Solved Probs: VII.20, VIII.10.9-10.10, VI.20-21, VIII.10.1-10.7, 10.15, 10.18-10.19

Supp Probs: VII.34, VIII.10.8-10.10, 11.27(a)-(b), VI.46-47, VIII.10.1-10.6, 10.11, 10.19-10.22, 10.24