

**CALCULUS VIDEOTAPES SUMMARY**

James M. Foran 1990-1992

The following is a list of the topics found on the videotapes presented by Professor James Foran, ~~\_\_\_\_\_~~

Each tape is about two hours in duration and consists of segments in which the topics of Calculus are presented. About half the segments involve worked out examples. The segments vary in length from about three to ten minutes each. While all the topics of Calculus are on the tapes, it is not likely that one could use these by themselves to learn the subject. They can serve as a review and/or give one additional exposure to this material.

<b>Calculus I, Tape 1 (110.15 min)</b>			<b>Calculus I, Tape 2 (120.00 min)</b>		
<b>Numbers and Inequalities</b>			<b>Sets in the Plane</b>		
<u>No.</u>	<u>Topic</u>	<u>Time</u>	<u>No.</u>	<u>Topic</u>	<u>Time</u>
1.1	Introduction	00.15	2.1	Formulas	07.50
1.2	Set Theory	09.40	2.2	Pythagorean Theorem	07.55
1.3	Numbers	09.45	2.3	The Plane (midpoint and distance formula)	09.05
1.4	The Line	12.25	2.4	Equation of a Line	10.20
1.5	Field Axioms	08.20	2.5	Intersection of Lines	07.30
1.6	Fields	06.10	2.6	Perpendicular Lines	06.50
1.7	Ordered Fields	09.55	2.7	Circles	03.35
1.8	Completeness	07.45	2.8	Equation of a Circle	07.55
1.9	Intervals	06.05	2.9	Graphs of Equations	07.40
1.10	Inequalities	07.05	2.10	Quadratic Equations	07.40
1.11	Inequalities	03.55	2.11	Functions	09.30
1.12	Inequalities	05.40	2.12	Functions (combinations)	09.20
1.13	Inequalities	07.40	2.13	Factoring	06.00
1.14	Inequalities (absolute values)	07.05	2.14	Graphing	06.20
1.15	Inequalities (absolute values)	08.30	2.15	Graphing	07.30
			2.16	Graphing	05.00

# CALCULUS VIDEOTAPE SUMMARY

## Calculus I, Tape 3 (117.15 min)

### Limits and Functions

<u>No.</u>	<u>Topic</u>	<u>Time</u>
3.1	Limits	05.30
3.2	The Limit	09.55
3.3	Epsilon and Delta	04.55
3.4	Epsilon and Delta	06.15
3.5	Epsilon and Delta	09.45
3.6	Limit of nth Root of x	07.10
3.7	Limit of cf	05.25
3.8	Limit of f+g	05.45
3.9	Limit of Products	05.45
3.10	Limit of fg	07.35
3.11	Limit of Quotients	05.15
3.12	Limit of f/g	06.40
3.13	Limit of Compositions	05.35
3.14	Continuous Functions	08.40
3.15	Squeeze Theorem	06.35
3.16	Infinite Limits	05.25
3.17	Infinite Limits	03.50
3.18	Infinite Limits	03.50
3.19	Infinite Limits	03.30

## Calculus I, Tape 4 (106.55 min)

### The Derivative of a Function

<u>No.</u>	<u>Topic</u>	<u>Time</u>
4.1	The Derivative	07.15
4.2	The Derivative	03.55
4.3	The Derivative	04.00
4.4	The Derivative	05.15
4.5	The Derivative of cf, f+g	04.25
4.6	Continuity	04.00
4.7	Derivative of fg	04.45
4.8	Derivative of $x^n$	09.00
4.9	Derivative of f/g	06.20
4.10	Derivatives	03.55
4.11	Derivative of f(g)	07.00
4.12	Derivative of nth Root of x	08.05
4.13	Derivative of $x^{p/q}$	05.40
4.14	Derivatives	04.45
4.15	Derivatives	04.40
4.16	Derivatives	05.50
4.17	Velocity	05.25
4.18	Rate of Change	06.45
4.19	Higher Derivatives	05.55

## Calculus I, Tape 5 (103.50 min)

### Trigonometric Functions

<u>No.</u>	<u>Topic</u>	<u>Time</u>
5.1	Angles	08.35
5.2	Special Angles	04.35
5.3	Radians	05.45
5.4	Trigonometric Functions	08.15
5.5	Graph of sin x, csc x	05.20
5.6	Graph of cos x, sec x	04.15
5.7	Graph of tan x, cot x	03.50
5.8	Trigonometric Formulas	13.05
5.9	Limits	07.10
5.10	Derivative of sin x	05.55
5.11	Derivative of cos x, tan x	03.45
5.12	Derivative of sec, cot, csc x	05.30
5.13	Derivatives	04.05
5.14	Derivatives	06.00
5.15	Derivatives	04.00
5.16	Derivatives	04.20
5.17	Graphing	03.10
5.18	Limits	06.15

## Calculus I, Tape 6 (102.15 min)

### Maxima and Minima

<u>No.</u>	<u>Topic</u>	<u>Time</u>
6.1	Bounded Functions	08.45
6.2	Maxima - Minima	10.50
6.3	Maximum of f	05.40
6.4	Criteria for Max - Min	04.30
6.5	Max - Min Problems	04.30
6.6	Example (fence)	04.30
6.7	Example (box)	06.30
6.8	Example (pool)	07.15
6.9	Example (trough)	05.20
6.10	Example (corridor)	07.00
6.11	Example (open intervals)	05.05
6.12	Example (window)	05.55
6.13	Example (can)	04.40
6.14	Example (box)	03.50
6.15	Example with two variables	07.15
6.16	Example ( $x^2+y^2$ )	02.35
6.17	Example (rect. in triangle)	03.40
6.18	Example (rect. in semicircle)	05.25

**Calculus I, Tape 7 (89.45 min)**

Applications of Derivatives

<u>No.</u>	<u>Topic</u>	<u>Time</u>
7.1	Implicit Differentiation	05.25
7.2	Implicit Differentiation	04.45
7.3	Example	05.10
7.4	Example	05.10
7.5	Implicit Differentiation	03.45
7.6	Related Rates (outline)	03.35
7.7	Example (airplanes)	03.35
7.8	Example (balloons)	06.10
7.9	Example (cone)	05.40
7.10	Example (beacon)	03.30
7.11	Example (ladder)	03.30
7.12	Differentials	07.00
7.13	Differentials (sphere)	04.30
7.14	Differentials	03.25
7.15	Differentials	04.25
7.16	Interpolation	04.45
7.17	Newton's Method	06.00
7.18	Newton's Method	04.45
7.19	Newton's Method	05.00

**Calculus I, Tape 8 (115.20 min)**

Graphing

<u>No.</u>	<u>Topic</u>	<u>Time</u>
8.1	Mean Value Theorem (for continuous functions)	08.35
8.2	Rolle's Theorem	06.55
8.3	Mean Value Theorem	07.10
8.4	Monotone Functions	08.35
8.5	Example ( $x^3-3x+1$ )	05.35
8.6	Relative Max & Min	05.45
8.7	Example ( $x^4-2x^2$ )	04.50
8.8	Concavity	10.25
8.9	Exs. ( $x^3+3x^2+3x-2, x^3-3x$ )	06.50
8.10	Limits (asymptotes)	08.50
8.11	Limits (infinite)	03.40
8.12	Examples (polynomials and rational functions)	10.25
8.13	Graph ex. $(x-1)/(x-3)^2$	11.30
8.14	Graph ex. $1/(x-1)(x-3)$	07.50
8.15	Graph ex. $1/(x^2+1)$	04.15
8.16	Graph ex. $x - \text{sq rt. } (x^2+1)$	07.10

**Calculus I, Tape 9 (110.30 min)**

Antiderivatives and Integrals

<u>No.</u>	<u>Topic</u>	<u>Time</u>
9.1	Antiderivatives (velocity, acceleration)	09.05
9.2	Antiderivatives (theory)	03.50
9.3	Antiderivatives (polynomials)	07.40
9.4	Example (gravity)	06.10
9.5	Substitution	03.45
9.6	Substitution	07.15
9.7	Substitution (formulas)	06.00
9.8	The Integral (introduction)	06.10
9.9	Summation	04.35
9.0	Area ( $y=x^2, 0 \leq x \leq 1$ )	06.15
9.11	Riemann Integral	05.45
9.12	Properties of the Integral	08.30
9.13	Fundamental Thm. of Calc.	07.20
9.14	Fundamental Thm. of Calc.	07.35
9.15	Fundamental Thm. of Calc.	04.50
9.16	Integrals	04.15
9.17	Integrals	03.45
9.18	Trapezoidal Rule	06.45

**Calculus I, Tape 10 (116.05 min)**

Applications of Integrals

<u>No.</u>	<u>Topic</u>	<u>Time</u>
10.1	Areas	04.05
10.2	Area (between f and g)	05.30
10.3	Volume (in general)	02.30
10.4	Volume (cone)	05.10
10.5	Volume (solid of revolution)	03.30
10.6	Volume (solid of revolution)	05.50
10.7	Volume (solid of revolution)	05.15
10.8	Volume (cylindrical shells)	07.25
10.9	Volume (cylindrical shells)	05.05
10.10	Arc Length	06.55
10.11	Surface Area	05.50
10.12	Surface Area	03.45
10.13	Work (Hooke's Law)	06.30
10.14	Work (chain)	02.45
10.15	Work (pump)	04.35
10.16	Work (spherical tank)	03.00
10.17	Liquid Pressure	11.05
10.18	Moments	12.05
10.19	Centroids	06.50
10.20	Centroids	08.05

# CALCULUS VIDEOTAPE SUMMARY

## Calculus II, Tape 1 (97.00 min)

### Exponent and Natural Logarithm

No.	Topic	Time
1.1	Exponents	08.00
1.2	Inverse Functions	10.30
1.3	Logarithms	13.50
1.4	$\ln(x) = \int_1^x 1/t \, dt$	08.20
1.5	$\ln(a \cdot b) = \ln a + \ln b$	03.40
1.6	$\ln(a^r) = r \cdot \ln(a)$	07.40
1.7	$\exp(x)$	07.50
1.8	$e = 2.7182818284\dots$	11.40
1.9	$\ln f(x) $	07.45
1.10	$\exp f(x)$	08.00
1.11	Logarithmic Differentiation	05.40
1.12	Differentiation	05.00

## Calculus II, Tape 2 (105.30 min)

### Exponent, Log, Inverse Functions

No.	Topic	Time
2.1	The Function $a^x$	04.25
2.2	$\log(x)$	08.20
2.3	$x$	05.15
2.4	$e^x$ and $e$	05.50
2.5	Interest rates	07.45
2.6	Exponential growth	07.20
2.7	Exponential growth	11.40
2.8	Hyperbolic Trig Functions	06.15
2.9	Hyperbolic Trig Functions	08.10
2.10	Hyperbolic Inverse Functions	05.25
2.11	Hyperbolic Inverse Functions	06.25
2.12	$\text{Arctan}(x)$	05.45
2.13	$\text{Arcsin}(x)$	04.30
2.14	$\text{Arcsec}(x)$	06.40
2.15	Other Inverse Functions	08.40
2.16	Derivatives	03.55

## Calculus II, Tape 3 (107.35 min)

### Antidifferentiation

No.	Topic	Time
3.1	Antiderivatives Review	07.00
3.2	Antiderivatives by Parts	06.20
3.3	Antiderivatives by Parts	03.00
3.4	Antiderivatives by Parts	06.40
3.5	Antiderivatives by Parts	03.35
3.6	Antiderivatives by Parts	05.15
3.7	$\int \sin^n(x) \cos^m(x) \, dx$	07.20
3.8	$\int \sin^n(x) \cos^m(x) \, dx$	07.45
3.9	$\int \sec^n(x) \tan^m(x) \, dx$	08.40
3.10	$\int \sec^n(x) \tan^m(x) \, dx$	03.00
3.11	$\int \sec^n(x) \, dx$ $n$ odd	06.00
3.12	Partial Fractions	10.00
3.13	Partial Fractions	07.55
3.14	Partial Fractions	05.10
3.15	Partial Fractions	05.25
3.16	Misc. Substitutions	06.10
3.17	Misc. Substitutions	03.30
3.18	Misc. Substitutions	04.50

## Calculus II, Tape 4 (115.00 min)

### L'Hopital, Improper Integrals

No.	Topic	Time
4.1	Indeterminate Forms	10.15
4.2	Cauchy's Mean Value Thm.	08.20
4.3	L'Hospital's Rule	06.00
4.4	L'Hospital's Rule	06.00
4.5	L'Hospital's Rule	04.40
4.6	L'Hospital's Rule	06.05
4.7	L'Hospital's Rule	07.25
4.8	L'Hospital's Rule	04.40
4.9	$(0^0)$ $(1^\infty)$ $(\infty^0)$ $(0 \cdot \infty)$	08.05
4.10	$(0^0)$ $(1^\infty)$ $(\infty^0)$ $(0 \cdot \infty)$	09.00
4.11	$(0^0)$ $(1^\infty)$ $(\infty^0)$ $(0 \cdot \infty)$	05.35
4.12	$(\infty - \infty)$	08.10
4.13	Improper Integrals	07.30
4.14	Improper Integrals	06.40
4.15	Improper Integrals	04.35
4.16	Improper Integrals	03.45
4.17	Improper Integrals	03.15
4.18	Improper Integrals	05.10

## CALCULUS VIDEOTAPE SUMMARY

Page 5 of 7

### Calculus II, Tape 5 (120.00 min) Sequences and Series

<u>No.</u>	<u>Topic</u>	<u>Time</u>
5.1	Sequences	08.15
5.2	Sequences	07.50
5.3	Series	07.55
5.4	Series	07.20
5.5	Integral Test	09.00
5.6	Integral Test	06.45
5.7	Comparison Test	07.15
5.8	Comparison Test	06.10
5.9	Comparison Test II	06.10
5.10	Comparison Test II	05.25
5.11	Alternating Series	06.00
5.12	Absolute Convergences	07.15
5.13	Ratio Test	05.20
5.14	Ratio Test	05.45
5.15	Ratio Test	05.20
5.16	Root Test	04.20
5.17	Root Test	04.55
5.18	Examples	05.05
5.19	Examples	03.55

### Calculus II, Tape 6 (107.00 min) Taylor Series, Power Series

<u>No.</u>	<u>Topic</u>	<u>Time</u>
6.1	Taylor Polynomials	07.50
6.2	Taylor Polynomials	06.45
6.3	Taylor's Theorem	10.00
6.4	Taylor's Theorem	06.10
6.5	Binomial Expansion	07.35
6.6	Power Series, Convergence	08.00
6.7	Power Series, Convergence	05.35
6.8	Operations	06.35
6.9	Examples	05.10
6.10	$\ln(x)$	04.40
6.11	$\tan^{-1}(x)$	03.40
6.12	$\sin^{-1}(x)$	06.00
6.13	Division of Series	06.10
6.14	Coefficients	06.10
6.15	Integrals	07.10
6.16	Limits	06.05

### Calculus II, Tape 7 (120.55 min) Conic Sections

<u>No.</u>	<u>Topic</u>	<u>Time</u>
7.1	Conic Sections	05.25
7.2	Parabolas	05.00
7.3	Parabolas	09.00
7.4	Ellipses	09.45
7.5	Ellipses	07.25
7.6	Ellipses	10.55
7.7	Ellipses	10.55
7.8	Hyperbolas	09.15
7.9	Hyperbolas	07.25
7.10	Hyperbolas	11.45
7.11	Hyperbolas	10.40
7.12	Rotation	04.55
7.13	Rotation	08.50
7.14	Rotation	06.25
7.15	The Discriminant	02.50

### Calculus II, Tape 8 (97.40 min) Polar Coordinates

<u>No.</u>	<u>Topic</u>	<u>Time</u>
8.1	Polar Coordinates	07.40
8.2	Graphing	05.45
8.3	Graphing	05.35
8.4	Graphing	05.50
8.5	Graphing	09.05
8.6	Graphing	04.45
8.7	Graphing Conic Sections	05.55
8.8	Graphing Conic Sections	09.10
8.9	Symmetry	06.10
8.10	Intersection of $r_1$ & $r_2$	09.50
8.11	Areas	05.35
8.12	Areas	05.10
8.13	Areas	06.35
8.14	Areas	05.45
8.15	$dy/dx$	04.50

**CALCULUS VIDEOTAPE SUMMARY****Calculus III, Tape 1 (121.25 min)**

## Parametric Equations, Vectors

<u>No.</u>	<u>Topic</u>	<u>Time</u>
1.1	Parametric Equations	08.25
1.2	Parametric Equations	07.50
1.3	Parametric Equations	05.40
1.4	Parametric Equations	06.45
1.5	Parametric Equations	13.25
1.6	dy/dx	07.00
1.7	Arc Length	09.35
1.8	Arc Length	09.25
1.9	Area and Volume	08.10
1.10	Vectors in the Plane	05.25
1.11	Dot Product	08.50
1.12	Dot Product	08.35
1.13	Components	07.40
1.14	Components	07.10
1.15	Motion	07.30

**Calculus III, Tape 2 (121.30 min)**

## Vectors, Lines, and Planes

<u>No.</u>	<u>Topic</u>	<u>Time</u>
2.1	Rectangular Coordinates	10.05
2.2	Distances	07.00
2.3	Spheres	05.45
2.4	Vectors	06.10
2.5	Vector Addition	05.10
2.6	Vectors, Dot Product	04.50
2.7	Vectors, Dot Product	05.50
2.8	Vectors, Dot Product	05.25
2.9	Direction Angles	06.05
2.10	comp <sub>v</sub> u	06.15
2.11	Cross Product	08.55
2.12	Cross Product	14.20
2.13	Lines	06.20
2.14	Planes	08.20
2.15	Intersection of Planes	10.55
2.16	Intersection, Planes & Lines	06.25
2.17	Cross Product	03.40

**Calculus III, Tape 3 (111.40 min)**

## Vector Valued Functions, Motion

<u>No.</u>	<u>Topic</u>	<u>Time</u>
3.1	Vector Valued Functions	07.30
3.2	Vector Valued Functions	10.15
3.3	Motion	09.30
3.4	Motion	06.50
3.5	Unit Tangent & Normal	05.15
3.6	Unit Tangent & Normal	06.00
3.7	Curvature in the Plane	10.25
3.8	Curvature	07.45
3.9	Curvature	08.55
3.10	Curvature	06.20
3.11	Curvature in Space	07.40
3.12	Curvature	07.05
3.13	Acceleration	09.00
3.14	Acceleration	09.10

**Calculus III, Tape 4 (99.25 min)**

## Surfaces

<u>No.</u>	<u>Topic</u>	<u>Time</u>
4.1	Graphs of Equations	04.30
4.2	Graphs of Planes	04.55
4.3	Graphs of Planes	07.50
4.4	Graphs of Ellipsoids	05.05
4.5	Graphs of Cylinders	04.55
4.6	Paraboloids	06.15
4.7	Hyperbolic Paraboloid	09.55
4.8	Hyperboloids of 1 Sheet	08.25
4.9	Hyperboloids of 2 Sheets	07.10
4.10	Cones	07.05
4.11	Translations	09.40
4.12	Solids of Revolution	05.25
4.13	Solids of Revolution	06.30
4.14	Functions	03.35
4.15	Cylindrical Coordinates	04.05
4.16	Spherical Coordinates	05.05

**CALCULUS VIDEOTAPE SUMMARY****Calculus III, Tape 5 (119.15 min)****Functions of Several Variables**

<u>No.</u>	<u>Topic</u>	<u>Time</u>
5.1	Functions of two Variables	05.20
5.2	Functions of two Variables	07.10
5.3	Continuity, Limits	06.55
5.4	Partial Derivatives	11.10
5.5	Partial Derivatives	08.05
5.6	Higher Partial	10.40
5.7	Higher Partial	06.45
5.8	Tangent Planes	12.40
5.9	Tangent Planes	06.20
5.10	Differentials	09.55
5.11	Differentials	08.15
5.12	Chain Rule	09.00
5.13	Chain Rule	05.30
5.14	Chain Rule	06.00
5.15	Implicit Differentiation	05.30

**Calculus III, Tape 6 (116.00 min)****Maximum and Minimum**

<u>No.</u>	<u>Topic</u>	<u>Time</u>
6.1	The Gradient	08.55
6.2	The Gradient	07.10
6.3	The Gradient	08.05
6.4	Local Max-Min	06.35
6.5	Max-Min of $f(x,y)$	07.50
6.6	Max-Min of $f(x,y)$	06.25
6.7	Max-Min	07.15
6.8	Max-Min	07.25
6.9	Max-Min	12.25
6.10	Second Derivative Test	10.05
6.11	Second Derivative Test	12.55
6.12	Lagrange Multipliers	10.15
6.13	Lagrange Multipliers	05.15
6.14	Lagrange Multipliers	05.05

**Calculus III, Tape 7 (100.35 min)****Multiple Integrals**

<u>No.</u>	<u>Topic</u>	<u>Time</u>
7.1	Double Integrals	06.40
7.2	Iterated Integrals	06.20
7.3	Iterated Integrals	05.10
7.4	Iterated Integrals	07.05
7.5	Mass and Moments	06.00
7.6	Mass and Moments	07.25
7.7	Moment of Inertia	04.45
7.8	Surface Area	07.20
7.9	Triple Integrals	05.55
7.10	Triple Integrals	06.25
7.11	Triple Integrals	05.10
7.12	Cylindrical Coordinates	06.15
7.13	Spherical Coordinates	08.25
7.14	Spherical Coordinates	05.30
7.15	Surface Area	05.30
7.16	Surface Area	06.55

**Calculus III, Tape 8 (118.45 min)****Vector Valued Functions**

<u>No.</u>	<u>Topic</u>	<u>Time</u>
8.1	Vector Valued Functions	06.05
8.2	Divergence	11.15
8.3	Curl	12.05
8.4	Line Integrals	09.55
8.5	Line Integrals	08.20
8.6	Work	08.55
8.7	Work	10.50
8.8	Conservative Fields	10.35
8.9	'Antigradients'	08.50
8.10	Green's Theorem	09.05
8.11	Green's Theorem	08.15
8.12	Flux	08.10
8.13	Surface Integrals	04.45
8.14	Final Theorems	01.40