STUDYWALKS · COURSE SYLLABUS

Calculus — High School Course with CLEP Preparation

Calculus is the mathematics of change: the derivative measures how fast a quantity is changing, and the integral adds up a quantity from its rate. This course works through limits, derivatives and integrals one rule at a time, with every worked example checked.

CREDIT LABEL	HOURS GOAL	STUDYWALKS LEARNING HOURS	SUGGESTED OFFLINE HOURS
1.0 credit	**120 h**	**26.5 h**	**93.5 h**
high school, with the study plan	the 1.0-credit convention	measured runtime plus assessment time	reading, review and writing

26.5 h StudyWalks (7.3 h of lessons, 12.6 h of lectures, 6.6 h of quizzes and exams) + **93.5 h** suggested offline study = **120 h**. 382 lessons in 17 units; prepares for the CLEP Calculus exam.

High school credit is granted by the homeschool parent under the state's rules. StudyWalks supplies the record: hours, scores and this syllabus. The credit label is a suggestion; the parent makes the final call.

Course contents

Unit	Title and lecture topics	Lessons	Lecture
1	**Getting Ready: The Exam and the Functions Calculus Uses** The exam · Functions, domains and compositions · Exponentials, logs and inverses · Trigonometry and the whole toolkit	22	40 min
2	**Limits: The Idea and the Limit Laws** The idea of a limit · One-sided limits and limits that fail · Infinite limits and vertical asymptotes · The first limit laws · Finishing the limit laws · The form zero over zero · Piecewise limits, squeezing and trig · Every limit tool	24	49 min (2 parts)
3	**Limits at Infinity, Asymptotes and Continuity** Limits at infinity · End behavior · Continuity at a point · Continuity on intervals and the Intermediate Value Theorem	20	38 min
4	**The Derivative: Definition and Meaning** From secants to tangents · The derivative at a point · The tangent line · The derivative as a rate · The derivative function · Where the derivative fails · Shape and higher derivatives	24	50 min (2 parts)
5	**Differentiation Rules** Constants and powers · Polynomials and tangent lines · Products and quotients · The trigonometric functions · Exponentials and logarithms · Every rule at once	24	51 min (2 parts)
6	**The Chain Rule, Implicit Differentiation and Inverse Functions** The chain rule · Powers, roots and named functions · Values, combinations and three layers · Implicit differentiation · Inverse functions · Logarithms, and the whole unit	24	53 min (2 parts)
7	**Rates of Change, Motion and Linear Approximation** Average and instantaneous rates · Motion along a line · Rates in context and linear approximation · The capstone	20	38 min

Unit	Title and lecture topics	Lessons	Lecture
8	**Related Rates** The method · Right triangles · Similar triangles and angles · Checking, and the capstone	14	29 min
9	**Extreme Values and the Mean Value Theorem** Absolute extrema and the Extreme Value Theorem · Local extrema and critical numbers · The closed interval method · Rolle's theorem and the Mean Value Theorem · The capstone	18	36 min
10	**The Shape of a Graph: f, f′ and f″** Rising, falling and the first derivative test · Concavity and inflection points · The second derivative test · Reading f from f′ · Asymptotes and curve sketching	22	39 min
11	**Optimization and L'Hospital's Rule** Setting up optimization · Optimization problems · L'Hospital's Rule · Other forms and growth rates · The capstone	20	39 min
12	**Antiderivatives and Initial Conditions** Reversing the derivative · The formula list · Combining and rewriting · Fixing the constant · Motion, other functions, and the whole unit	24	39 min
13	**Riemann Sums and the Definite Integral** Rectangles under a curve · Any sample point, and tables · Judging an estimate · The definite integral · Signed area and geometry · Properties of the definite integral · Motion and the whole unit	28	54 min (2 parts)
14	**The Fundamental Theorem, Net Change and Average Value** Accumulation and Part 1 · Part 2 and evaluation · Average value · Net change · Displacement, distance and motion · Accumulation and the whole unit	26	55 min (2 parts)
15	**Integration by Substitution** The substitution method · Adjusting constants · Trig, e and logarithms · Inverse trigonometric forms · Definite substitution · Leftover x, errors and the capstone	26	57 min (2 parts)
16	**Area, Accumulation and Growth and Decay** Area between curves · Crossings, the axis and slicing in y · Accumulated change · Accumulation from data · Growth and decay · Half-life, cooling and the capstone	28	56 min (2 parts)
17	**The Calculator Section, Mixed Problems and Capstone** The calculator section · Calculator judgment · Reading the question · Motion, a calculator problem and the capstone	18	38 min

Assessment and grading

- **Unit quizzes.** 17 quizzes, 10 questions each, checked as the student goes, each answer with the lesson to review. Untimed; retakes are unlimited.
- **Mid exam.** 50 questions on units 1–9, drawn fresh each time and scored at the end with a breakdown by content area. Untimed; retakes are unlimited.
- **Final exam.** 44 questions, 90 minutes, on the whole course. Scored 20–80; 50 passes (29 of 44 correct, about 66%). Retakes are unlimited with a 24-hour wait, each a fresh draw.

Suggested composite grade

Part	Weight
Unit quizzes (average of best scores)	20%
Mid exam (best score)	20%
Final exam (percent correct)	60%

Suggested letter scale

Letter	Composite
A	90–100
B	80–89
C	70–79
D	60–69
F	below 60

Suggested; the parent sets the grade. A passing final is the completion standard for the course record.

Study plan

The 93.5 offline hours are spread over the units in proportion to each unit's StudyWalks time. For each unit: read the matching sections of *Calculus Volume 1 (OpenStax); Active Calculus; APEX Calculus*, review the unit quiz misses, and write a one-page unit summary. Log the time as you go.

Unit	Title	StudyWalks	Offline, suggested	Unit total
1	Getting Ready: The Exam and the Functions Calculus Uses	1 h 5 min	5 h 5 min	6 h 10 min
2	Limits: The Idea and the Limit Laws	1 h 16 min	5 h 55 min	7 h 11 min
3	Limits at Infinity, Asymptotes and Continuity	1 h 1 min	4 h 45 min	5 h 46 min
4	The Derivative: Definition and Meaning	1 h 17 min	6 h	7 h 17 min
5	Differentiation Rules	1 h 18 min	6 h 5 min	7 h 23 min
6	The Chain Rule, Implicit Differentiation and Inverse Functions	1 h 21 min	6 h 20 min	7 h 41 min
7	Rates of Change, Motion and Linear Approximation	1 h 1 min	4 h 45 min	5 h 46 min
8	Related Rates	45 min	3 h 30 min	4 h 15 min
9	Extreme Values and the Mean Value Theorem	57 min	4 h 30 min	5 h 27 min
Lessons and lectures		**19 h 55 min**	**93 h 30 min**	**113 h 25 min**
Quizzes, mid exam and final (stated time)		**6 h 36 min**	**—**	**6 h 36 min**

Unit	Title	StudyWalks	Offline, suggested	Unit total
10	The Shape of a Graph: f, f′ and f″	1 h 4 min	5 h	6 h 4 min
11	Optimization and L'Hospital's Rule	1 h 2 min	4 h 50 min	5 h 52 min
12	Antiderivatives and Initial Conditions	1 h 6 min	5 h 10 min	6 h 16 min
13	Riemann Sums and the Definite Integral	1 h 26 min	6 h 45 min	8 h 11 min
14	The Fundamental Theorem, Net Change and Average Value	1 h 24 min	6 h 35 min	7 h 59 min
15	Integration by Substitution	1 h 26 min	6 h 45 min	8 h 11 min
16	Area, Accumulation and Growth and Decay	1 h 28 min	6 h 55 min	8 h 23 min
17	The Calculator Section, Mixed Problems and Capstone	58 min	4 h 35 min	5 h 33 min
Lessons and lectures		**19 h 55 min**	**93 h 30 min**	**113 h 25 min**
Quizzes, mid exam and final (stated time)		**6 h 36 min**	**—**	**6 h 36 min**

Unit times are the unit's lecture runtime plus its lessons at the course's measured average lesson length; totals can differ from the learning hours by rounding.

Sources

- **Anchor:** Gilbert Strang, Edwin "Jed" Herman and others. *Calculus Volume 1*. OpenStax, Rice University. CC BY-NC-SA 4.0
- **Witness:** Matthew Boelkins. *Active Calculus*, second edition. Grand Valley State University (facts only). CC BY-NC-SA 4.0
- **Witness:** Gregory Hartman and others. *APEX Calculus*, Version 4 (facts only). CC BY-NC 4.0

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