Class schedule: Math 1060-300, Fall 2019

Week 1: 8/21–8/23. Course overview. Two lectures covering *Lecture 0: A historial perspective. Part 1: Mesopotamia to Ancient Egypt*, and *Part 2: Ancient Greece to 17th Century Japan* (pp. 1–9). Slides available on Canvas.

HW due Monday: Read Hahn, pp. 1–9 and 12–18.

Week 2: 8/27–8/31. Two lectures covering *Lecture 0: A historical perspective. Part 2: Ancient Greece to 17th Century Japan* (pp. 10–33). Slides available on Canvas. One lecture on Infinity, Hilbert's Hotel, Cantor's diagonal argument, and the Continuum Hypothesis. One-half lecture on review of domain and range. Quiz #1 on Friday.

Due Friday: Read Hahn, pp. 18–25, and Steven Strogatz's NYT article on The Hilbert Hotel (on course webpage).

Week 3: 9/2–9/6. Three lectures covering a review of graphic basic functions ($f(x) = x^n$, x^{-n}, e^{ax}, $\ln x$, $\sin x$, $\cos x$). Limits of functions. The epsilon-delta definition of a limit (not required for this class, given just for context). Quiz #2 Tuesday.

Due Friday: WeBWorK HW 1.

READ **Active Calculus 2.0**, Chapter 1: *Understanding the derivative.*

- Section 1.2: *The notion of limit* (pp. 11–16).
- Section 1.7: *Limits, continuity, and differentiability* (pp. 70–74).

Week 4: 9/9–9/13. Three lectures covering average rate of change vs. instantaneous rate of change, and the derivative. The graph of $f(x)$ vs. $f'(x)$. The second derivative. The tangent line approximation to a curve. Quiz #3 Tuesday.

Due Sunday: WeBWorK HW 2.

READ **Active Calculus 2.0**, Chapter 1: *Understanding the derivative.*

- Section 1.1: *How do we measure velocity* (pp. 1–6).
- Section 1.3: *The derivative of a function at a point* (pp. 22–30).
- Section 1.4: *The derivative function* (pp. 34–40).
- Section 1.6: *The second derivative* (pp. 55–65).
- Section 1.8: *The tangent line approximation* (pp. 82–88).
- Section 3.1: *Using derivaties to identify extreme values* (pp. 165–175).

Week 5: 9/16–9/20. Three lectures covering computing derivatives of polynomials, the reciprocal rule, product rule, and quotient rule. Quiz #4 Tuesday.

Due Sunday: WeBWorK HW 3.

READ **Active Calculus 2.0**, Chapter 2: *Computing derivatives.*

- Section 2.1: *Elementary derivative rules* (pp. 91–91).
- Section 2.3: *The product and quotient rules* (pp. 106–113).

Week 6: 9/23–9/27. Three lectures covering the squeeze theorem, limits of $\frac{\sin x}{x}$ and $\frac{\cos x - 1}{x}$ as $x \to 0$, computing derivatives of trig functions, and intuition/motivation for the chain rule. (To be done on Monday). Quiz #5 Tuesday.

Due Sunday: WeBWorK HW 4.

READ **Active Calculus 2.0**, Chapter 2: *Computing derivatives*, and *Ohio University Active Calculus Supplement*, by Martin J. Mohlenkamp.

- Section 1.1 (Supplement): *The Squeeze Theorem* (online only).
- Section 2.2: *The sine and cosine functions* (pp. 100–104).
- Section 2.4: *Derivatives of other trigonometric functions* (pp. 118–122).

Week 7: 9/30–10/4. Two lectures covering the chain rule, implicit differentiation, and related rates. HW and midterm review Friday. Quiz #6 Tuesday.

Due Sunday: WeBWorK HW 5.

- Section 2.5: *The chain rule* (pp. 124–130).
- Section 2.7: *Derivatives of functions given implicitly* (pp. 145–152).

Week 8: 10/7–10/11. Three lectures covering an introduction to the exponential function (Mon.), derivatives of e^x and $\ln x$, the derivative of $x^{p/q}$ (Wed.), and related rates (Fri.). Midterm 1 Tuesday. HW 6 posted (due next Wed.)

- Section 2.1.2: *Computing derivatives: Constant, power, and exponential functions* (pp. 93–97).
- Section 2.6.1: *Basic facts about inverse functions* (pp. 135–136).
- Section 2.6.2: *The derivative of the natural logarithm function* (pp. 136–138).
- Section 3.4: *Applied optimization* (pp. 194–198).
- Section 3.5: *Related rates* (pp. 200–207).

Week 9: 10/14–10/18. Fall break Mon.–Tues.

One lecture on an introduction to definite integrals, signed area, and the motivation behind the Fundamental Theorem of Calculus. One class going over HW 7 (related rates).

- Section 4.1: *Determining distance traveled from velocity.* (pp. 209–219)

Due Wednesday: WeBWorK HW 6.
Due next Monday: WeBWorK HW 7.

Week 10: 10/21–10/25. Three lectures on Riemann sums, the area function, antiderivatives, the Fundamental Theorem of Calculus, and indefinite integrals. Quiz #7 Tuesday.

- Section 4.2: *Riemann sums.* (pp. 223–232)
- Section 4.3: *The definite integral.* (pp. 237–248)
- Section 4.4: *The fundmental theorem of calculus.* (pp. 254–265)
- Section 5.1: *Constructing accurate graphs from antiderivatives.* (pp. 269–277)
- Section 5.2: *The second fundamental theorem of calculus.* (pp. 281–289)

Due next Monday: WeBWorK HW 8.

Week 11: 10/28–11/1. Three lectures on the average value of a function, computing integrals by u-substution, area between curves, and computing the volumes of solids by slicing. Quiz #8 Tuesday.

- Section 5.3: *Integration by substitution.* (pp. 292–299)
- Section 6.1.1: *The area between two curves.* (pp. 335–338)

- Section 6.1.2: *Finding area with horizontal slices.* (pp. 339–340)
- Section 6.2.1: *The volume of a solid of revolution.* (pp. 344–346)

Due next Monday: WeBWorK HW 9.

Week 12: 11/4–11/8. Three lectures on computing volumes of solids by disks, washers, and shells. Finding the length of a curve. Quiz #9 Tuesday.

- Section 6.2: *Using definite integrals to find volume.* (pp. 344–352)
- Section 6.1.3: *Finding the length of a curve.* (pp. 340–343)
- Section 6.1.4: *Summary.* (pp. 344–346)
- Section 6.5.1: *Improper integrals involving unbounded intervals.* (pp. 377–379)

Due next Monday: WeBWorK HW 10.

Week 13: 11/11–11/15. Two lectures on finding the arc length of a curve, the Hagia Sophia, and computing the weight of its dome using integrals. Quiz #10 Tuesday. Class canceled Wednesday; Tuesday class extended 8:00–9:15am.

- Section 6.1.3: *Finding the length of a curve.* (pp. 340–343)
- Hahn, Chapter 7: *Basic calculus and its applications to the analysis of structures.* Subsection: *Volumes of spherical domes*, pp. 276–278.

Reading due Friday: Read Hahn, Chapter 3 (*Architecture inspired by faith*), pp. 53–60.

Due next Monday: WeBWorK HW 11.

Week 14: 11/18–11/22. Three lectures on computing the weight of the dome of the Hagia Sophia and the load bearing forces on the supporting buttresses, computing the volume of the dome of the Roman Pantheon, and what an ideal arch is. Slides posted to Canvas. Midterm 2 Tuesday.

- Hahn, Chapter 6: *A new architecture: materials: structural analysis, computers, and design.* Subsection *Hanging chains and rising domes*, pp. 217–226.
- Hahn, Chapter 7: *Basic calculus and its applications to the analysis of structures.* Subsection: *Volumes of spherical domes*, pp. 276–281.

Reading due next Monday:

- Hahn, Chapter 6, (*A new architecture: materials: structural analysis, computers, and design*), pp. 205–226.
- Hahn, Chapter 7 (*Basic calculus and its applications to the analysis of structures*), pp. 276–286.

Due next Monday: WeBWorK HW 12.

Week 15: 11/25–11/29. One lecture on hanging chains, arches, and domes (slides on Canvas), and one lecture on polynomial approximation of functions, and how to write functions such as e^x, $\cosh x$, $\sinh x$, $\cos x$, and $\sin x$ with infinite series. Quiz #11 Tuesday. No class Wednesday–Friday (Thanksgiving Break).

- Active Calculus, Section 8.5.1–8.5.2: *Taylor polynomials and Taylor series*, pp. 499–507.

Week 16: 12/2–12/6. Two lectures, on the calculus of ideal arches, and the geometry of the St. Louis Arch. Review session and Quiz 13 Friday.

Reading due Tuesday:

- Hahn, Chapter 2: *Greek geometry and Roman engineering.* Subsections: *Dealing with forces*, and *The Roman arch*, pp. 25–36.
- Hahn, Chapter 7: *Basic calculus and its applications to the analysis of structures.* Subsection: *The shape of an ideal arch*, pp. 281–286.

Due next Tuesday: WeBWorK HW 13.