Class schedule: Math 1060-300, Fall 2020

Week 1: 8/19–8/21. Course overview. Three lectures covering *Lecture 0: A historial perspective*, *Part 1: Mesopotamia to Ancient Egypt*, and *Part 2: Ancient Greece to 17th Century Japan* (pp. 1–28). Slides available on Canvas.

HW due Monday: Read Hahn, Chapter 1, *Humanity Awakening: Sensing Form and Creating Structure* (pp. 1–9) and Chapter 2, *Greek Geometry and Roman Engineering* (pp. 12–18). Read the section "*Gods of Geometry*" from pp. 18–25, but don't worry too much about the details in the equations equations; the content is the most important.

Week 2: 8/24–8/28. One lecture covering *Lecture 0: A historical perspective. Part 2: Ancient Greece to 17th Century Japan* (pp. 28–33). 1.5 lectures on Infinity, Hilbert's Hotel, Cantor's diagonal argument, and the Continuum Hypothesis. 1.5 lectures on review of domain and range, and limits.

Week 3: 8/31–9/4. Four 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). The tangent line and its slope.
WeBWorK: HW 1 due Friday, HW 2 assigned Friday.

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).
- Section 1.1: *How do we measure velocity* (pp. 1–6).

Week 4: 9/7–9/11. 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.

WeBWorK: HW 2 due Wednesday, HW 3 assigned Thursday.

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

- 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).

Chapter 3: *Using derivatives.*

- Section 3.1: *Using derivaties to identify extreme values* (pp. 165–175).

Week 5: 9/14–9/18. Three lectures covering tangent line approximations, computing derivatives of polynomials, the reciprocal rule, product rule, and quotient rule. Quiz #2 Thursday.

WeBWorK: HW 2 due Wednesday, HW 3 assigned Thursday.

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

- Section 1.8: *The tangent line approximation* (pp. 82–88).

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: 9/21–9/25. 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 the chain rule. (To be done on Monday). Quiz #3 Thursday.

WeBWorK: HW 3 due Wednesday, HW 4 assigned Thursday.

READ **Active Calculus 2.0**, Chapter 1: *Understanding the derivative*, online supplement, *Ohio University Active Calculus Supplement*, by Martin J. Mohlenkamp.

- Section 1.1: *The Squeeze Theorem.*

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

- Section 2.2: *The sine and cosine functions* (pp. 100–104).
- Section 2.4: *Derivatives of other trigonometric functions* (pp. 118–122).
- Section 2.5: *The chain rule* (pp. 124–130).

Week 7: 9/28–10/2. Two lectures covering the chain rule, implicit differentiation, and the exponential function. HW 4 Friday. Quiz #4 Tuesday.

WeBWorK: HW 4 due Wednesday (extended to Friday), HW 5 assigned Thursday.

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

- Section 2.5: *The chain rule* (pp. 124–130).
- Section 2.7: *Derivatives of functions given implicitly* (pp. 145–152).
- Section 2.1.2: *Computing derivatives: Constant, power, and exponential functions* (pp. 93–97).

Week 8: 10/5–10/9. Three lectures covering derivatives of e^x and $\ln x$, the derivative of $x^{p/q}$, and related rates, and introduction to definite integrals, signed area, and the motivation behind the Fundamental Theorem of Calculus. Midterm 1 Thursday. HW 6 posted (due next Wed.)

WeBWorK: HW 5 due Wednesday, HW 6 assigned Thursday.

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

- 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).

Chapter 3: *Using derivatives.*

- Section 3.4: *Applied optimization* (pp. 194–198).
- Section 3.5: *Related rates* (pp. 200–207).

Chapter 4: *The definite integral.*

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

Week 9: 10/12–10/16. Three lectures on signed area, Riemann sums, the defnite integral, and the Fundamental Theorem of Calculus, Part 1.

WeBWorK: HW 6 due Wednesday, HW 7 assigned Thursday (due Monday).

READ **Active Calculus 2.0**, Chapter 4: *The definite integral.*

- 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, Part 1.* (pp. 254–265)

Week 10: 10/19–10/23. One day (Monday) of working on related rates problems from the homework. Two lectures on the fundamental theorem of calculus, antiderivatives, and indefinite integrals. Quiz #6 Thursday.

WeBWorK: HW 8 due Monday, HW 9 due Friday (extended to next Monday).

READ **Active Calculus 2.0**, Chapter 4: *The definite integral.*

- Section 4.4: *The fundmental theorem of calculus, Part 1.* (pp. 254–265)

Chapter 5: *Evaluating integrals.*

- Section 5.1: *Constructing accurate graphs from antiderivatives.* (pp. 269–277)
- Section 5.2: *The second fundamental theorem of calculus.* (pp. 281–289)

Week 11: 10/26–10/30. Three lectures on the average value of a function, computing integrals by u-substution, area between curves. Quiz #7 Thursday.

WeBWorK: HW 9 due Friday.

READ **Active Calculus 2.0**, Chapter 4: *The definite integral.*

- Section 4.3.3: *How the definite integral is connected to a function's average value.* (pp. 237–239) Chapter 5: *Evaluating integrals.*
- Section 5.3: *Integration by substitution.* (pp. 292–299) Chapter 6: *Using definite integrals.*
- Section 6.1.1: *The area between two curves.* (pp. 335–338)

Week 12: 11/2–11/6. Fall break Mon.–Tues. Two lectures on area between curves, computing volume by slicing, improper integrals. Quiz # 8 Thursday.

WeBWorK: HW 10 assigned.

READ **Active Calculus 2.0**, Chapter 6: *Using definite integrals.*

- Section 6.1.2: *Finding area with horizontal slices.* (pp. 339–340)
- Section 6.2: *Using definite integrals to find volume.* (pp. 344–352)
- Section 6.5.1: *Improper integrals involving unbounded intervals.* (pp. 377–379)

Week 13: 11/9–11/13. Three lectures on computing volumes of solids of revolution, the arc length of a curve, the Hagia Sophia, and computing the weight of its dome using integrals. Quiz #9 Thursday.

WeBWorK: HW 10 due Monday, HW 11 assigned.

READ **Active Calculus 2.0**, Chapter 6: *Using definite integrals.*

- 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)

READ (for next Monday) **Mathematical Excursions to the World's Great Buildings**.

- Chapter 3: *Architecture inspired by faith.*
  - Introduction, pp. 53–56
  - *The Hagia Sophia*, pp. 56–60.
- Chapter 7: *Basic calculus and its applications to the analysis of structures.*
  - Introduction, pp. 265–276
  - *Volumes of spherical domes*, pp. 276–281.

Week 14: 11/16–11/20. Three lectures on the Hagia Sophia and computing 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 Thursday.

WeBWorK: HW 11 due Monday, HW 12 assigned.

READ **Mathematical Excursions to the World's Great Buildings**.

- Hahn, Chapter 6: *A new architecture: materials, structural analysis, computers, and design.*
  - Introduction, pp. 205–207,
  - *Evolving Structures: Domes from St. Paul's in London to the Capitol in Washington*, pp. 207–217,
  - *Hanging chains and rising domes*, pp. 217–226.

Week 15: 11/23–11/27. One lecture on hanging chains, arches, and domes (slides on Canvas). The hyperbolic cosine function $\cosh x$, and how to write it and e^x as an infinite series. No class Wednesday–Friday (Thanksgiving Break).

WeBWorK: HW 12 due Tuesday. HW 13 assigned (final exam review; optional but strongly recommended)

READ **Mathematical Excursions to the World's Great Buildings**.

- Hahn, Chapter 2: *Greek geometry and Roman engineering.*
  - *Dealing with forces*, pp. 25–30.
  - *The Roman arch*, pp. 30–36.
- Chapter 7: *Basic calculus and its applications to the analysis of structures.*
  - *The shape of an ideal arch*, pp. 281–286.

Week 16: 11/30–12/4. Three lectures, on infinite series of functions, hyperbolic sine and cosine functions, the calculus of ideal arches, and the geometry of the St. Louis Arch. Quiz 10 Friday.

WeBWorK: All HW opened back up until midnight of Sunday. HW 13 optional (final exam review; optional but strongly recommended, and will count to bring up a non-passing HW grade)

READ **Active Calculus 2.0**, Section 8.5.1–8.5.2: *Taylor polynomials and Taylor series*, pp. 499–507.

READ **Mathematical Excursions to the World's Great Buildings**. Make sure you're caught up; see the sections and chapters from the previous weeks.