Yale University, Department of Mathematics
Math 115 Calculus
Fall 2017

Final Exam Review Guide

When/Where. The Final Exam will take place during 9:00 – 12:30 am on Saturday, December 16th, 2017 in the SSS 114.

Directions. You will have 3 hours to complete the Final Exam and 30 minutes to review your work. No electronic devices will be allowed. No notes will be allowed. On all problems, you will have to show your work to get full credit.

Topics covered and practice problems.

- Evaluating definite integrals using the Fundamental Theorems of Calculus. Interpretation of definite integral as "net change". "Area so far" functions and their graphs. Indefinite integrals. Practice problems §5.3 #1–48, 56–63; §5.4 #5–12, 14–18, 21–39, 41–46, 49–58, 68–71.
- u-substitution. Practice problems §5.5 #1–36, 38–48, 53–73, 77–78, 80–84, 85–92.
- Area between curves. Finding the intersection points of curves. Practice problems §6.1 #15–28, 47–48.
- Volume of solids. Using cross section areas. Disk/washer method. Shell method. Practice problems §6.2 #1–18, 39–42; §6.3, #1–20, 29–32, 39–43.
- Integration by parts. Practice problems §7.1 #3–24, 26–46, 61–64, 67–69.
- Integration using multiple methods. Practice problems §7.5 #1–6, 8–10, 13–14, 18–19, 22–24, 37–38, 43–50, 55–57, 63–66, 71–72, 78–79.
- Approximate integration. Midpoint, trapezoid, and Simpson's rule. Error. Practice problems §7.7 #1–2, 5–18, 19–21 (especially parts (b) and (c)), 22, 29–31, 36–38, 45–48.
- Improper integrals. Practice problems §7.8 #1–3, 5–42, 49–54, 57–59, 63, 76–79.
- Arc length. Practice problems §8.1 #7–10, 12–13, 17–18, 23–26, 35.
- Parametric curves. Sketch curves given a parameterization and given graphs of parameters. Find Cartesian equations. Practice problems §10.1 #1–18, 23–28, 40–46.
- Tangents, area under, and arc length of parametric curves. Practice problems §10.2 #1–20, 27–30, 32–35, 37–44, 48–54, 57–63.

- Polar coordinates. Graphing, computing tangent slopes, area, and arc length of polar functions. Practice problems §10.3 #1–48, 49–51, 54–64; §10.4 #1–44.
- Sequences. Practice problems §11.1 #3–56, 64–78.
- Series. Geometric series. Tests: Test for Divergence, Integral Test, Comparison Test, Alternating Series Test, Ratio Test, Root Test. Absolute convergence. Error bounds and estimating series. Practice problems §11.2 #27–42; §11.3 #3–32, 36–42; §11.4 #1–32, 33–36, 38–46; §11.5 #1–20, 23–31, 32–34; §11.6 #2–30, 35–37; §11.7 #1–38.
- Power series. Radius of convergence. Practice problems §11.8 #3–28, 31–33, 41–42.
- Functions as power series. Differentiating and integrating power series. Practice problems §11.9 #3–10, 13–20, 25–32, 39–40.
- Taylor series. Taylor polynomials. Taylor's inequality. Error. Practice problems §11.10 #1–10, 13–20, 29–34, 37–38, 43–44, 47–52, 54, 55–58, 63–70.
- Using Taylor's Inequality to estimate functions by Taylor polynomials. Practice problems §11.11 #3–10 (don't graph), 13–21 (parts (a),(b)), 23–26, 27–29 (don't need to check graphically), 31, 33, 37.
- Differential equations. Initial values. General solutions and solutions with specified initial values. Modeling. Practice problems §9.1 #1–5, 6 (parts (a), (c), (d)), 7, 8 (no graphing required), 9–13, 14–15.
- Direction fields for differential equations. Sketching/matching direction fields. Autonomous differential equations. "Qualitative analysis" identifying equilibrium solutions of an autonomous differential equation and deciding whether they are stable, unstable, or saddle points. Long term behavior of solutions to autonomous differential equations. Euler's method. Practice problems §9.2 #1–14, 18, 19–24, 27–28.
- Separable equations. Practice problems §9.3 #1–10, 11–14
- Models for population growth. Exponential model. Logistic model. Logistic model with harvesting. Practice problems §9.4 #1, 2 (parts (a), (b), (e)), 3–10, 15–16, 17 (not part (e)), 18 (not part (a)), 19 (parts (a) and (b)), 20 (don't worry about precise graphing in part (b)).

True/False practice quizzes.
(Found in the Review section at the end of each chapter.)

- Chapter 5, #1–18.
- Chapter 7, #5–8, 10–14.
- Chapter 9, #1–4, 7.
- Chapter 10, #4–7.
- Chapter 11, #1–22