

Final review. The final is Tuesday Dec. 9 10:10 - 12:10 in 219 EGRA (engineering) building. **From reviews 1), 2), 3) and 4), know how to do all of the problems that are important for the final F1) – F43).** The problems with two or three stars (F1, F2, F3, F10, F12, F13, F14, F15, F16, F17, F18, F20 F21, F22, F23, F25, F26, F28, F30, F31, F33, F34, F35, F36, F37, F38, F40, F41 and F42) are especially important.

The final will likely look like this:

- 1) limits F1)–F11)
 - a) cancellation (easy) F1)
 - b) F2) or F3) (rationalize numerator or multiply by $(1/\sqrt{x^2})/(1/\sqrt{x^2})$)
 - c) F4) or F6) d) F10)

2) Use the definition of the derivative to find the derivative of $f(x)$. F12)
The choices $f(x) = \sqrt{x}$, $f(x) = x^2 + ax$ are especially popular. Tip: Use a simpler rule to check your answer.

- 3) Find $f'(x)$.
 - a) sum of powers, exponentials and trig functions (easy) F14)
 - b) product rule often combined with the chain rule F15)
 - c) quotient rule often combined with the chain rule F16)
 - d) chain rule F17)
 - e) logarithmic differentiation on $f(x) = [h(x)]^{g(x)}$ F21)
 - f) fundamental theorem of calculus part I F28) (or possibly F27))

4) Given $y(x)$ find $y'(x)$ using implicit differentiation F18) (and you may need to evaluate $y(x)$ at x_o and $y'(x)$ at x_o F19)).

5) Tangent line. F13) Often chain rule is needed to find $f'(x)$.

6) Related rates problem, F20), usually with the Pythagorean theorem. (hard)

7) Find the absolute max and min of $f(x)$ on $[a, b]$. F22) Usually you need to give both coordinates of the min and max.

8) min-max optimization story problem (hard). F26) Usually the area of a rectangle is used: fence, poster, biggest rectangle inside a parabola. Volume of box given surface area and volume of can given surface area are sometimes used.

9) Given a graph of the derivative $f'(x)$ find intervals where f is increasing, decreasing, concave up and concave down. F23) Also find the x coordinates of the relative (= local) mins and of the relative maxs. (easy) (Occasionally you are given the formula for $f'(x)$ and then do the above. F24))

10) Evaluate indefinite integrals.

- a) integrand is sum of powers exponentials and trig functions F31), F34a)
- b), c) u-substitution F35), F37), F38) or f39)
- d) find u , du and x as a simple function of u , then use power rule F38)

11) Evaluate definite integrals.

- ab) Use u-substitution F36), F37), F38) or F39).
- c) absolute value F34c),
- d) Break the integral into two parts. F30)
- e) An odd function integrates to 0 on $[-a, a]$. F43).

12) Find the area in a region bounded by 2 curves. F40)

13) Given a region in the first quadrant,

- a) set up but do not evaluate the volume of the solid of revolution using shells. F42)
 - b) set up but do not evaluate the volume of the solid of revolution using washers (or disks). F41)
- Sometimes a) and b) are swapped.

14) Evaluate the volume of a solid of revolution using the method of disks F41) or F42).

15) Given a graph of the velocity $v(t)$ on $[a, b]$, sketch the graph of the acceleration $a(t)$ and find the total distance traveled and the total displacement from time $t = a$ to time $t = b$. F33)