

Math 150 Practice Final

1. Find $\lim_{x \rightarrow \infty} \frac{3x^2 - 2x + 5}{x + 4}$.
2. Find $\lim_{x \rightarrow 0} \frac{x^2 - 4x + 4}{x^2 - 3}$.
3. Find $\lim_{x \rightarrow 0} \frac{\sin^2 x}{x}$.
4. Find $\lim_{x \rightarrow -\infty} e^{\frac{1}{x}}$.
5. Use the definition of the derivative to find $f'(x)$ if $f(x) = x^2 - 2$.
6. Use the definition of the derivative to find $f'(x)$ if $f(x) = \frac{2}{x^2}$.
7. Find the tangent line to the graph of $f(x) = x \ln x + 1$ at the point where $x = 1$.
8. Find $\frac{d}{dx} \left[\frac{x \ln x}{\sqrt{\sin x}} \right]$.
9. Find $\frac{dy}{dx}$ if $\ln \left(\frac{x}{y} \right) = 1$.
10. Use logarithmic differentiation to find $\frac{dy}{dx}$ if $y = (\cosh x)^x$.
11. Find an equation for the line tangent to the graph of $x^2 + 2y^2 = 9$ at the point $(1, 2)$.
12. A girl flies a kite at a height of 300 ft, the wind carrying the kite horizontally away from her at a rate of 25 ft/sec. How fast must she let out the string when the kite is 500 ft away from her?
13. Find the intervals of increase and decrease and concavity for:
 - a. $f(x) = xe^{\frac{1}{x}}$.
 - b. $f(x) = x\sqrt{8 - x^2}$.
14. Find and classify the relative extrema of $f(x) = x^2\sqrt{3 - x}$.

15. Find the absolute extrema (if they exist) of $f(x) = x^2 - 6x + 9$ on the interval $[0,5]$.
16. Find the absolute extrema (if they exist) of $f(x) = \frac{1}{x^2 - 1}$ on the interval $(-\infty, \infty)$.
17. You are planning to make an open rectangular box from an 8 in by 15 in piece of cardboard by cutting congruent squares from the corners and folding up the sides. What are the dimensions of the box of largest volume you can make?
18. Evaluate $\int \left(3t^2 - \frac{2}{t} \right) dt$.
19. Evaluate $\int \sinh x e^{\cosh x} dx$.
20. Evaluate $\int_1^4 \frac{dy}{\sqrt{y}(1+\sqrt{y})^2}$.
21. Evaluate $\int_{\ln(\frac{\pi}{6})}^{\ln(\frac{\pi}{2})} 2e^v \cos(e^v) dv$.
22. Solve the initial value problem: $\frac{dy}{dx} = 3x^{-\frac{2}{3}}, y(-1) = -5$.
23. Find the position function of a particle with $a(t) = -4 \sin 2t$, $v(0) = 2$, and $s(0) = -3$.
24. Find the area between the two curves $y = 4 - x^2$ and $y = -x + 2$.
25. Find the volume generated by revolving the region bounded by $y = x$, $y = 1$, and $x = 0$ about the x -axis.
26. Find the work done in pumping all the water out of a full tank in the shape of a hemisphere, flat side down, with radius 8 ft.