

Show all work on separate paper. Calculators, gold sheet, triq sheet are allowed. Worst problem will be omitted.

1a) $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x^3 - 8}$ b) $\lim_{x \rightarrow 3} \frac{\sqrt{x+1} - 2}{x-3}$ c) $\lim_{x \rightarrow 0} \frac{|x|}{x}$

2. If $f(x) = \frac{3x^2}{\sqrt{x^2 + 2x - 1}}$, find $f'(x)$ and simplify.

3. If $y = \sin^3(\sqrt{x})$, find $\frac{dy}{dx}$

4. Find $\frac{dy}{dx}$ for $x^3 - x^2y^2 + y^3 = 9$

5. For $f(x) = 3x^4 - 4x^3$, find all relative max & mins, intervals in which $f(x)$ is concave up or down.

6. $\int \frac{x^3 + 3x^2 - 4x + 2}{x^2} dx$

7. $\int \frac{\cos x}{\sin^3 x} dx$

8. $\int x \sqrt{2x+4}$

9a) $\int \frac{(\ln x)^3}{x} dx$ b) If $y = e^{x^2}$, find $\frac{dy}{dx}$. c) $\int e^{3x} dx$

10. If $y = x^{\sin x}$, find $\frac{dy}{dx}$

11. The initial population of a city is 20,000. If it takes 5 years for the population to double, find the equation of growth. How long will it take to reach 100,000?

12. Beginning with $a(t) = -32 \text{ ft/sec}^2$, derive formulas for velocity and position at any time t . Now, Santa's sleigh is stationary at 1600 ft when a refrigerator falls out of it. How long does it take to reach the ground and how fast does it hit?