

**Math 141 - Homework 12**

Name: \_\_\_\_\_

Calculate the following limits. You can use L'Hospital's rule if it is appropriate.

1.  $\lim_{x \rightarrow 4} \frac{x^2 - 16}{x - 4}$

2.  $\lim_{x \rightarrow a} \frac{x - a}{x^n - a^n}$

3.  $\lim_{x \rightarrow 4} \frac{x^2 - 16}{x + 4}$

4.  $\lim_{x \rightarrow \pi} \frac{\cos(x/2)}{x - \pi}$

5.  $\lim_{x \rightarrow \infty} \frac{x^2}{5x + \sqrt{x}}$

6.  $\lim_{x \rightarrow \infty} \frac{6x^5 - 3x^4 + 7x}{5x^5 + 16x^3 - 9x^2}$

Calculate the following antiderivates.

7.  $\int 4x^3 + 3x^2 dx$

8.  $\int \sec^2 x + \cos x dx$

9.  $\int 10x^4 - 5 dx$

10.  $\int \sqrt{x} + 1 dx$

11.  $\int \frac{1}{x^2} dx$

12.  $\int \frac{5}{\sqrt{x}} dx$

13.  $\int 0 \, dx$

14.  $\int \frac{x^5 + x^3}{x^2} \, dx$

15.  $\int x^{-1/3} + x^{1/3} \, dx$

16. Find a function  $f(x)$  such that  $f'(x) = 4x$  and  $f(1) = 5$ .

17. Solve the initial value problem  $\frac{dy}{dx} = \cos x + \sin x$  with  $y(0) = 3$ .

18. Find the horizontal asymptotes of  $f(x) = \frac{4x}{\sqrt{x^2 + 3}}$  by calculating the limits as  $x$  approaches  $+\infty$  and  $-\infty$ , then sketch a graph of the function. Hint: This function is always increasing because its derivative  $f'(x) = 12(x^2 + 3)^{-3/2}$  is always positive.