**Math 141 - Homework 12** **Name:** _____

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

1. $\lim_{x\to 4} \dfrac{x^2-16}{x-4}$

2. $\lim_{x\to a} \dfrac{x-a}{x^n-a^n}$

3. $\lim_{x\to 4} \dfrac{x^2-16}{x+4}$

4. $\lim_{x\to \pi} \dfrac{\cos(x/2)}{x-\pi}$

5. $\lim_{x\to \infty} \dfrac{x^2}{5x+\sqrt{x}}$

6. $\lim_{h\to \infty} \dfrac{6x^5-3x^4+7x}{5x^5+16x^3-9x^2}$

*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. $\int \dfrac{1}{x^2}\,dx$

12. $\int \dfrac{5}{\sqrt{x}}\,dx$

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.