Name _____

There are 10 problems on 5 pages. Each problem is worth 10 points. each. SHOW your work. $\boxed{CIRCLE}$ your answer.   **NO CALCULATORS!** CHECK your answer whenever possible.

1. Find the limit of the sequence whose n^{th} term is $a_n = n \sin\left(\dfrac{1}{2n}\right)$.

2. Find the limit of the sequence whose n^{th} term is $a_n = \left(\dfrac{n-1}{n+1}\right)^n$.

3. Find $\displaystyle\int_0^\infty \frac{1}{1+x^2}\,dx$.

4. Find $\displaystyle\int_{-3}^1 \frac{1}{x^2}\,dx$.

5. Find $\displaystyle\int \frac{1}{\sqrt{4-9x^2}}\,dx$. Check your answer.

6. Find $\displaystyle\int \frac{\ln x}{x^2}\,dx$. Check your answer.

7. Find $\displaystyle\int \frac{4x^2+x-2}{x^2(x-1)}\,dx$. Check your answer.

8. Find $\displaystyle\int \frac{3x^2-3x+1}{x(x^2+1)}\,dx$. Check your answer.

9. Find the general solution of $\dfrac{dy}{dx} + \dfrac{3x}{x^2+1}y = \dfrac{6x}{x^2+1}$. Check your answer.

10. Which number $\displaystyle\int_1^{n+1} \frac{1}{\sqrt{x}}\,dx$ or $\displaystyle\sum_{k=1}^n \frac{1}{\sqrt{k}}$ is bigger? Does the sequence whose

   n^{th} term is $a_n = \displaystyle\sum_{k=1}^n \frac{1}{\sqrt{k}}$ converge? Justify your answer.