

You may keep this page of questions. Turn in your answers with all of your work on the ivory colored paper. You are **NOT** allowed to use your calculator for any of the questions on this exam.

I. (1) 10 Points. Write down the abstract partial fractions decomposition for

$$f(x) = \frac{x^9 - 6x^8 + 7x - 113}{(x+5)(x-2)^3(x^2+5)^2(x^2+x+14)^2}.$$

(2) 10 Points. Find an exact value for $\lim_{x \rightarrow 3} \left(\frac{2^x - 8}{\sin(\pi x^2)} \right)$.

II. Analyze and evaluate the following antiderivatives, definite integrals and improper integrals. The five problems in this section are worth 14 points each.

$$(3) \int_0^\pi x \sin(3x) dx. \quad (4) \int_0^\infty e^{-3x} dx.$$

$$(5) \int \frac{dx}{(x^2+9)^{\frac{3}{2}}}. \quad (6) \int_0^2 \frac{dx}{(x-1)^6}. \quad (7) \int \frac{x^2 - 13x + 4}{(x-3)(x^2+4)} dx.$$

III. (8) 10 Points. Given that $\frac{1}{24} \frac{x^3 + 6x}{(x^2 + 4)^{\frac{3}{2}}}$ is an antiderivative for $\frac{1}{(x^2 + 4)^{\frac{5}{2}}}$

find a value for k so that $f(x) = \frac{k}{(x^2 + 4)^{\frac{5}{2}}}$ is a probability density function.