

You may keep this page of questions. Turn in your answers with all of your work on the colored paper. You are **NOT** allowed to use calculators or Mathcad for the first seven questions, but you are expected to use Mathcad for the last question.

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

$$f(x) = \frac{x^7 - 3x^4 + 7x + 19}{x(x-5)^3(x^2 - 4x + 40)(x^2 + 7)^3}.$$

(2) 10 Points. Solve the differential equation $x \frac{dy}{dx} - 2y = x^5$.

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

(3) $\int x^2 \cosh(3x) dx.$

(4) $\int_4^{\infty} \frac{dx}{x^{\frac{3}{2}}}.$

(5) $\int \sin(7\theta) \sin(4\theta) d\theta$

(6) $\int \frac{dx}{(\sqrt{x^2 - 4x + 13})^3}.$

(7) $\int \frac{x^2 + 14x + 33}{(x-2)(x^2 + 9)} dx.$

III. Turn in the above work on the blue paper and receive gray paper to use for this last question. Use Mathcad to find the following antiderivative.

(8) 10 Points. $\int x e^{-2x} \sin(5x) dx$