

You may keep this page of questions. For this part of the exam, turn in your answers with all of your work on the blue paper. You are not allowed to use Mathcad or a calculator for this part of the exam. Problems # 1–8 are worth 12 points each. Problems # 9–13 are worth 16 points each.

I. (1) Find $f'(x)$ if $f(x) = \sinh^{-1}(2x)$.

(2) Find the Maclaurin series for $y = f(x) = x \sin x$. Express your final answer using summation notation.

(3) State the formal definition for the number L to be the limit of the sequence $\{a_n\}$ as n goes to infinity: that is, state the definition for

$$L = \lim_{n \rightarrow \infty} a_n.$$

Illustrate the definition with a sketch.

II. Analyze and evaluate the following definite, indefinite, or improper integrals.

$$(4) \int x^2 e^{x^3} dx \quad (5) \int x^2 e^{3x} dx \quad (6) \int_0^{\frac{\pi}{6}} \cos^3(2\theta) \sin^2(2\theta) d\theta$$

$$(7) \int_1^4 \frac{dx}{(x-2)^2} \quad (8) \int \frac{6x-9}{x^3+9x} dx$$

III. The problems in this section are worth 16 points each.

(9) Find the volume of the solid of revolution that is generated by revolving the region bounded by $y = 0$ and $y = 2x - x^2$ about the y -axis.

(10) Find the interval of convergence for the power series

$$\sum_{k=0}^{\infty} \frac{k(x+2)^k}{5^k}$$

Determine whether the series converges or diverges at the endpoints. State which tests you are using. Show your work.

(11) Find the arc length of the curve given by the parametric equations $x = 3t^2$, $y = 2t^3$ for $0 \leq t \leq 1$.

(12) Sketch a graph showing the curves having polar equations $r = 4 \sin \theta$ and $r = 2 \csc \theta$. Then find the area of the region that is below the first curve, but above the second curve. Hint: You might want to find cartesian equations for these two curves.

(13) Determine whether the series $\sum_{k=1}^{\infty} \frac{2k+3}{81k^2+4}$ converges or diverges.

State which test or tests you are using and show your work.

IV. For these last two questions, it is intended that you **WILL** use Mathcad and/or a calculator. Do **NOT** work these two problems on the blue paper. I have printed these two questions here in order that you might judge how much time you want to allow for them. When you have finished the problems in parts I – III, turn them in on the blue paper and receive a page of lemon paper for these last two problems. They are worth 12 points each.

(14) Use Mathcad to find the antiderivative $\int x e^{-2x} \cos(3x) dx$.

(15) If you save \$100 at the end of every month for 40 years and you invest this money at 5.25% nominal annual interest compounded monthly, how much money will you have at the end of 40 years?