

This test is closed-book and closed-notes. No calculator is allowed for this test. For full credit show all of your work (legibly!), unless otherwise specified. Algebraic simplification of final answers will not be generally necessary except where specifically requested.

The problems are in no particular order, and it is suggested that you look at all of them before beginning to answer any.

1. **(15 points)** You are constructing an open-topped cardboard box with a square base which must have a volume of thirty-two cubic feet. What is the least amount of cardboard you could use to do so?

2. **(15 points)** Answer the following questions related to the shape of the graph of $f(x) = x^3 + 6x^2 - 15x + 7$.

(a) **(5 points)** Where is it increasing? Where is it decreasing?

(b) **(5 points)** Where are its local extrema, and what type of extrema are they?

(c) **(5 points)** Where is it concave up? Where is it concave down? Does it have any points of inflection?

3. **(15 points)** Transylvania Polygnostic University currently has 3000 students. Enrollment is expected to rise by 4% each year.

(a) **(6 points)** Create a function $f(t)$ to describe the expected number of students t years from now.

(b) **(9 points)** How many years will it take for enrollment to reach 4000 students?

4. **(10 points)** Answer the following questions related to the shape of the graph of $g(x) = \frac{x^2+5x+13}{x+1}$

(a) **(5 points)** Where is it increasing? Where is it decreasing? Identify its local extrema.

(b) **(5 points)** Which of its local extrema are also global extrema, and why?