

Name: _____

Answer the questions in the spaces provided on the question sheets. If you
run out of room for an answer, continue on the back of the page.

No calculators or notes allowed.

Show all work clearly.

Use proper notation.

Question	Points	Score
1	5	
2	5	
3	10	
4	15	
5	15	
6	5	
7	5	
8	25	
Total	75	

1. (5 points) Use implicit differentiation to find the derivative of $y = \tan^{-1}(x)$. (*Hint:*
 $y = \tan^{-1}(x) \Rightarrow \tan(y) = x$)

2. (5 points) An object's acceleration to Earth's core is not a constant 9.8 m/s^2 , but rather the acceleration changes. This is because $F = ma$, the mass m of the object is unchanging, but $F = G\frac{Mm}{d^2}$, where G is a constant, M is the (constant) mass of Earth, and d is the distance between Earth and the object.

- (a) (2 points) Suppose that rocket launches straight up into Earth's atmosphere. What does the sign of $\frac{dF}{dt}$ mean?

- (b) (3 points) What can we conclude about velocity when $\frac{dF}{dt} = 0$?

3. (10 points) Find the absolute and local maximums, minimums, and the x values for which they occur, for the function $f(x) = x^4 - 2x^2 + 10$ over the interval $[-3,1]$.

4. (15 points) Graph $y = x^5 - 5x^4$, including its correct intercepts, local extrema, and inflection points.

5. (15 points) You are commissioned by a livestock company to design a the dimensions of a rectangular pen. One side of the rectangle is natural cliffs. The side parallel to the cliffs will be electric, which cost \$3/ft/day to maintain. The other two sides cost only \$1/ft/day. Because of material imitations, only 20ft of total fencing is possible. The company makes \$1/ft²/day off of livestock contained in the pen. When dimensions maximize their profit?

6. (5 points) Approximate the following integral, using the graph, and three rectangles of equal width.

$$\int_1^7 v(t) dt$$



7. (5 points) Write in sigma notation the following:

$$\frac{4}{5} + \frac{5}{7} + \frac{6}{9} + \frac{7}{11} + \cdots + \frac{15}{27}$$

8. (25 points) Evaluate the following:

(a) (5 points) $\int_0^1 x^2 + \sqrt{x} \, dx$

(b) (5 points) $\int 1 + \cos(t) \, dt$

(c) (5 points) $\int (2r + 1)^3 dr$

(d) (10 points) $\int x^{1/2} \sin(x^{3/2} + 1) dx$