Name:	____________
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Signature:	____________
Score:	___/33

Math 108
Spring 2024
Dr. Lily Yen

Midterm II

Show all your work

One calculator (TI-83 or 84) is allowed for this test.

Problem 1: The height of a triangle is shrinking at a rate of 1 cm/min while the base of the triangle is increasing at a rate of 1.5 cm/min. Find the rate at which the area of the triangle changes when the base is 20 cm and the height is 9 cm.

Score: /4

Problem 2: Estimate $\sqrt{8.99}$ using linear approximation. Your steps need to include a proposed f and a corresponding anchor point a, and its linear approximation $L(x)$. Find the difference between your calculator's evaluation and your estimate.

Score: /4

Problem 3: Draw a graph that satisfies the given specifications for the domain $[-3, 3]$. The function does not have to be continuous or differentiable.

- $f(x) > 0$ and $f'(x) > 0$ for $x > 1$ and $-3 < x < 0$.
- $f'(x) = 0$ for $0 < x < 1$.
- $f''(x) > 0$ for $-3 < x < 0$.

Score: /4

/12

Problem 4: In the Salmon Creek of Ketchikan, Alaska, the number of salmon swimming upstream to spawn is approximated by

$$S(x) = -x^3 + 3x^2 + 360x + 6000, \quad 3 \le x \le 15,$$

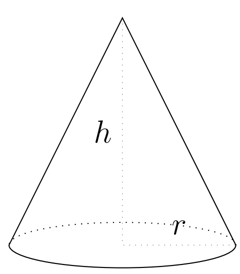
where x represents the temperature of the water in degrees Celsius.

a. Find and graph S' in the given domain.

b. Find the water temperature that produces the maximum number of salmon swimming upstream.

Score: /5

Problem 5: A sand storage tank used by BC's highway department for snow storms is leaking. As the sand leaks out, it forms a conical pile. The radius of the base of the pile increases at the rate of 1.54 cm/minute. The height of the pile is always twice the radius of the base. Find the rate at which the volume of the pile is increasing at the instant the radius of the base is 10 cm. Hint: The volume of a cone is $V = \pi r^2 h/3$.



Score: /5

/10

Problem 6: Let the derivative of f be defined by $f'(x) = (2x-3)(x+1)^2$.

a. Draw f'.

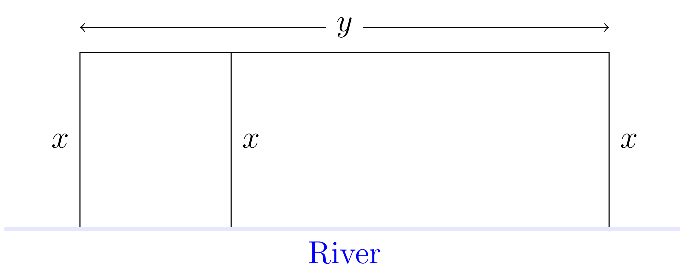
b. List all intervals where the original function f is DECREASING.

c. List all inflection points of f.

d. List all intervals where the graph of f is concave UP.

Score: /5

Problem 7: A Rocha directors have 1400 m of fencing and would like to enclose a rectangular field bordering Little Campbell River, with no fencing needed along the river. Suppose the fencing material also needs to subdivide the field into two both of which with water access, find the dimensions of the entire rectangular field that maximizes its area.



Score: /6

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