

Math 108
Spring 2024
Dr. Lily Yen

Midterm Two

Show all your work

Name: _____
Number: _____
Signature: _____
Score: ____/33

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

Problem 1: The base of a triangle is shrinking at a rate of 2 cm/min while the height of the triangle is increasing at a rate of 0.5 cm/min. Find the rate at which the area of the triangle changes when the base is 10 cm and the height is 8 cm.

Score: /4

Problem 2: Estimate $\sqrt{3.99}$ 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 error 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

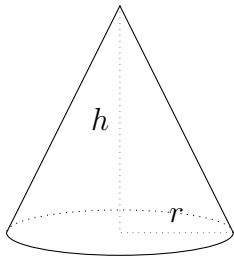
$$S(x) = -x^3 + 3x^2 + 360x + 7000, \quad 2 \leq x \leq 14,$$

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

- Find and graph S' in the given domain.
- 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 height of the pile increases at the rate of 0.735 cm/minute. The radius of the base is always twice the height of the pile. Find the rate at which the volume of the pile is increasing at the instant the height of the pile is 10 cm. Hint: The volume of a cone is $V = \pi r^2 h/3$.



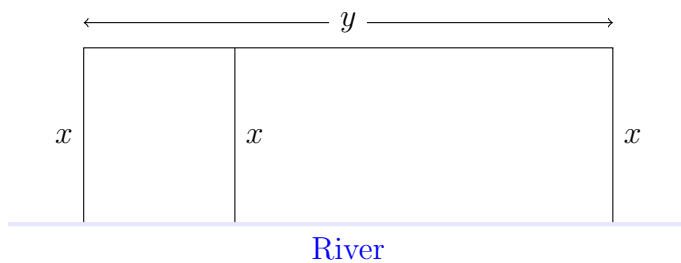
Score: /5

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

- Draw f' .
- List all intervals where the original function f is INCREASING.
- List all inflection points of f .
- List all intervals where the graph of f is concave DOWN.

Score: /5

Problem 7: A Rocha directors have 1200 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