Name: _____

4-digit code: _____

- Write your name and the last 4 digits of your SSN in the space provided above.

- The test has five (5) pages, including this one.

- You have fifty (50) minutes to complete the exam.

- Enter your answer in the box(es) provided.

- You must show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.

- Credit for each problem is given in parentheses at the right of the problem number.

- No books, notes or calculators may be used on this test.

Page	Max. points	Your points
2	30	
3	20	
4	20	
5	30	
Total	100	

Problem 1 (30 pts)**.** Sketch the graph of the function

$$f(x) = \frac{x}{x-2}$$

Make sure to indicate clearly:

- Zeros of the function.

- Domain.

- Vertical and horizontal asymptotes.

- Extreme values and inflection points.

- Intervals of increase/decrease.

- Intervals of concavity.

Problem 2 (20 pts). An oil refinery is located on the north bank of a straight river that is 6 km wide. A pipeline is to be constructed from the refinery to storage tanks located on the south bank of the river 8 km east of the refinery. The cost of laying pipe is \$1,000/km over land to a point P on the north bank, and \$3,000/km under the river to the tanks. To minimize the cost of the pipeline, where should P be located?

Hints: Use "thousands of dollars" as your monetary units for simplicity. Use the approximations $\sqrt{40} \approx 6.32$, $3\sqrt{40} \approx 18.97$ if needed.

Problem 3 (20 pts). A rectangular storage container with an open top is to have a volume of $20 \, \mathrm{m}^3$. The length of its base is twice the width. Material for the base costs \$10 per square meter. Material for the sides costs \$6 per square meter. Find the cost of materials for the cheapest such container.

Problem 4 (10 pts). Does there exist a function f such that $f(0) = -1$, $f(2) = 4$, and $f'(x) \leq 2$ for all x? Use the Mean Value Theorem to either explain the function does not exist, or to build one that satisfies those properties.

Problem 5 (20 pts). A ladder $10\,\text{ft}$ long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of $1\,\text{ft/s}$, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is 6 ft from the wall?