

**Name:** \_\_\_\_\_

**4-digit code:** \_\_\_\_\_

- Write your name and the last 4 digits of your SSN in the space provided above.
- The test has six (6) pages, including this one.
- 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.

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| Page         | Max. points | Your points |
|--------------|-------------|-------------|
| 2            | 30          |             |
| 3            | 20          |             |
| 4            | 20          |             |
| 5            | 30          |             |
| <b>Total</b> | 100         |             |

**Problem 1** (30 pts). Sketch on the next page the graph of the function  $f(x) = \frac{x}{x-2}$ .

Make sure to indicate clearly:

- Zeros of the function.
- Domain and Range
- Vertical and horizontal asymptotes.
- Extreme values and inflection points.
- Intervals of increase/decrease.
- Intervals of concavity.

Keep all the computations on this page



**Problem 2** (10 pts). Use the first or second derivative test to compute the local maxima and minima of the function  $f(x) = x^{1/5} - x^{-4/5}$

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**Problem 3** (10). Find at least one critical point of the function  $f(x) = 4x - \tan x$ . You **do not** have to indicate whether they are local maxima, local minima, or neither.



**Problem 4** (10 pts). Assume the function  $f(x)$  satisfies the conditions of the Mean Value Theorem. We know that  $f(9) = 10$  and  $4 \leq f'(x) \leq 5$  for  $9 \leq x \leq 12$ . Estimate the maximum and minimum possible values for  $f(12)$ .

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**Problem 5** (10pts). Find the global maximum and global minimum **values** of the function  $f(x) = 2x^3 - 6x^2 - 48x + 5$  on the interval  $[-3, 5]$ .

**Problem 6.** Compute the following limits:

$$(5\text{pts}) \lim_{x \rightarrow \infty} \frac{1}{5x + 7}$$

$$(5\text{pts}) \lim_{x \rightarrow \infty} \frac{1 - x - x^2}{5x^2 - 9}$$

$$(5\text{pts}) \lim_{x \rightarrow 0^+} \ln x + \frac{3}{x}$$

$$(5\text{pts}) \lim_{x \rightarrow \infty} \frac{12x^3}{5e^x}$$

$$(5\text{pts}) \lim_{x \rightarrow \pi/2^+} \frac{1 - \sin x}{\cos x}$$

$$(5\text{pts}) \lim_{x \rightarrow \infty} \left(1 - \frac{3}{x}\right)^x$$