

Suffolk County Community College  
Michael J. Grant Campus  
Department of Mathematics

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Wednesday, May 13, 2026

**MAT 141**  
**Calculus with Analytic Geometry I**  
**Final Exam**

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**Instructor:**

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*Please print the requested information in the spaces provided:*

**Student:**

Name:

Student Id:

Email:

include to receive the final grade via email ONLY if you are not getting email updates

- *Any violation of academic integrity on this exam will result in a failing grade for the whole course.*
- *Notes and books are permitted, but cannot be shared.*
- *Graphing calculators, smartwatches, computers, cell phones and any other communication-capable devices are prohibited. Their mere presence in the open — even without use — is a violation of academic integrity.*
- *You will not receive full credit if there is no work shown, even if you have the right answer. Please don't attach additional pieces of paper: if you run out of space, please ask for another blank final.*

**Problem 1.** Consider the following claim:

$$\lim_{x \rightarrow +\infty} e^{-x} = 0.$$

(1). Make a sketch of the graph of the function  $f(x) = e^{-x}$  and determine, based on that graph, if the above claim makes sense. (An intuitive conclusion without rigorous proof is sufficient for full credit.)

*Space for your solution:*

(2). Using the definition of limit, express the above claim as a precise statement of predicate logic.

*Space for your solution:*

(3). Using the rigorous and precise definition of the limit from the previous subproblem, prove or disprove the statement

$$\lim_{x \rightarrow +\infty} e^{-x} = 0.$$

*Space for your solution:*

**Problem 2.** Relying on the limit of composition theorem and the knowledge of asymptotic behavior of  $e^x$ , find

$$\lim_{x \rightarrow +\infty} \frac{e^{x^2+5}}{e^{2x^2+3} - e^{2x^2-1}}.$$

(You must show how the result follows from the things you may rely on; the answer alone is not sufficient.)

*Space for your solution:*

**Problem 3.** Consider the function with range  $\mathbb{R}$  defined as  $f(x) = \frac{1}{x}$  on the maximum set of real numbers  $x$  for which this formula makes sense.

(1). What is the domain of the function  $f$ ?

*Space for your solution:*

(2). Is the function  $f(x)$  continuous at  $x = 5$ ? Why? (Making intuitively obvious statements about certain limits without proof is acceptable.)

*Space for your solution:*

**(3).** Is the function  $f(x)$  continuous at  $x = 5$ ? Prove your answer starting from basic principles. (Making intuitively obvious statements without proof is not acceptable.)

*Space for your solution:*

**(4).** Is the function  $f(x)$  continuous at  $x = 0$ ? Why?

*Space for your solution:*

**(5).** Is the function  $f(x)$  continuous on the set of all real numbers?

*Space for your solution:*

**(6).** Is the function  $f$  continuous?

*Space for your solution:*

(7). Classify all real numbers as points continuity of  $f$ , or points of discontinuity of  $f$  (i.e. the points where the function is defined, but is not continuous), or removable singularities of  $f$ , or significant singularities of  $f$ , or none of the above.

*Space for your solution:*

(8). Suppose that  $\mathbb{R}$ , the range of the function  $f$ , is compactified with infinity:  $\overline{\mathbb{R}} = \mathbb{R} \cup \{\infty\}$ . Classify all real numbers as in the previous problem. (Strictly speaking, the function we are talking about in this sub-problem is not the  $f$ , but a new function  $\overline{f}$ , defined the same way as  $f$ , except as one having the range  $\overline{\mathbb{R}}$  instead of  $\mathbb{R}$ .)

*Space for your solution:*

**Problem 4.** Find  $\frac{d}{dx} \frac{4x-5}{x^3-1}$ .

*Space for your solution:*

**Problem 5.** Find

$$\frac{d}{dx} \arcsin \left( \frac{x}{\sqrt{x} + \ln x} \right).$$

*Space for your solution:*