*This midterm has **4 questions** on **5 pages**, for a total of 35 points.*

Duration: 50 minutes

- Read all the questions carefully before starting to work.
- Give complete arguments and explanations for all your calculations, answers without justifications will not be marked.
- Continue on the back of the previous page if you run out of space.
- Attempt to answer all questions for partial credit.
- This is a closed-book examination. **None of the following are allowed**: documents, cheat sheets or electronic devices of any kind (including calculators, cell phones, etc.)

Full Name (including all middle names): _____

Student-No: _____

Signature: _____

Question:	1	2	3	4	Total
Points:	15	6	7	7	35
Score:					

SHORT ANSWER QUESTIONS.

Please show your work and also underline your answer.
Each question is worth 3 marks, but an incorrect answer will be given at most 1 mark.
Unless otherwise stated, it is not necessary to simplify your answers.

3 marks 1. (a) Evaluate the limit $\lim_{x\to 2} \dfrac{x-2}{x^2-4}$ or determine that it does not exist.

3 marks (b) Evaluate the limit $\lim_{t\to 0} \dfrac{\sqrt{t+9}-3}{t}$ or determine that it does not exist.

3 marks (c) What value of c makes the following function continuous?

$$h(x) = \begin{cases} 3x+2 & \text{if } x < c \\ 4-x & \text{if } x \geq c \end{cases}$$

3 marks (d) Find the derivative of $f(x) = \dfrac{e^x}{x^3 + 3}$

3 marks (e) Find the *second* derivative of $f(x) = x^2 e^x$.

FULL-SOLUTION PROBLEMS

In questions 2–4, justify your answers and **show all your work.** If you need more space, use the back of the *previous* page.

6 marks

2. Let

$$f(x) = e^{\sin x} - x$$

Explain why $f(x)$ is continuous for all x. Then use the Intermediate Value Theorem to prove there is a point c in the open interval $(0, \pi)$ so that $f(c) = 0$.

7 marks

3. Find the equation of a line that is tangent to the curve $f(x) = x^2 - 2x$ and passes through the point $(2, -4)$.

7 marks 4. Let $g(t) = \dfrac{t}{2+t}$. Use the definition of the derivative to find $\frac{\mathrm{d}g}{\mathrm{d}t}$.

You must show your work.

No credit will be given on this problem for using derivative formulas.