

# TIKTOK EXAM

Spring 2022

**Final Exam**

January 23rd, 2022

## Instructions:

- Check out [#thetiktokexam](#) on TikTok for related videos.
- All answers must be written clearly.
- **Explain** your answers.
- You may use a calculator, your book, and your notes. **You may not use any other online resource, and you may not discuss the exam with anyone.**
- You must show all your work in order to receive credit.
- Be sure to erase or cross out any work that you do not want graded.

**ACADEMIC INTEGRITY:** All students shall act in accordance with the student code at the University, which states that: “Academic misconduct is dishonest or unethical academic behavior that includes, but is not limited to, misrepresenting mastery in an academic area (e.g., cheating), failing to properly credit information, research, or ideas to their rightful originators or representing such information, research, or ideas as your own (e.g., plagiarism).”

My signature below affirms that all work included in this exam is mine alone and was completed using only the approved resources. Moreover, I did not discuss the exam with anyone, or consult external resources that are not approved by my instructor.

Your Full Name:

Your Signature:

1. An aircraft is descending according to

$$P(t) = 2 \cdot e^{-t}$$

where  $t$  is in seconds and  $P(t)$  is in miles above ground.

How long will it take for the aircraft to land?

2. An aircraft is descending according to

$$P(t) = 2 \cdot e^{-t}$$

where  $t$  is in seconds and  $P(t)$  is in miles above ground.

- (a) How long will it take for the aircraft to land?
- (b) How fast is the aircraft going when it lands?

3. How many elements are there in

$$(\mathbb{Z}/13\mathbb{Z})^\times$$

4. Compute the following derivative:

$$\frac{d^3}{dx^3} \left( \frac{\lim_{h \rightarrow 0} \frac{(x+h)^3 - x^3}{h} \cdot \sum_{n=0}^{\infty} \frac{x^{n+1}}{n+1}}{\int_0^x \ln t \, dt} \right)$$

5. Compute the following derivative:

$$\frac{d^3}{dx^3} \left( \sqrt[3]{\frac{\lim_{h \rightarrow 0} \frac{(x+h)^3 - x^3}{h} \cdot \sum_{n=0}^{\infty} \frac{x^{n+1}}{n! + 1}}{\int_0^x \sin t^2 dt} \cdot \frac{\arcsin \left( \frac{\ln(\sin(x^3+1))}{\cosh(\tan(\sqrt{x}))} \right)}{\sqrt[5]{\arccos(x^7 + e^x)}}} \right)$$

6. Which of the following functions is continuous at  $x = 0$ ?

$$(a) f(x) = \begin{cases} \frac{\sin(x)}{x} & \text{if } x \neq 0, \\ 1 & \text{if } x = 0. \end{cases}$$

$$(b) f(x) = \frac{x^2 + 1}{x^2 - 1}.$$

$$(c) f(x) = \begin{cases} e^{-1/x} & \text{if } x > 0, \\ x^2 & \text{if } x \leq 0. \end{cases}$$

$$(d) f(x) = |x|.$$

$$(e) f(x) = \int_0^x \sin(t^2) dt.$$

$$(f) f(x) = \begin{cases} x \cdot \sin\left(\frac{1}{x}\right) & \text{if } x \neq 0, \\ 0 & \text{if } x = 0. \end{cases}$$

7. Plot the following sequence in the real line:

$$a_n = (-1)^n$$



8. Decide whether the following limit is 0, 1, or  $\infty$ :

$$\lim_{x \rightarrow 0^+} \frac{x^k}{\sin(x)}$$

where  $k$  is a fixed constant.

9. Is there a solution for the following system of equations?

$$\begin{aligned}3x + 5y - 37z + \pi u - \sqrt{2}v + 34568w &= 0 \\ \sqrt{3}x - 47y - 3213z + e^7u - v + 897612345w &= 0 \\ 7x + 50y - \sqrt{37}z + \pi^3u - \sqrt{3}v - w &= 0 \\ 34x + 54y - \sqrt[3]{37}z + (\ln 2)u - \sqrt{5}v + 68w &= 0 \\ -97x - 43y - \sqrt[4]{37}z + \sin(3)u - \sqrt{7}v + 568w &= 0 \\ 12780x + 78910y - 37^7z + \tan(2)u - \sqrt{11}v - 568\pi w &= 0\end{aligned}$$

10. Find a function  $f: \mathbb{R} \rightarrow \mathbb{R}$  such that:

1.  $f$  is continuous on  $[0, \pi]$ ,

2.  $f$  is differentiable on  $(0, \pi)$ ,

3.  $f'(1) = f''(2)$ ,

4.  $\lim_{x \rightarrow 0} \frac{f(x)}{\sin(x)} = 0$ ,

5.  $\int_0^\pi f(x) \sin(x) dx = 0$ , and

6.  $\int_0^1 e^{f(x)} dx = 1$ .

11. Find the length of the hypotenuse for a right triangle with sides  $x = 8$  and  $y = 15$ .

12. Find the value of the following expression:

$$2 + \frac{1}{1 + \frac{1}{2 + \frac{1}{3 + \frac{1}{4 + \frac{1}{5 + \frac{1}{6 + \frac{1}{7 + \frac{1}{\ddots}}}}}}}}}$$

13. Find the value of the integral:

$$\int_0^9 6x^5 - 4x^3 + 80 \, dx$$

14. Find the following derivatives of

$$f(x) = 5e^x - 2 \sin x - \frac{5}{2}x^2 - 3x + 1$$

(a)  $f'(0)$

(b)  $f''(0)$

(c)  $f'''(0)$

15. Simplify the expression:

$$e^{e^{e^{e^{\ln(\ln(\ln(\ln(7))))}}}}$$



16. Find  $\frac{d^2}{dx^2}(f(x))$  where

$$f(x) = \frac{\sin^2(x) + \cos^2(x)}{1 + x^2} - \frac{1}{1 + x^2}$$

17. Suppose you have  $B$  grocery bags and each bag contains  $M$  different items. In how many ways can you pick an item from each bag?

18. What number is larger?

$$5^3 \quad \text{or} \quad 5^7$$