MATH 1007 Elementary Calculus I

Study Session Questions

December 28, 2025

Section 1: Precalculus

- Inequalities
- Radicals
- Trigonometric properties
- Transformations
- Domain/Range
- Composition

1. Find the product $(4\sqrt{a} - 5\sqrt{b})(4\sqrt{a} + 5\sqrt{b})$ and express in simplest form.
   A. $16a - 25b$
   B. $16a + 25b$
   C. $16ab - 25ab$
   D. $16a - 10\sqrt{ab} - 25b$

2. For $f(x) = 2e^x$ and $g(x) = x^2$, find the following:

1. $(f \circ g)(x)$	**A.** $2e^{(x^2)}$
2. $(g \circ f)(x)$	**B.** $4e^{2x}$
3. $(f \cdot g)(x)$	**C.** $2x^2e^x$
4. $(f + g)(x)$	**D.** $2e^x + x^2$

3. If $\tan(\theta) = \dfrac{12}{5}$, and $0 \leq \theta \leq \dfrac{\pi}{2}$, which of the following are true? Select all that apply.
   ◯ $\sin(\theta) = \dfrac{13}{12}$
   ◯ $\sin(\theta) = \dfrac{12}{13}$
   ◯ $\cos(\theta) = \dfrac{12}{5}$
   ◯ $\cos(\theta) = \dfrac{5}{13}$

◯ $\sec(\theta) = \dfrac{13}{12}$

◯ $\sec(\theta) = \dfrac{13}{5}$

4. Decompose $f(x) = \ln(2x^2 + 3)$ into $f(x) = p(g(x))$.

A. $p(x) = \ln x,\ g(x) = 2x^2 + 3$

B. $p(x) = \ln x,\ g(x) = 2x^2 + 3$

C. $p(x) = x^2 + 3,\ g(x) = \ln(2x^2)$

D. $p(x) = x,\ g(x) = \ln(2x^2 + 3)$

E. $p(x) = 2x^2 + 3,\ g(x) = \ln x$

F. none of these are true

5. Match each inequality to its solution in interval notation.

1. $x(x+4)(x-6) \leq 0$ **A.** $(-\infty, -4] \cup [0, 6]$

2. $x(x-4)(x+6) \geq 0$ **B.** $[-6, 0] \cup [4, \infty)$

3. $x(x+6)(x-4) < 0$ **C.** $(-\infty, -6) \cup (0, 4)$

4. $x(x-6)(x+4) > 0$ **D.** $(-4, 0) \cup (6, \infty)$

6. Given $\dfrac{x^2 - 4}{x - 2}$, determine the domain and range.

◯ $D : (-\infty, -2] \cup (2, \infty)$

◯ $R : (0, \infty)$

◯ $D : (-2, 2) \cup (2, \infty)$

◯ $R : (-\infty, 0) \cup (0, \infty)$

◯ $D : (-\infty, 2) \cup [2, \infty)$

◯ $R : (-1, 0] \cup (1, \infty)$

7. Solve $\dfrac{3\cos^2 x - (7\cos x)}{2(\cos x)(2 - \cos x)} = 0$ over the interval $[0, 2\pi)$.

A. $x = 0$

B. $x = \dfrac{\pi}{2}$

C. $x = \dfrac{2\pi}{3}$

D. $x = \pi$

E. $x = \dfrac{4\pi}{3}$

F. $x = \dfrac{3\pi}{2}$

8. Match each function with one of the graphs below.

◯ $f(x) = (x-2)^2 - 1$

◯ $f(x) = -\big((x+1)^2 + 2\big)$

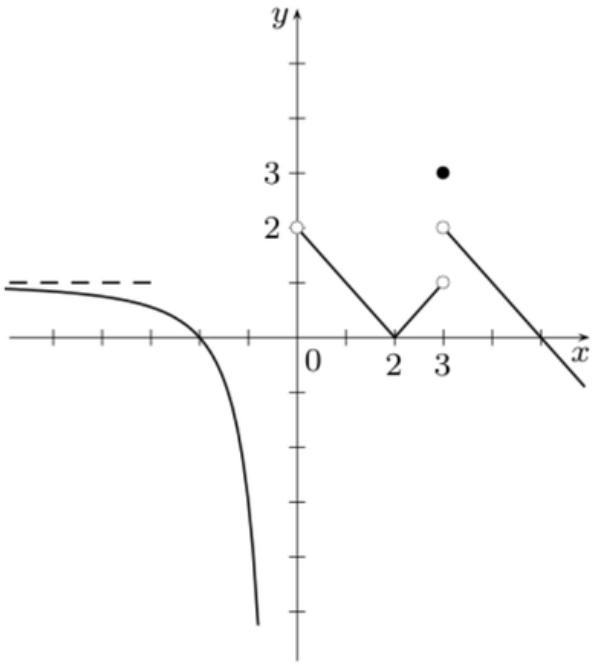
◯ $f(x) = (x-1)^2 + 2$

◯ $f(x) = (x-1)^2 - 2$

Section 2: Limits

- Limits of common functions
- Limit rules
- L'Hôpital's rule
- Squeeze Theorem

9. Which of the following statements are true? Select all that apply.



- ◯ $\lim_{x\to-\infty} f(x) = 1$
- ◯ $\lim_{x\to 0} f(x) = 1$
- ◯ $\lim_{x\to 0^-} f(x) = 2$
- ◯ $\lim_{x\to 3^+} f(x) = 3$
- ◯ $f(3) = 3$
- ◯ $f(0) = 2$

10. Sort the values of the following limits from greatest to least.

(a) $\lim_{x\to 0} \dfrac{2^x + \sin(x)}{x^4}$

(b) $\lim_{x\to 5} \dfrac{x^2 - 25}{x^2 - 4x - 5}$

(c) $\lim_{x\to-\infty} 3\left(\dfrac{x-3}{5-x}\right)$

(d) $\lim_{x\to 0} \left(24\ln(x)\right)$

11. Find the value of k such that $\lim_{x\to 5} \dfrac{x^2+kx-20}{x-5}$ exists and is finite.

12. Which of the following are true for the piecewise function $f(t)$ described below? Select all that apply.

$$f(t) = \begin{cases} t^2 & \text{for } t < -2 \\ \dfrac{t+6}{t^2-t} & \text{for } -1 < t < 2 \\ 3t-2 & \text{for } t \geq 2 \end{cases}$$

- ◯ $\lim_{t\to 2} f(t) = 4$
- ◯ $f\left(-\frac{3}{2}\right)$ DNE
- ◯ $f(2) = 4$
- ◯ $\lim_{t\to -1^+} f(t) = \frac{5}{2}$
- ◯ $\lim_{t\to 0} f(t) = \infty$
- ◯ none of these

13. Sort the values of the following limits from greatest to least.

(a) $\lim_{x\to \frac{\pi}{4}} \dfrac{\ln(\tan x)}{\sin x - \cos x}$

(b) $\lim_{x\to 0} x \sin\left(\dfrac{1}{x}\right)$

(c) $\lim_{x\to 0} \dfrac{e^x - x - 1}{\cos x - 1}$

14. Which of the following are true? Use l'Hôpital's rule or Squeeze Theorem where needed.

- ◯ $\lim_{x\to\infty}\left(\dfrac{e^{-x}}{\sin(x)+2}\right)$ DNE
- ◯ $\lim_{x\to\infty}\left(x^{\frac{1}{\ln x}}\right) = e$
- ◯ $\lim_{x\to 0}\dfrac{e^{-x}}{\sin x}$ DNE
- ◯ $\lim_{x\to\infty}\dfrac{e^{x}}{x} =$ DNE

Section 3: Derivatives

- Chain Rule
- Product/Quotient Rules
- Trigonometric functions
- Second derivatives
- Curve Sketching

15. Which of the following functions are NOT differentiable for at least one real value of x?
    A. $f(x) = x^2 + 1$
    B. $f(x) = |x|$
    C. $f(x) = \dfrac{1}{x^2 + 1}$
    D. $f(x) = x^3 - 3x$

16. Determine $\dfrac{dy}{dx}$ for $\dfrac{x^2 - 4}{x^2 + 4}$ when $x = 1$.
    A. $-\dfrac{16}{25}$
    B. $\dfrac{16}{25}$
    C. $\dfrac{4}{25}$
    D. 1

17. Determine $\dfrac{dy}{dx}$ for $\ln(5x^2 + 9)$ when $x = 1$.
    A. 1
    B. $\dfrac{5}{7}$
    C. $\dfrac{25}{9}$
    D. 0

18. Determine $\dfrac{dy}{dx}$ for $\dfrac{x}{1 - (\ln x)^2}$ when $x = 1$.
    A. 0
    B. 1
    C. e
    D. undefined

19. Determine $\dfrac{dy}{dx}$ for $\cos(\tan x)$ when $x = \pi$.
    A. 0
    B. 1
    C. $\dfrac{1}{2}$
    D. undefined

20. Find an equation of the tangent line to $x^4 + y^2 = 3$ at $(1, -2)$.

A. $y = x + 2$

B. $y = \frac{1}{2}x - 2$

C. $y = 2(x - 2)$

D. $y = \frac{1}{2}(x + 2)$

Section 4: Integrals

- uh oh

21. Let $F(x) = \int_1^x t^2 + 3\, dt$. Which of the following are true?

◯ $F(1) = 0$
◯ $F(1) = 1$
◯ $F'(1) = \frac{1}{2}$
◯ $F'(1) = 2$
◯ $F''(1) = 2$
◯ $F''(1) = \frac{1}{2}$

22. Find the exact area of the region that lies beneath the curve $y = 6^4 x$ from $1 \leq x \leq 16$.

23. Determine $f(x)$ given that $f'(x) = 12x^2 - 4x$ and $f(-3) = 17$.

A. $f(x) = 6x^3 - 4x^2 + 143$
B. $f(x) = 4x^3 - 2x^2 + 143$
C. $f(x) = 4x^3 - 2x^2 + 140$
D. $f(x) = 3x^3 - 2x^2 + 150$

24. Evaluate the definite integral $\int_1^9 \frac{6x^2 + 23}{x}\, dx$.

25. Find the area of the region enclosed by the curves $y = 5x,\ y = 6x^2$.

26. Evaluate the integral $\int_0^5 \frac{5}{9+x^2}\,dx$. Answer to 3 decimal places.