Form A

Instructions:

- Fill in A, B or C in the Test Version section.
- Enter your NAME, ID Number, CRN (under Class ID) and write A, B, or C (under Test ID) on the op-scan sheet.
- Darken the appropriate circles below your ID number and Class ID (CRN).
Use a number 2 pencil. Machine grading may ignore faintly marked circles.
- Mark your answers to the test questions in rows 1–14 of the op-scan sheet. Your score on this test will be the number of correct answers.
- You have **one hour** to complete this portion of the exam. Turn in the op-scan sheet with your answers, this exam and all scrap paper at the end of this part of the final exam.

Exam Policies: You may not use a book, notes, formula sheet, or a calculator or computer.

Name (printed): ______________________________

Student ID #: ______________________________

Honor Pledge: I have neither given nor received unauthorized assistance on this exam.

Signature: ______________________________

1. Consider the vertical and horizontal asymptotes of the following function:

$$f(x) = \begin{cases} \dfrac{x^2-25}{x^2-2x-15} & , \quad x < 5, \quad x \neq -3 \\[2ex] \dfrac{2e^x}{7+e^x} & , \quad x > 5. \end{cases}$$

Which one of the following statements is TRUE?

(A) $f(x)$ has exactly one vertical asymptote and one horizontal asymptote.
(B) $f(x)$ has exactly one vertical asymptote and two horizontal asymptotes.
(C) $f(x)$ has exactly two vertical asymptotes and one horizontal asymptote.
(D) $f(x)$ has exactly two vertical asymptotes and two horizontal asymptotes.

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2. Let $f(x) = \cos x$. Find $f^{(8)}(x) - f^{(5)}(x)$.

(A) $2\sin x$
(B) $\cos x + \sin x$
(C) $\sin x - \cos x$
(D) 0

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3. Find the linearization $L(x)$ centered at $x = e$ for $f(x) = \ln \sqrt{x}$.

(A) $L(x) = 1 + \dfrac{x}{2e}$
(B) $L(x) = \dfrac{x}{2e} - \dfrac{1}{4}$
(C) $L(x) = \dfrac{x}{\sqrt{e}} - 1$
(D) $L(x) = \dfrac{x}{2e}$

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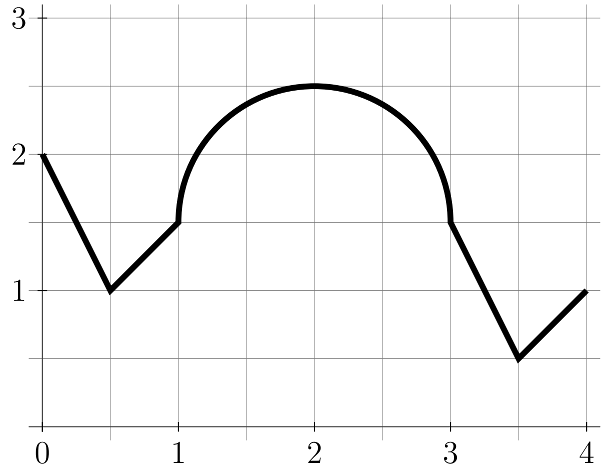
4. Which of the following functions

$$f(x) = x^{2/3} \text{ on } [-1, 8], \qquad g(x) = x^{4/5} \text{ on } [0, 1]$$

satisfy the **hypotheses** of the Mean Value Theorem on their respective intervals?

(A) Only $f(x)$.
(B) Only $g(x)$.
(C) Both $f(x)$ and $g(x)$.
(D) Neither $f(x)$ nor $g(x)$.

5. The graph of a function $f(x)$ on $[0, 4]$ is given below. Find the **largest value** of $\delta > 0$ such that for all x with $0 < |x - 3| < \delta$ implies $|f(x) - 1.5| < 1$



(A) $\delta = 0.5$ (B) $\delta = 1$ (C) $\delta = 1.5$ (D) $\delta = 3$

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6. Evaluate the indefinite integral: $\displaystyle\int \frac{3x^5 - 2x^7}{x^6}\, dx$

(A) $\dfrac{\frac{1}{2}x^6 - \frac{1}{4}x^8}{\frac{1}{7}x^7} + C$

(B) $\left(\dfrac{1}{2}x^6 - \dfrac{1}{4}x^8\right) \ln(x^6) + C$

(C) $\dfrac{1}{5}x^{-5} \left(\dfrac{1}{2}x^6 - \dfrac{1}{4}x^8\right) + C$

(D) $3\ln(x) - x^2 + C$

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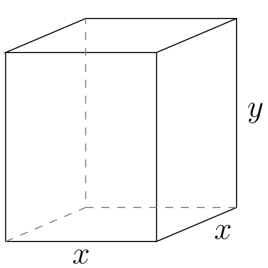
7. You want to minimize the cost of building a rectangular box with capacity of 100 cubic meters. The box must have a square top and bottom, with edge length x, as in the picture below. The material for the sides costs \$2 per square meter, and for the top and bottom costs \$3 per square meter. Which function should be minimized?



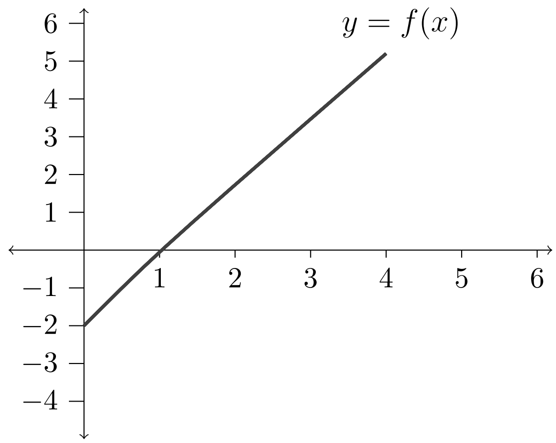
(A) $f(x) = x(200 - 6x^2)$

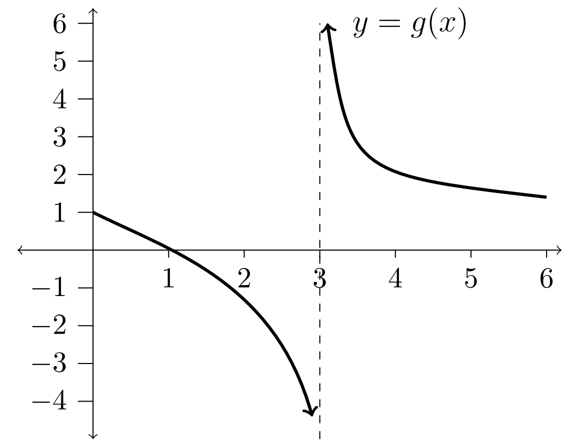
(B) $f(x) = x(200 - 6x^2) - 100$

(C) $f(x) = 6x^2 + \dfrac{800}{x}$

(D) $f(x) = x(100 - 6x^2) - 200$

8. The graphs of f and g are given below. Determine which limit **does NOT** exist.





(A) $\lim_{x\to 1} f(x)g(x)$

(B) $\lim_{x\to 2} \dfrac{g(x)}{f(x)}$

(C) $\lim_{x\to 3} \dfrac{f(x)}{g(x)}$

(D) All these limits exist

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9. The tangent line to the ellipse $5x^2 - 4xy + 5y^2 = 1$ at the point $\left(0, \frac{1}{\sqrt{5}}\right)$ has slope:

(A) $\dfrac{4\sqrt{5}}{5\sqrt{5}+2}$

(B) $\dfrac{2}{5}$

(C) 1

(D) The tangent line is vertical

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10. Let f and g be continuous functions, and suppose that $\int_0^2 f(x)\,dx = 5$ and $\int_0^2 g(x)\,dx = 7$.

Find $\int_0^2 2f(x) - 3g(x) + 10\,dx$.

(A) 9

(B) 51

(C) 8

(D) -1

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11. What is TRUE about the function $F(x) = \int_5^{\sin(x)} e^{t^2}\,dt$?

(A) $F(x)$ is an increasing function for all x values.

(B) $F'(x) = e^{\sin^2(x)} - 5$.

(C) $F(x)$ is decreasing on the interval $(\pi/2, \pi)$.

(D) $F(x)$ is a decreasing function for all x values.

12. Consider the following function

$$f(x) = \begin{cases} \dfrac{1}{x} & 0 < x < 1 \\ \ln(x) & x \geq 1. \end{cases}$$

Which one of the following statements is TRUE?

(A) f has a critical number at $x = 1$.

(B) The absolute maximum occurs at $x = 1$.

(C) f has a local maximum at $x = 1$.

(D) f is continuous at $x = 1$.

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13. Use Newton's method with initial approximation $x_1 = 2$ to find x_2, the second approximation to a root of $f(x) = x^2 - 3$.

(A) $\frac{3}{2}$ (B) $\frac{9}{4}$ (C) $\frac{3}{4}$ (D) $\frac{7}{4}$

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14. When you use the upper Riemann sum with $n = 4$ sub-intervals to estimate $\int_{-4}^{4} |x|\, dx$, you get:

(A) 0 (B) 16 (C) 24 (D) 48