Form A

Instructions: Fill in A, B or C in the Test Version section. Then 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. Giving or receiving unauthorized aid is an Honor Code Violation.

Signature: ______________________________

Name (printed): ______________________________

Student ID #: ______________________________

1. The expression $\dfrac{1}{50}\left(\sqrt{\dfrac{1}{50}}+\sqrt{\dfrac{2}{50}}+\sqrt{\dfrac{3}{50}}+\cdots+\sqrt{\dfrac{50}{50}}\right)$ is a Riemann sum approximation for

   (A) $\displaystyle\int_0^1 \sqrt{\frac{x}{50}}\,dx$

   (B) $\displaystyle\frac{1}{50}\int_0^1 \sqrt{\frac{x}{50}}\,dx$

   (C) $\displaystyle\int_0^1 \sqrt{x}\,dx$

   (D) $\displaystyle\frac{1}{50}\int_0^1 \sqrt{x}\,dx$

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2. Let $f(x) = 1 + \dfrac{\ln(x)}{x}$ for $x > 0$. Which of the following is true about f:

   (A) It has a local maximum at $x = 1$.

   (B) It has a local maximum at $x = e$.

   (C) It has a local minimum at $x = e$.

   (D) None of the above are true.

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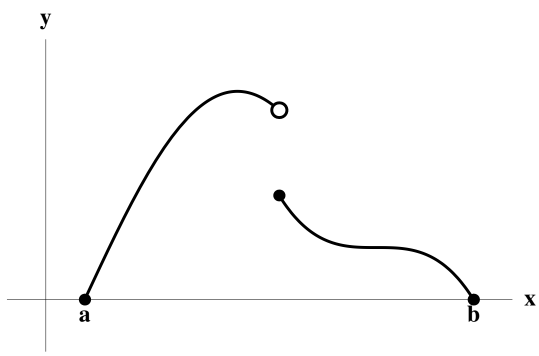
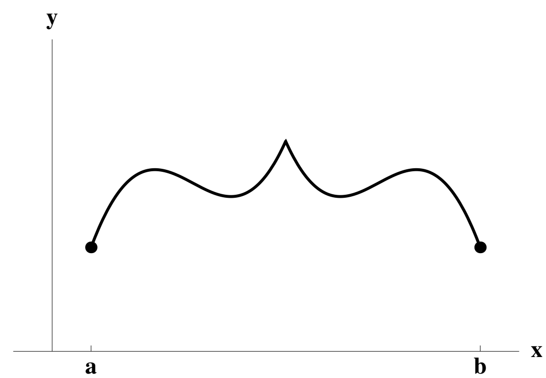
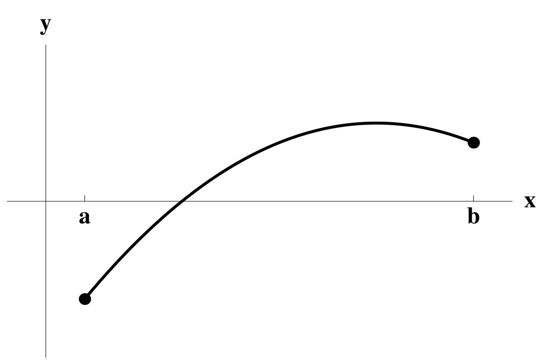
3. Which of the following graphs shows a function that satisfies the hypotheses of Rolle's Theorem on the interval $[a, b]$?



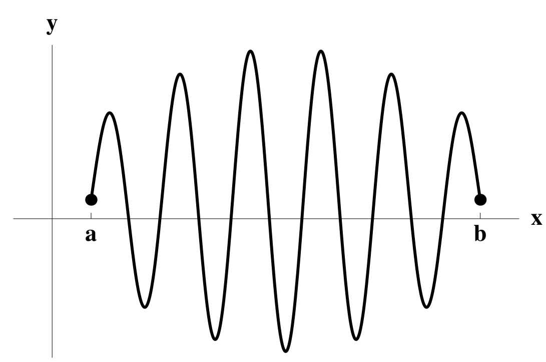
(A)



(C)



(B)



(D)

4. Find the derivative of $f(x) = \sqrt{\sin(x^2) + \cos^2(x)}$:

(A) $f'(x) = \dfrac{1}{2\sqrt{\sin(x^2) + \cos^2(x)}} \left(\cos(x^2) + 2\cos(x)\right)(2x - \sin(x))$

(B) $f'(x) = \dfrac{\cos(x^2) \cdot 2x}{2\sqrt{\sin^2(x)}} - \sin(x)$.

(C) $f'(x) = \dfrac{2x\cos(x^2) - 2\sin(x)\cos(x)}{2\sqrt{\sin(x^2) + \cos^2(x)}}$

(D) $f'(x) = 0$

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5. "A five-gallon tank full of water starts draining at $t = 0$ at a rate of $\dfrac{1}{1+t}$ gallons per hour. How long until the tank is empty?"

A correct setup of the problem above in terms of functions is:

(A) $f'(t) = \ln(1+t) + C$, $f'(0) = 5$, find t so that $f'(t) = 0$.

(B) $f'(t) = -\dfrac{1}{1+t}$, $f(0) = 0$, find t so that $f(t) = 5$.

(C) $f(t) = -\dfrac{1}{1+t} + C$, $f(5) = 0$, find t so that $f(t) = 0$.

(D) None of these will give the correct solution.

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6. Which of the following is TRUE?

(A) $\lim\limits_{x\to 0} \left(x^2 \sin \dfrac{1}{x}\right) = \left(\lim\limits_{x\to 0} x^2\right)\left(\lim\limits_{x\to 0} \sin \dfrac{1}{x}\right)$

(B) $\lim\limits_{x\to 0} \dfrac{x}{x^2 + x} = \dfrac{\lim\limits_{x\to 0} x}{\lim\limits_{x\to 0} x^2 + x}$

(C) $\lim\limits_{x\to 0} \sin(e^x) = \sin\left(\lim\limits_{x\to 0} e^x\right)$.

(D) $\lim\limits_{x\to\infty} \left(\sqrt{x} - x\right) = \left(\lim\limits_{x\to\infty} \sqrt{x}\right) - \left(\lim\limits_{x\to\infty} x\right)$

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7. The edge of a cube is measured to be 20 inches. If the measurement is to be correct to within 1/10 inch, use differentials to find the error in the volume of the cube.

(A) $\pm\dfrac{1}{1000}\,\text{in}^3$ (B) $\pm\dfrac{3}{100}\,\text{in}^3$ (C) $\pm 120\,\text{in}^3$ (D) $\pm 240\,\text{in}^3$

8. The derivative $\frac{d}{dx}\left(\int_{2x}^{-1} \sin(t^2)dt\right)$ is:

(A) $-2x\cos(x^2) + C$

(B) $2\cos(1) + 2\cos(4x^2) + C$

(C) $\sin(x^2) - \sin(1)$

(D) $-2\sin(4x^2)$

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9. The curve given by the equation $(y-x)^2 = 1 + yx$ defines y as an implicit function of x. What is the slope of the tangent line to the curve at the point $(1, 3)$?

(A) $-\frac{1}{4}$ (B) $\frac{2}{3}$ (C) $\frac{7}{4}$ (D) $\frac{7}{3}$

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10. The limit $\lim_{h\to 0} \frac{1-(h+1)}{h(h+1)}$ is equal to which of the following?

(A) $f'(h)$ if $f(x) = \frac{1}{x+1}$

(B) $f'(0)$ if $f(x) = x + 1$

(C) $f'(0)$ if $f(x) = \frac{1}{x+1}$

(D) $f(0)$ if $f(x) = \frac{1}{x+1}$

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11. Using the method of u−substitution, the definite integral $\int_0^1 \frac{y^2+4y-4}{\sqrt{y^3+6y^2-12y+9}}\,dy$ is equivalent to which of the following integrals?

(A) $\int_0^1 \frac{1}{\sqrt{u}}\,du$

(B) $\int_9^4 \frac{3}{\sqrt{u}}\,du$

(C) $-\int_4^9 \frac{1}{3\sqrt{u}}\,du$

(D) $\int_4^9 \frac{1}{3\sqrt{u}}\,du$

12. If $\int_a^b f(x)dx = a + 2b$, then the evaluation of $\int_a^b (3f(x) + 5)\, dx$ is:

(A) $11b - 2a$ (B) $3a + 6b + 5$ (C) $3a - 6b$ (D) $3(a+2b)(b-a)+5$

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13. A 15-meter ladder leans on a wall forming a right triangle. The bottom of the ladder is being pushed towards the wall at a speed of $\frac{1}{4}$m/s. At what rate is the **area** of the triangle changing when the bottom of the ladder is 12 meters away from the wall? (The top of the ladder moves up at the speed of $\frac{1}{3}$m/s at that point.)

(A) $-\frac{1}{24}\text{m}^2/\text{s}$ (B) $\frac{7}{8}\text{m}^2/\text{s}$ (C) $\frac{7}{6}\text{m}^2/\text{s}$ (D) $2\text{m}^2/\text{s}$

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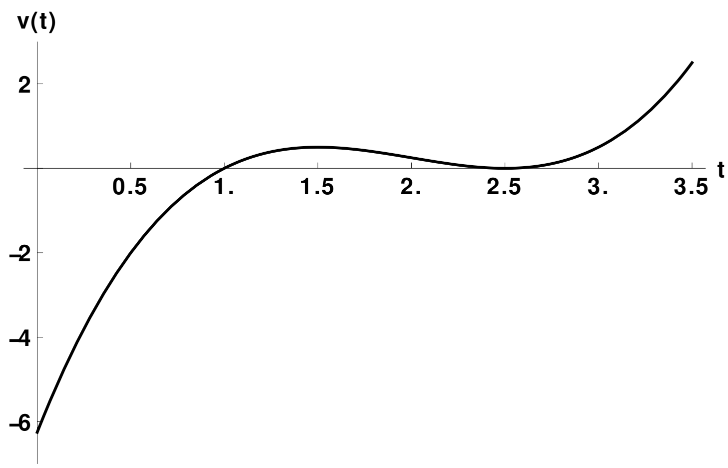
14. Let $s(t)$ be the position function of an object. If the **velocity function** for the object is pictured below, then the total distance traveled over the time interval $[0, 3]$ is given by:



(A) $|s(1.5) - s(0)| + |s(2.5) - s(1.5)| + |s(3) - s(2.5)|$

(B) $|s(1) - s(0)| + |s(3) - s(1)|$

(C) $|s(3) - s(0)|$

(D) $|s(1.5) - s(0)| + |s(3) - s(1.5)|$