MA 22300 **EXAM 2** **Form A**

INSTRUCTIONS

1. You must use a #2 pencil on the scantron answer sheet.
2. Fill in your name, your four digit section number, and your student identification number. Make sure to blacken in the appropriate spaces. If you do not know your section number, ask your instructor. (Leave the test/quiz number blank.) Sign your name.
3. There are 15 questions. Blacken in your choice of the correct answer in the spaces provided on the scantron answer sheet. **Only the scantron answer sheet will be graded. When you have completed the exam, turn in the scantron answer sheet only. You may take the exam booklet with you.**
4. **The exam is self-explanatory. Do not ask your instructor any questions about the exam problems.**
5. **Only one-line calculators (any brand) are allowed. Cell phones and PDA's may not be used as a calculator and must be put away during the exam. NO BOOKS OR PAPERS ARE ALLOWED. Use the back of the test pages for scrap paper.**

Volume & Surface Area

Right Circular Cylinder
$V = \pi r^2 h$
$SA = \begin{cases} 2\pi r^2 + 2\pi rh \\ \pi r^2 + 2\pi rh \end{cases}$

Sphere
$V = \frac{4}{3}\pi r^3$
$SA = 4\pi r^2$

Right Circular Cone
$V = \frac{1}{3}\pi r^2 h$
$SA = \pi r\sqrt{r^2 + h^2} + \pi r^2$

1. Find the equation of the line that is tangent to the graph of the given function at the point $(c, f(c))$ for the specified value of $x = c$.

$$f(x) = x^3 - 3x^2 - 5x + 4\sqrt{x}; \qquad x = 4$$

A. $y = 20x - 84$

B. $y = 18x + 74$

C. $y = 20x - 80$

D. $y = 20x - 76$

E. $y = 18x + 70$

2. Given $s(t) = \dfrac{2t+1}{3t^2+4t+1}$, find the derivative, $s'(t)$, and simplify.

A. $s'(t) = \dfrac{2(3t^2+3t+1)}{(3t^2+4t+1)^2}$

B. $s'(t) = \dfrac{-2(3t^2+3t+1)}{(3t^2+4t+1)^2}$

C. $s'(t) = \dfrac{2(9t^2+11t+1)}{(3t^2+4t+1)^2}$

D. $s'(t) = \dfrac{2}{6t+4}$

E. $s'(t) = \dfrac{-2(3t^2+3t+1)}{(3t^2+4t+1)}$

3. Find $\dfrac{dy}{dx}$ by differentiating implicitly, if x and y satisfy:

$9x^2 + 4y^2 = 36$.

A. $\dfrac{-9x}{4y}$

B. $\dfrac{-9}{4}x$

C. $\dfrac{-9x}{8y}$

D. $\dfrac{-9x}{2y}$

E. $\dfrac{18-9x}{4y}$

4. When is $g(x) = 5x^7 - 28x^5$ increasing?

   A. When $x < -2$ and $0 < x < 2$

   B. When $-2 < x < 0$ and $x > 2$

   C. When $-2 < x < 0$ and $0 < x < 2$

   D. When $x < -2$ and $x > 2$

   E. When $x < 0$ and $x > 0$

5. An object moves up and down such that its position from a horizontal line is given by the function $s(t) = t^3 - t^2 + t - 1$. Find its velocity when the acceleration is 1 m/s^2.

   A. $v = -2$ m/s

   B. $v = -\frac{5}{8}$ m/s

   C. $v = \frac{3}{4}$ m/s

   D. $v = \frac{5}{4}$ m/s

   E. $v = 2$ m/s

6. At a certain factory, $q(t) = t^2 + 10t$ units are produced during the first t hours of a production run, and the total cost of manufacturing q units is $C(q) = 0.1q^2 + q + 400$ dollars. Find the rate (in dollars per hour) at which the manufacturing cost is changing with respect to time 1 hour after the production commences.

   A. 3.75

   B. 14.4

   C. 38.4

   D. 0.27

   E. 20

7. An average worker arriving to work at a factory at 8:00 AM is expected to have assembled $P(t) = 20t^{\frac{1}{2}} + 15t$ units t hours later. Which of the following expressions should be used to estimate, using approximation by increments, the number of units to be assembled between 10:00 and 10:15 AM?

   A. $\left(20\sqrt{2} + 30\right)\left(\frac{1}{4}\right)$

   B. $\left(\frac{10}{\sqrt{2}} + 15\right)\left(\frac{1}{4}\right)$

   C. $\left(10\sqrt{2} + 15\right)\left(\frac{1}{4}\right)$

   D. $\left(20\sqrt{2.25} + 33.75\right) - \left(20\sqrt{2} + 30\right)$

   E. $\left(\frac{10}{\sqrt{2.25}} + 15\right) - \left(\frac{10}{\sqrt{2}} + 15\right)$

8. A bowling ball is launched off the top of a 300 foot tall building. The height of the bowling ball above the ground t seconds after being launched is $s(t) = -16t^2+20t+300$ feet above the ground. What is the velocity of the ball as it hits the ground?

   A. -140 ft/s

   B. -120 ft/s

   C. -100 ft/s

   D. -80 ft/s

   E. -60 ft/s

9. At a certain factory, the number of chairs produced, Q, is related to the number of skilled carpenter hours x and unskilled labor hours y by the equation $Q = 5x^3 + 2x^2y^2 + (1+y)^4$. If the current number of skilled hours available is $x = 10$ and the current number of unskilled hours is $y = 25$, use calculus to estimate the change in unskilled labor hours y that should be made to offset a decrease of 0.4 hours in skilled labor so that the number of chairs being produced will be maintained at the current level.

   A. 0.639 hr

   B. 0.256 hr

   C. 0.132 hr

   D. 0.330 hr

   E. 3.872 hr

10. An automobile dealership pays $C(x) = 10\left(\frac{1}{x} + \frac{3x}{x+3}\right)$ thousand dollars to order and have x hundred automobiles delivered. Assuming at least one automobile is ordered and delivered, find the minimum cost for having cars ordered and delivered, rounded to the nearest dollar.

A. \$28,979

B. \$19,333

C. \$29,478

D. \$11,378

E. \$16,667

11. Find $f''(1)$ if $f(x) = 4\sqrt{x} + \frac{(x^3 - 2)}{x}$.

A. -3

B. 5

C. -6

D. -1

E. -7

12. At which of the following x values does $f(x) = x\sqrt{2-x^2}$ have a horizontal tangent?

    A. -2

    B. -1

    C. 0

    D. $\frac{1}{2}(3+\sqrt{17})$

    E. $\sqrt{2}$

13. A 13-ft ladder, whose base is sitting on level ground, is leaning at an angle against a vertical wall when its base starts to slide away from the vertical wall. When the base of the ladder is 5 ft away from the bottom of the vertical wall, the base is moving at a rate of 5 ft/sec. At what rate is the vertical distance from the top of the ladder to the ground changing when the base of the ladder is 5 ft away from the bottom of the vertical wall?

    A. -12 ft/sec

    B. 12 ft/sec

    C. -5 ft/sec

    D. $-\frac{25}{12}$ ft/sec

    E. $\frac{25}{12}$ ft/sec

14. If $f'(x) = \dfrac{3x^2 - 4x - 7}{(2+2x)^2}$ and $f(x)$ has the same domain as $f(x)$, describe the critical points of f.

    A. f has no critical points

    B. f has one critical point, a relative maximum

    C. f has one critical point, a relative minimum

    D. f has one critical point, which is neither a relative maximum nor a relative minimum

    E. f has two critical points, one relative minimum and one relative maximum

15. Given $y = \dfrac{2(1-x^2)}{\sqrt{1-3x^2}}$. Find $\dfrac{dy}{dx}$.

    A. $\dfrac{2x(9x^2-5)}{(1-3x^2)^{\frac{3}{2}}}$

    B. $\dfrac{2x(3x^2+1)}{(1-3x^2)^{\frac{3}{2}}}$

    C. $\dfrac{2x(9x^2-5)}{(1-3x^2)^{\frac{1}{2}}}$

    D. $\dfrac{2x(3x^2+1)}{(1-3x^2)^2}$

    E. $\dfrac{3x(x^2-3)}{1-3x^2}$