1. Find an equation for the tangent line at $x = 1$ for $f(x) = \dfrac{3x+1}{2x^2-1}$.

   A. $y = -5x - 1$

   B. $y = -5x + 9$

   C. $y = -13x + 17$

   D. $y = -13x + 9$

   E. $y = -7x + 11$

2. If $f(x) = \dfrac{1}{\sqrt[3]{x}}$, find $f'(x)$.

   A. $f'(x) = \dfrac{1}{3\sqrt[3]{x}}$

   B. $f'(x) = -\dfrac{\sqrt[3]{x}}{3}$

   C. $f'(x) = -\dfrac{1}{3\sqrt[4]{x^3}}$

   D. $f'(x) = -\dfrac{x\sqrt[3]{x}}{3}$

   E. $f'(x) = -\dfrac{1}{3x\sqrt[3]{x}}$

3. Use increments to estimate how much the function

$$f(x) = 7x^2 - 5x + 2$$

   will change as the variable x increases from 3 to 3.4.

   A. 14.8

   B. 15.92

   C. 37

   D. 42.6

   E. 65.92

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

$V = \frac{1}{3}\pi r^2 h$

$SA = \pi r\sqrt{r^2 + h^2} + \pi r^2$

4. Find dy/dx by implicitly differentiating: $2y^3 + 3x^2y - x = 8$

   A. $\frac{dy}{dx} = \frac{1}{6y^2+3x^2}$

   B. $\frac{dy}{dx} = \frac{1-3x^2}{6y^2+3x^2}$

   C. $\frac{dy}{dx} = \frac{1-6xy}{6y^2+3x^2}$

   D. $\frac{dy}{dx} = \frac{6y^2+3x^2}{3x^2-1}$

   E. $\frac{dy}{dx} = \frac{6y^2+3x^2}{6xy-1}$

5. Find all points on the graph of $y = (x-2)(x^2 - 7x + 10)$ where the tangent line is horizontal.

   A. $(2, 0), (4, -4)$

   B. $(2, 0), (4, 0)$

   C. $(5, 0), (2, 0)$

   D. $(-2, -168), (-6, -324)$

   E. $(2, 0), (4, 4)$

6. Find $f'(x)$, where $f(x) = \sqrt{3x^3 + x}$.

   A. $\frac{9x^2+1}{2\sqrt{3x^3+x}}$

   B. $\frac{6x^2+1}{2\sqrt{3x^3+x}}$

   C. $\frac{(9x^2+1)(3x^3+x)^{3/2}}{2}$

   D. $\frac{1}{2\sqrt{3x^3+x}}$

   E. $\frac{9x^2+1}{\sqrt{3x^3+x}}$

7. Luigi's Pizza Parlor will sell

$$P(x) = 5x^2 - 3x + 11$$

pizzas per day, where x represents the number of hundreds of dollars that Luigi spends on newspaper advertisements. Luigi currently spends \$300 per day on newspaper advertisements. Using calculus, estimate the amount by which the number of pizzas sold per day will drop if he decreases his daily advertising-expenditure by \$70.

   A. 13.3

   B. 14.4

   C. 16.5

   D. 18.9

   E. 27

8. For a particular store, the weekly sales S are given by $S(x) = 0.35x^2 + 50x + 2250$ dollars, where x represents the weekly advertising costs, also in dollars. The current weekly advertising costs are \$1,500 and these costs are increasing at a rate of \$125 per week. Find the current rate of change of the weekly sales.

   A. weekly sales are increasing at a rate of \$139,750 per week

   B. weekly sales are increasing at a rate of \$1,100 per week

   C. weekly sales are increasing at a rate of \$131,300 per week

   D. weekly sales are increasing at a rate of \$3,350 per week

   E. weekly sales are increasing at a rate of \$137,500 per week

9. Find the equation of the line tangent to the curve $y = \frac{1}{4}(x^2 - 3x - 14)^2$ at the point where $x = -2$.

   A. $y = -2x$

   B. $y = 14x + 32$

   C. $y = 2x + 8$

   D. $y = -14x - 24$

   E. $y = 56x + 116$

10. A company posts a video online and notices that the number of views v of the video t hours after it has been posted is given by the equation $v = t^3 - 2t^2 + 4t + 12$. At what rate is the number of views changing with respect to time two hours after the video has been posted? Additionally, how many views did the video actually receive during the third hour it has been online?

    A. rate: 33 views/hour, actual views: 27

    B. rate: 8 views/hour, actual views: 33

    C. rate: 8 views/hour, actual views: 11

    D. rate: 8 views/hour, actual views: 13

    E. rate: 27 views/hour, actual views: 13

11. The manager of a local electronics factory determines that the cost of manufacturing q DVD players is $C(q) = 0.5q^2 + 14q + 300$ dollars. The workday starts at 8:00 AM, and on a typical workday the factory produces $q(t) = t^2 + 45$ DVD players in the first t hours after 8:00 AM, $0 \leq t \leq 9$. At what rate will the manufacturing cost be changing with respect to time at 11:00 AM?

    A. \$3960 per hour

    B. \$408 per hour

    C. \$138 per hour

    D. \$474 per hour

    E. \$2514 per hour

12. Suppose the wholesale price p of oranges, in dollars per crate, and the daily supply x, in thousands of crates, are related by the equation $px + 7x + 8p = 328$. If there are 4,000 crates available today at a price of $25 per crate, and if the supply is decreasing at a rate of 300 crates per day, at what rate is the price per crate changing?

   A. price is increasing at a rate of $28.13 per day

   B. price is decreasing at a rate of $1.88 per day

   C. price is increasing at a rate of $0.04 per day

   D. price is decreasing at a rate of $1.21 per day

   E. price is increasing at a rate of $0.80 per day

13. A company that sells coffee has estimated that if t thousand dollars are spent in promotion and advertising, then

$$A(t) = 35 + \frac{0.2}{t^2} - \frac{3}{t^3}$$

hundred kilograms of coffee are sold. At what rate (in kilograms per thousand dollars) will the sales be changing when $\$11,000$ are spent in promotion and advertising?

   A. 0.03

   B. 2.12

   C. -0.09

   D. 0.09

   E. -1.12

14. An object moves along a straight line. After t minutes, its distance from the starting point is $D(t) = (t+1)(3t+2) + \frac{1}{2t+1}$. Find the velocity of that object at the end of the first minute.

   A. $\frac{25}{9}$
   B. $\frac{98}{9}$
   C. $\frac{97}{9}$
   D. $\frac{31}{3}$
   E. $\frac{34}{3}$

15. The output Q at a certain factory is related to inputs x and y by the equation $Q = \dfrac{\sqrt[4]{x^3}}{8} + \dfrac{1}{\sqrt{y}}$. If the current levels of the inputs are $x = 81$ and $y = 16$, use increments to estimate the change in input y to offset an increase of 0.6 in input x, so that the output will be maintained at its current level.

   A. increase y by 55.2 units
   B. increase y by 4 units
   C. increase y by 0.9 units
   D. increase y by 2.4 units
   E. increase y by 29.5 units