

- A spherical balloon is being inflated at a rate of $4 \text{ ft}^3/\text{s}$. How fast in ft/s is the radius increasing when the radius is 2 ft ?
- $f'(x) = (\ln x)(\sin 3x)$ over $[0,3]$. To the nearest thousandth give the interval(s) where f is concave up.
- Give the letter of the functions that are differentiable at $x = 0$. A) $f(x) = \sin|x^2|$
B) $f(x) = \text{Arctan}|x|$ C) $f(x) = e^{x^2}$ D) $f(x) = \sqrt{x^2 + 0.1} - 0.1$ E) $f(x) = \tan|x|$
- $f(1) = 4$, $g(1) = 1$, $f'(1) = -2$, and $g'(1) = 3$. Find $\frac{d}{dx} \left[\frac{f(x) - g(x)}{f(x)} \right]$ at $x = 1$.
- List the letters of the statements that are true.
A) $\lim_{h \rightarrow 0} \frac{\cot(x+h) - \cot(x)}{h} = \csc^2(x)$ B) If the acceleration is positive, then the velocity is increasing. C) The domain of $\ln(x^2 - 4)$ is $|x| \geq 2$. D) Average speed over an interval is found by dividing displacement by the elapsed time. E) If $f'(x) = x(x+3)^2(x-2)$, then f has three relative extrema. F) The graph of the line through $(-2,4)$ and $(3,5)$ is parallel to the tangent line to $y = \ln(x)$ at $x = 5$.
- Find the exact area of the largest rectangle that can be formed with lower base on the x -axis and upper vertices on the parabola $y = 14 - 2x^2$.
- The graph of $f'(x)$ is given. Each tick mark represents a unit of 1. If it is known that $f(2) = 3$, use the linearization of f at $x = 2$ to estimate $f(2.03)$.
- Let A be the number of values over $[-2,3]$ that satisfy the conclusion of the Mean Value Theorem for $f(x) = x^3 - 5x + 2$. Let B be the number of relative maximum points that f has over $[0, 4\pi]$ if $f'(x) = \frac{x}{15} + \sin(e^{0.2x})$. Let C be the number of points of inflection that $f''(x) = 0.5 + \cos(x) - e^{-x}$ has over $[0, 20]$. Find $A + B + C$.
- Let $f(x) = x^3 - 7x^2 + 25x - 39$. Let g be the inverse function of f . What is the value of $g'(0)$?
- Locate the midpoint between the coordinates of the relative maximum and minimum of on the graph of $y = x^3 + 2x^2 + x - 4$.
- The rate of consumption of oil in the United States during the 1980's (in billions of barrels per year) is modeled by the function $C = 27.08e^{t/25}$, where t is the number of years after January 1, 1980. Find the total consumption of oil in the United States from January 1, 1982 to January 1, 1985 to the nearest billion.
- The area of an equilateral triangle is increasing at a rate of $24 \text{ in}^2/\text{min}$. Find the rate of change of the perimeter when the side of the triangle has length of 6 in .
- If $0 \leq k \leq \frac{\pi}{2}$ and the area under the curve $y = \cos(x)$ from $x = k$ to $x = \frac{\pi}{2}$ is 0.2 , then $k = ?$
- The position function s of a point moving rectilinearly is given by the equation $s(t) = 2t^3 - 15t^2 + 48t - 10$. Find the acceleration when the velocity is first $12 \text{ m}/\text{sec}$.
- Find the area of the region enclosed by the graphs of $y = 3x^2 - 5x + 5$ and $y = 4 - x^2$.

