

Except for problem#4, all answers must be simplified and exact (i.e., they may contain  $\pi$ , radicals, fractions, terminating or repeating decimals, but they may *NOT* contain decimal approximations). Radicals must be expressed in simplest radical form, and fractions must be expressed in lowest terms. Final answers may not contain negative exponents or fractional exponents. Where appropriate include the correct units and the appropriate sign to represent the direction for quantities representing vectors.

1. \_\_\_\_\_ Find  $f'(x)$  for  $f(x) = 5x^3 - \pi x^2 - \frac{7}{x^4}$ .

2. \_\_\_\_\_ Find  $\int (6r^5 + \sqrt{r} + \frac{3}{r^7}) dr$

3. \_\_\_\_\_  $\lim_{x \rightarrow 7} \frac{x^2 - 49}{x - 7}$

4. \_\_\_\_\_ A home run by Yadier Molina of the St. Louis Cardinals followed a path given by the equation  $f(x) = -0.00279x^2 + 1.235x + 3$ , where  $x$  is the distance from home plate measured in feet and  $f(x)$  is the height of the baseball in feet. To the nearest foot, find the maximum height of the baseball.

5. \_\_\_\_\_ Suppose  $f(x)$  is an even function and  $\int_1^3 f(x) dx = \frac{5}{4}$ . Find  $\int_{-3}^{-1} f(x) dx$ .

6. \_\_\_\_\_  $\lim_{x \rightarrow 0} \frac{\sqrt{4+x} - 2}{x}$

7. \_\_\_\_\_ For  $f(x) = 2x^3 + 7$ , the Mean Value Theorem states there is at least one value  $c$  in the interval  $[0, 2]$  for which  $\frac{f(2) - f(0)}{2} = f'(c)$ . Find the value(s) of  $c$ .

8. \_\_\_\_\_ Find the total area of the region enclosed by the  $x$ -axis and the curve  $y = x^3 - 9x$ .
9. \_\_\_\_\_ Find the absolute minimum point for  $g(t) = t + \frac{1}{\sqrt{t-1}}$ .
10. \_\_\_\_\_  $\lim_{x \rightarrow -\infty} \frac{2x}{\sqrt{x^2 + 4}}$
11. \_\_\_\_\_ Find the slope of the tangent line to the curve  $y = \sqrt{9-4x}$  at the point  $(-4, 5)$ .
12. \_\_\_\_\_ Find the  $x$ -coordinate(s) at which the relative, or local, minimum point(s) occur for  $y = x^2 + \frac{9}{x}$ .
13. \_\_\_\_\_ Find the interval(s) on which the graph of  $y = (x-5)(x-2)^2$  is concave downward.
14. \_\_\_\_\_ Find the interval(s) on which the graph of  $y = x^3 - 3x + 1$  is increasing.
15. \_\_\_\_\_ Find the coordinates of the inflection point(s) for  $y = x^2 - \frac{1}{x}$ .
16. \_\_\_\_\_ Let  $f$  and  $g$  be functions such that  $f(5) = -3$ ,  $f'(5) = 10$ ,  $f'(7) = 20$ ,  $g(5) = 7$ ,  $g'(5) = \frac{1}{3}$  and  $g'(7) = \frac{1}{4}$ . Find  $(f \circ g)'(5)$ .
17. \_\_\_\_\_ The velocity of a moving particle is  $v(t) = 30 - 2t$  feet per second. Find the total distance the particle travels between the times  $t = 10$  and  $t = 18$  seconds.