

Directions: Evaluate and/or calculate as indicated.

1. A man 6 ft tall is walking at a rate of 3 ft/s toward a streetlight 18 ft high. (a) At what rate is his shadow length changing? (b) How fast is the tip of his shadow moving?

For the following find where f is increasing/decreasing, relative max/min(s), intervals of concavity, inflection points, and all asymptotes.

2. $f(x) = x - \frac{1}{x} - \frac{1}{x^2}$
3. $f(x) = \frac{x^3 - 4x - 8}{x + 2}$
4. $f(x) = \frac{x^5}{x^2 + 1}$
5. $f(x) = \frac{(x - 2)^3}{x^2}$
6. $f(x) = 4x^4 - 16x^2 + 17$
7. $f(x) = \sqrt[3]{x^2 - 25}$
8. $f(x) = \frac{8}{x - 1} + \frac{27}{x + 4}$
9. $f(x) = (x^3 + 3x^2)^3$
10. $f(x) = x^3(x + 1)^2$
11. $f(x) = \frac{x^4 - x}{2x^2 - 3x + 1}$
12. $f(x) = \frac{x^4 - 2x^2 - 3}{x^2 + 1}$
13. $f(x) = 2x^3 + 7x - 1$
14. $f(x) = x^4 - 2x^2 + 1$
15. $f(x) = x^2(x - 1)^{2/3}$
16. $f(x) = x^{-1/2} + \frac{1}{3}x^{3/2}$
17. $f(x) = \frac{3x}{\sqrt{4x^2 + 1}}$

Tips: $\frac{d}{dx}[f(x)g(x)] = f(x)g'(x) + g(x)f'(x)$

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{(g(x))^2}$$

18. $f(x) = \sqrt{x^2 - 3x - 10}$

19. $f(x) = \frac{x^2 - 9}{(x + 1)^2}$

20. $f(x) = \sqrt{x}(x - 2)^2$

21. $f(x) = x - x^{2/3}$

For the following find the 1st and 2nd derivatives and critical values of f on $[0, 2\pi]$.

22. $f(x) = x - \sin(x)$

23. $f(x) = 2 \tan(x) - \tan^2(x)$

24. $f(x) = (1 - 2 \sin x)^2$

25. $f(x) = \sin^2(x)$

26. $f(x) = \cos(x) - \sin(2x)$

27. $f(x) = \cos(2x) + \cos(x)$

28. $f(x) = \sin^2(x) + \cos(x)$

Find the Extrema and Mean Values on in the given intervals.

29. $f(x) = \cos(x); [\pi/2, 3\pi/2]$

30. $f(x) = \frac{1}{2}x - \sqrt{x}; [0, 4]$

31. $f(x) = \frac{1}{x^2} - \frac{4}{3x} + \frac{1}{3}; [1, 3]$