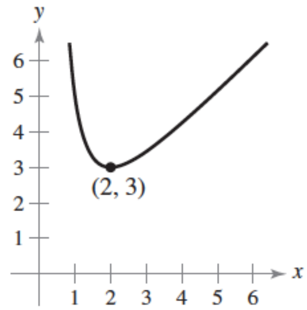
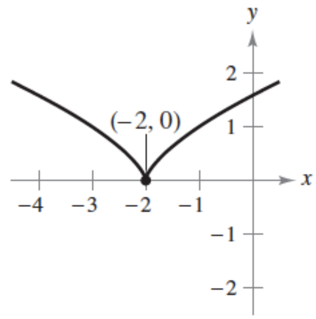
3A Exercises

Extrema on an Interval

3. $g(x) = x + \dfrac{4}{x^2}$



5. $f(x) = (x + 2)^{2/3}$



Find the any critical numbers of the function.

11. $f(x) = x^3 - 3x^2$

14. $f(x) = \dfrac{4x}{x^2 + 1}$

15. $h(x) = \sin^2 x + \cos x$

$0 < x < 2\pi$

Find the absolute extrema of the function on the interval

19. $g(x) = x^2 - 2x,\ [0, 4]$

23. $y = 3x^{2/3} - 2x,\ [-1, 1]$

25. $g(t) = \dfrac{t^2}{t^2 + 3},\ [-1, 1]$

33. $f(x) = \cos \pi x,\ \left[0, \dfrac{1}{6}\right]$

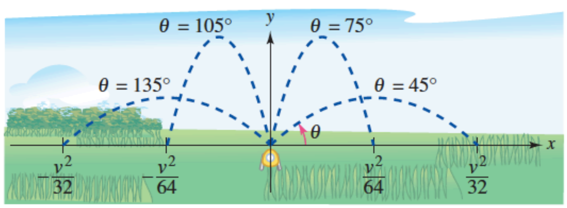
36. $y = \tan\left(\dfrac{\pi x}{8}\right),\ [0, 2]$

Choose one of the following applications to complete

62. ***Lawn Sprinkler*** A lawn sprinkler is constructed in such a way that $d\theta/dt$ is constant, where θ ranges between 45° and 135° (see figure). The distance the water travels horizontally is

$$x = \frac{v^2 \sin 2\theta}{32}, \quad 45° \le \theta \le 135°$$

where v is the speed of the water. Find dx/dt and explain why this lawn sprinkler does not water evenly. What part of the lawn receives the most water?



Water sprinkler: $45° \le \theta \le 135°$

■ **FOR FURTHER INFORMATION** For more information on the "calculus of lawn sprinklers," see the article "Design of an Oscillating Sprinkler" by Bart Braden in *Mathematics Magazine*. To view this article, go to the website *www.matharticles.com*.

63. ***Honeycomb*** The surface area of a cell in a honeycomb is

$$S = 6hs + \frac{3s^2}{2}\left(\frac{\sqrt{3} - \cos\theta}{\sin\theta}\right)$$

where h and s are positive constants and θ is the angle at which the upper faces meet the altitude of the cell (see figure). Find the angle θ $(\pi/6 \le \theta \le \pi/2)$ that minimizes the surface area S.