3.5.33

Exercise 3.5.33 A ball is thrown vertically upward with an initial velocity of 80 feet per second. The distance s (in feet) of the ball from the ground after t seconds is $s(t) = 80t - 16t^2$. (a) At what time t will the ball strike the ground? (b) For what time t is the ball more than 96 feet above the ground?

Solution

(a) The ball is at ground level when $s(t) = 80t - 16t^2 = 0$ or $16t(5-t) = 0$ or when $t = 0$ seconds or $t = 5$ seconds. So at $t = 0$ it is released at ground level, it goes up, falls down, and strikes the ground when $\boxed{t = 5 \text{ seconds.}}$

(b) We want $s(t) = 80t - 16t^2 > 96$ or $-16t^2 + 80t - 96 > 0$. Since $a = -16 < 0$ then the graph of $y = -16t^2 + 80t - 96$ is concave down. So the graph is above the t-axis (and the inequality is satisfied) between the t-intercepts. So consider $-16t^2 + 80t - 96 = 0$ or $-t^2 + 5t - 6 = 0$ or $(-t+2)(t-3) = 0$. Therefore the t-intercepts are $t = 2$ and $t = 3$ and the ball is more than 96 feet above the ground for $\boxed{t \in (2, 3)}$.

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