Lesson 7.1.3

7-25. See below:

a. Since the length of his shadow increases as Eric walks away from the lamp, $\frac{dx}{dt}$ and $\frac{ds}{dt}$ will both be positive. If $\frac{dx}{dt}$ is constant, s will increase at a constant rate.

b. If the height of the lamppost is l and Eric's height is h, then similar triangles shows that $\frac{s}{h} = \frac{x+s}{l}$. Then $hx + hs = sl$ and $h\frac{dx}{dt} + h\frac{ds}{dt} = l\frac{ds}{dt}$. Thus, $\frac{ds}{dt} = \frac{h}{l-h}\frac{dx}{dt}$.

c. $\frac{ds}{dt} = \frac{20}{11} \approx 1.818 \frac{\text{ft}}{\text{sec}}$

7-26. See below:

a. 15 feet.

b. They are equal.

c. $V = \frac{1}{3}\pi h^3$

d. 0.168 feet per minute

7-28. See below:

a. $20 \cdot 6^{20}x^{19}$

b. $6\sec^2(6x)$

c. $\frac{1}{x}$

7-29. See below:

a. $\frac{6^{19}}{20}x^{20} + C$

b. $\frac{1}{6}\tan(6x) + C$

c. $\frac{1}{6}\ln|x| + C$

7-30. See below:

a. $u^2 - 3u = -2$, $(u-2)(u+1) = 0$, $u = 2, -1$

b. $u = \sqrt{5}$

7-31. See below:

a. $\frac{dy}{dx} = \frac{e^{5y}}{3-5xe^{5y}}$

b. $y = \frac{x}{3}$

c. $y = \frac{1}{30} \approx 0.0333$

d. underestimate

7-32. It represents the rate at which her hair grows; it is positive. If she gets a haircut, it is undefined at that moment, then positive again.

7-33. $A = \frac{1}{2}x\sqrt{13-x^2}$, so $\frac{dA}{dt} = \frac{1}{2}\left(\frac{x-(-2x)}{\sqrt{13-x^2}} + \sqrt{13-x^2}\right)\frac{dx}{dt}$. Then $\frac{dA}{dt} \approx 2.479$ units per second.

7-34. See below:

a. $+\infty$

b. 1

c. $-\infty$

d. $\frac{1}{2}$

7-35. 7.581 billion people

7-36. The triangle will have a maximum area of 42.25 un^2 when both legs have length ≈ 9.192 units.