Solutions:

1. a) 40 foot-pounds
   b) 200 foot-pounds

2. a) 10,000 foot-pounds
   b) 17,500 foot-pounds
   c) 6875 foot-pounds

3. Differentiate the following functions.

a) $f'(x) = 2e^{2x}$.

b) $f'(x) = \frac{1}{x}$.

c) $h'(x) = -\frac{3^{1/x}\ln(3)}{x^2}$.

d) $f'(x) = -2^{-4x}[\sin(x) + \ln(16)\cos(x)]$.

e) $f'(x) = \frac{2x}{\sqrt{1-x^4}}$.

f) $g'(x) = \frac{6(\tan^{-1}(2x))^2}{1+4x^2}$.

g) $f'(x) = \frac{x}{x^2\ln(4)+\ln(4)}$.

4. Differentiate using logarithmic differentiation.

a) $y' = \left[\frac{9}{3x+2} + \frac{20}{4x-5}\right](3x+2)^3(4x-5)^5$.

b) $y' = \left[-\sin(x)\ln(x) + \frac{\cos(x)}{x}\right]x^{\cos(x)}$.

c) $y' = \frac{2\ln(x)}{x}x^{\ln(x)}$.

d) $y' = \left[\ln(\ln(x)) + \frac{1}{x\ln(x)}\right](\ln(x))^x$.

5. A bacterial population starts with 10,000 bacteria and grows at a rate proportional to its size. After 2 hours there are 40,000 bacteria.

a) 320,000

b) $t = \frac{2\ln(100)}{\ln(4)}$

≈ 13.29 hours

6. $t = \frac{5{,}730\ln(0.7)}{\ln\left(\frac{1}{2}\right)}$

$\approx 2,948.5$ years

7. Evaluate the integral for each of the following.