Solutions:

1. Differentiate the following functions.

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

b) $h'(x) = 3e^{-3x\csc(x)}\csc(x)(x\cot(x) - 1)$.

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) $h'(x) = -\frac{3e^{3x}}{\sqrt{1-e^{6x}}}$.

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

i) $h'(x) = \frac{2\ln(2x)}{x}$.

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

k) $g'(x) = \frac{2\tan(\ln(x))\sec^2(\ln(x))}{x}$.

2. $y' = \frac{x-3xy^2}{3x^2y-2y^3}$

3. y=6-6x

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. An object is moving along a coordinate line according to the formula $s(t) = t^3 - 3t^2 - 24t$, where $s(t)$ is the position function (in feet) and t is in second ($t \geq 0$).

a) $v(t) = 3t^2 - 6t - 24$; t=4 seconds ; s(4)=-80 feet.

b) RIGHT: $(4, \infty)$; LEFT: $[0, 4)$

c) -70

d) 90

e) $a(3) = 12$

6. 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

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

$\approx 2,948.5$ years

8. Estimate $(32.3)^{2/5}$ using differentials.

$(32.3)^{2/5} = (32 + 0.3)^{2/5} \approx 4 + \frac{1}{20}(0.3) = 4.015$

9. Estimate tan(44.8 °) using differentials.

$\tan(44.8°) = \tan\left(\frac{\pi}{4} - \frac{\pi}{900}\right) \approx 1 + \frac{1}{2}\left(-\frac{\pi}{900}\right) = \frac{1800-\pi}{1800}$

10. $V = 13.824 \pm 0.00864$ meters

11. $dV = 2.4\,\pi\,\text{in}^3$