Section 4.4

1. Differentiate each function:

a.) $f(t) = \cos^2 t(\ln t)$

b.) $f(x) = \ln(\sin 2x)$

c.) $h(x) = \ln(\ln 3x)$

d.) $y = \ln \sqrt{\dfrac{x^2+1}{3x-5}}$

e.) $f(x) = \log_5(e^{10x})$

f.) $f(x) = 3^{\tan(7x)}$

g.) $y = x^{\sin x}$

2. Find the equation of the tangent line to the graph of $f(x) = x \ln x$ at $x = e^2$.

3. What is the slope of the parametric curve $x = t \ln t$, $y = 2^{3t}$ at the point $(0, 8)$?

Section 4.5

4. A bacteria culture starts with 400 bacteria and the population triples every 20 minutes.

a.) Find an expression for the number of bacteria after t hours.

b.) Find the number of bacteria after 2 days.

c.) When will the population reach 20,000?

5. A curve that passes through the point $(0, 25)$ has the property that the slope at every point (x, y) is eight times the y coordinate. Find the equation of the curve.

6. **A tank contains 200 liters of brine with a concentration of 0.1 kg of salt per liter. Pure water enters the tank at a rate of 5 liters per minute. The solution is kept mixed and exits the tank at the same rate. How many kg of salt will remain after half an hour?**

7. **A pie is taken from an oven, where the temperature is 450°, to a 75° room. After 15 minutes, the temperature of the pie reads 350°. What will the temperature of the pie be after 27 minutes?**

Section 4.6

8. Compute the following without the aid of a calculator.

a.) $\arcsin \frac{\sqrt{3}}{2}$ **b.)** $\arccos(-\frac{1}{\sqrt{2}})$

c.) $\sin^{-1}(-\frac{\sqrt{2}}{2})$ **d.)** $\arctan \frac{1}{\sqrt{3}}$

e.) $\cot \arccos(-\frac{3}{5})$ **f.)** $\sin(\arcsin 2)$

g.) $\arccos(\cos(\frac{2\pi}{3}))$ h.) $\arctan(\tan\frac{5\pi}{4})$

i.) $\cos(\arccos 0.4)$ j.) $\arcsin(\sin((\frac{11\pi}{6}))$

k.) $\arccos(\cos\frac{5\pi}{4})$ l.) $\sin(2\arccos(\frac{1}{3}))$

9. Find the derivative of $y = \arctan(1 - x)$

10. Find the equation of the tangent line to the graph of $y = \arcsin \dfrac{x}{2}$ at $x = -1$.

11. What is the domain of $f(x) = \arcsin(2x - 1)$? Of $\arctan(2x - 1)$?

12. Find $\lim_{x \to \infty} \arctan x$.

13. $\cos(\arctan x)$ is equivalent to what?

Section 4.8

14. Find the following limits.

a.) $\lim_{x \to \infty} \dfrac{(\ln x)^2}{x - 1}$

b.) $\lim_{x \to 0} \dfrac{\sin x - x}{x^3}$

c.) $\lim_{x \to 0^+} x^2 \ln x$

d.) $\lim_{x \to \infty} (e^x + x)^{\frac{1}{x}}$

e.) $\lim_{x \to 0} (1 + \sin 4x)^{\cot x}$

f.) $\lim_{x \to 0} (\sin x)^{\tan x}$

g.) $\lim_{x \to 1} \left(\frac{1}{\ln x} - \frac{1}{x - 1} \right)$