MATH 100 – WORKSHEET 8
LOGARITHMS AND THEIR DERIVATIVES

1. Review of Logarithms

Logarithm rules.

$$\boxed{\log_b(b^x) = b^{\log_b x} = x}$$

$$\boxed{\log_b(xy) = \log_b x + \log_b y} \qquad \boxed{\log_b(x^y) = y \log_b x} \qquad \boxed{\log_b \frac{1}{x} = -\log_b x}$$

(1) $\log\left(e^{10}\right) =$ $\qquad$ $\log(2^{100}) =$ $\qquad$ (in terms of $\log 2$)

(2) A variant on *Moore's Law* states that computing power doubles every 18 months. Suppose computers today can do N_0 operations per second.

(a) Write a formula for the power of computers t years into the future:

- Computers t years from now will be able to do $N(t)$ operations per second where

$$N(t) =$$

(b) A computing task would take 10 years for today's computers. Suppose we wait 3 years and then start the computation. When will we have the answer?

(c) At what time will computers be powerful enough to complete the task in 6 months?

2. Differentiation

$$\boxed{(\log x)' = \frac{1}{x}} \qquad \boxed{f' = f \times (\log f)'}$$

(1) Differentiate

(a) $f(t) = \log\left(t^2 + 3t\right)$. $f'(t) =$

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(b) $g(x) = x^2 \log(1 + x^2)$. $g'(x) =$

(c) $h(r) = \frac{1}{\log(2+\sin r)}$. $h'(r) =$

(d) Find y' if $\log(x + y) = e^y$

(2) Using the chain rule, $\frac{d(\log(ax))}{\mathrm{d}x} =$

(3) Use logarithmic differentiation to differentiate:

(a) $\frac{x^5 \cos x}{\sqrt{5+x}}$

(b) x^x

(c) $(\log x)^{\cos x}$