

1. (4pts) Evaluate without using the calculator:

$$\log_3 81 = 4$$

$$3^4 = 81$$

$$\log_7 \frac{1}{49} = -2$$

$$7^{-2} = \frac{1}{49}$$

$$\log_5 \sqrt[3]{5^3} = \frac{3}{8}$$

$$5^{\frac{3}{8}} = 5^{\frac{3}{8}}$$

$$\log_a \sqrt[3]{a} = \frac{1}{3}$$

$$a^{\frac{1}{3}} = a^{\frac{1}{3}}$$

2. (7pts) Solve the equations:

$$\log_4 x = 5$$

$$4^5 = x$$

$$x = 1024$$

$$\ln x = 7$$

$$e^7 = x$$

$$x \approx 1096.63$$

$$10^{3x-1} = 32 \quad | \log$$

$$\log 10^{3x-1} = \log 32$$

$$3x-1 = \log 32$$

$$3x = \log 32 + 1$$

$$x = \frac{\log 32 + 1}{3} \approx 0.83$$

$$\log_2(2x+8) = 5$$

$$2^5 = 2x+8$$

$$32 = 2x+8$$

$$24 = 2x$$

$$x = 12$$

3. (4pts) If  $A$  represents the area of a wound, then normal healing of a wound that is  $120\text{mm}^2$  in size is represented by  $A = 120e^{-0.35t}$ , where  $t$  is the number of days following the injury. How long is it before the wound is  $1/3$  of the original size?

$$1/3 \text{ size} = 40 \text{ mm}^2$$

$$40 = 120e^{-0.35t} \quad | \div 120$$

$$\frac{40}{120} = e^{-0.35t}$$

$$\frac{1}{3} = e^{-0.35t} \quad | \ln$$

$$\ln \frac{1}{3} = \ln e^{-0.35t}$$

$$\ln \frac{1}{3} = -0.35t$$

$$t = \frac{\ln \frac{1}{3}}{-0.35} = 3.14 \text{ days}$$

4. (5pts) Write as a sum and/or difference of logarithms. Express powers as factors. Simplify if possible.

$$\log_3 \frac{x^7}{\sqrt{x-1}} = \log_3 x^7 - \log_3 \sqrt{x-1} = 7 \log_3 x - \frac{1}{2} \log_3 (x-1)$$

$(x-1)^{\frac{1}{2}}$

$$\ln(e^x(e^x - 4)^5) = \ln e^x + \ln(e^x - 4)^5 = x + 5 \ln(e^x - 4)$$

5. (6pts) Write each the following as a single logarithm. Simplify if possible.

$$\frac{1}{3} \log v^6 + 2 \log v^2 = \log (v^6)^{\frac{1}{3}} + \log (v^2)^2 = \log v^2 \cdot v^4 = \log v^6$$

$$\ln(x^2 - x + 2) - 2 \ln(x + 1) = \ln(x^2 - x + 2) - \ln(x + 1)^2$$

$$= \ln \frac{(x^2 - x + 2)}{(x + 1)^2} \leftarrow \text{doesn't factor}$$

6. (4pts) Solve the equation:

$$3^{x+1} = 7^{2x-3} \quad | \ln$$

$$\ln 3^{x+1} = \ln 7^{2x-3}$$

$$(x+1) \ln 3 = (2x-3) \ln 7$$

$$x \ln 3 + \ln 3 = 2x \ln 7 - 3 \ln 7$$

$$x \ln 3 - 2x \ln 7 = -\ln 3 - 3 \ln 7$$

$$x(\ln 3 - 2 \ln 7) = -\ln 3 - 3 \ln 7$$

$$x = \frac{-\ln 3 - 3 \ln 7}{\ln 3 - 2 \ln 7} = \frac{\ln 3 + 3 \ln 7}{2 \ln 7 - \ln 3} \approx 2.48$$