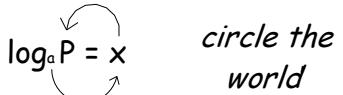## Logarithm Review

| $\log_a P = x$   circle the world | $\log_a x = b \ \leftrightarrow \ a^b = x$    e.g. $\log_2 16 = 4$ because $2^4 = 16$ <br> $\ln a = b \leftrightarrow e^b = a$      e.g. $\ln 100 \approx 4.605$ because $e^{4.605} \approx 100$ |
|---|---|

| LOG 1000 = 3 | LOG 0.001 = –3 | LOG $10^n$ = n | LOG $\sqrt{10}$ = LOG $(10)^{\frac{1}{2}}$ = 0.5 | –LOG x = LOG $\dfrac{1}{x}$ |
|---|---|---|---|---|

| $\ln e = 1$ <br> $\ln e^n = n$ <br> $\ln 1 = 0$ <br> $\ln 0$ = undefined | $\ln (x > 1)$ = pos <br> $\ln 1 = 0$ <br> $\ln (0 \text{ to } 1)$ = neg <br> log (neg) = non-real | Inverse relationships <br><br> $e^{\ln [f(x)]} = f(x)$ <br><br> $\ln e^{f(x)} = f(x)$ |
|---|---|---|

| $\ln \sqrt{e} = \ln e^{\frac{1}{2}} = 0.5$ | $\ln (\frac{1}{2}) = -\ln 2$ | $\ln 1/e = -1$ | $\ln 1/x = -\ln x$ |
|---|---|---|---|

| log A + log B = log [AB] | log A – log B = log [A/B] | log $A^n$ = n log A |
|---|---|---|

| log ($A^n$ $B^m$) = n log A + m log B | log $\sqrt{x}$ = log $x^{\frac{1}{2}}$ = $(\frac{1}{2})$ log x | log A + log B – log C – log D = log $\dfrac{A \, B}{C \, D}$ |
|---|---|---|

| General change of base: $\log_a b = \dfrac{\ln b}{\ln a}$ | Change to base 'e': $a \, (b^x) \leftrightarrow A \, e^{rt}$ then a = A, x = t, r = ln b |
|---|---|

| $\dfrac{\log A}{\log B}$ does not simplify | log (A+B) does not simplify | (log A)(log B) does not simplify |
|---|---|---|

(1)   ln 8 + 2 ln x – ln 3 =

(2)   ln 1 + ln 2 + ln 3 + ln 4 + ln 5 =

(3)   (ln 1)(ln 2)(ln 3)(ln 4)(ln 5) =

(4)   $\ln \sqrt{e^5}$ =

(5)   $2 \ln \dfrac{x \sqrt{y}}{z}$ – ln (yx) + ln ($z^2$) =

(6)   ln 27 – ln 3 + ln 4 – ln 12 =

(7)   ln $[(2354968427384)^0]$ =

(8)   ln [ ln $(\frac{1}{2})$ ] =

(9)   ln $[5e^{5x^2 + 7}]$ =

(10)   $e^{2\ln x}$ =

(11)   ln [2abc] – ln a – ln b – ln c =

(12)   $\log_3 81$ =

(13)   $\log_5 600 - \log_5 24$ =

(14)   $(\frac{1}{2})$ ln $[100x^2]$ =

(15)   0.16 ln $x^{25}$ =

(16)   ln $[8x^2]$ – ln $[200 \, x^3]$ + 2 ln [5x] =

(17)   4 ln $\sqrt{8e^5}$ – 5 ln (2) – 10 =

(18)   $100(1.25)^x$ = _____ $e \xrightarrow{\quad} x$

(19)   (ln e)(ln 2e) – ln 2 =

(20)   $\sqrt{\dfrac{(\ln 2)(\ln 4)}{2}}$ =

(1)   $\ln 8 + 2 \ln x - \ln 3 = \ln [8x^2/3]$

(2)   $\ln 1 + \ln 2 + \ln 3 + \ln 4 + \ln 5 = \ln 5! = \ln 120$

(3)   $(\ln 1)(\ln 2)(\ln 3)(\ln 4)(\ln 5) = 0$

(4)   $\ln \sqrt{e^5} = 2.5$

(5)   $2 \ln \dfrac{x\sqrt{y}}{z} - \ln (yx) + \ln (z^2) = \ln x$

(6)   $\ln 27 - \ln 3 + \ln 4 - \ln 12 = \ln 3$

(7)   $\ln [(2354968427384)^0] = 0$

(8)   $\ln [ \ln (\tfrac{1}{2}) ] = \text{non-real}$

(9)   $\ln [5e^{5x^2 + 7}] = \ln 5 + 5x^2 + 7$

(10)  $e^{2\ln x} = x^2$

(11)  $\ln [2abc] - \ln a - \ln b - \ln c = \ln 2$

(12)  $\log_3 81 = 4$

(13)  $\log_5 600 - \log_5 24 = 2$

(14)  $(\tfrac{1}{2}) \ln [100x^2] = \ln [10x]$

(15)  $0.16 \ln x^{25} = 4 \ln x = \ln x^4$

(16)  $\ln [8x^2] - \ln [200 x^3] + 2 \ln [5x] = \ln x$

(17)  $4 \ln \sqrt{8e^5} - 5 \ln (2) - 10 = \ln 2$

(18)  $100(1.25)^x = 100\, e^{\,(\ln 1.25)\, x}$

(19)  $(\ln e)(\ln 2e) - \ln 2 = 1$

(20)  $\sqrt{\dfrac{(\ln 2)(\ln 4)}{2}} = \ln 2$