MU ALPHA THETA CONVENTION 2003
THETA LOGS AND EXPONENTS SOLUTIONS

1) (D)

2) $\left(\log_{1/9}\left(\frac{3^3\cdot 3^4}{3^6}\right)\right)^{-3} = \left(\log_{1/9}\left[\left(\frac{1}{3}\right)^{-1}\right]\right)^{-3}$
$= \left(\log_{1/9}\left[\left(\frac{1}{9}\right)^{-\frac{1}{2}}\right]\right)^{-3}$
$= -8$ (D)

3) (B)

4) $2^{3x^2-x} = 16^{x+3}$
$3x^2-x = 4x+12$
$3x^2-5x-12=0$
$x = -4/3, 3$ (A)

5) $\log(x+3)-\log(x+2)=\log x$
$x+3 = x^2+2x$
$x^2+x-3=0$
$x = \frac{-1\pm\sqrt{13}}{2}$
Valid $x = \frac{-1+\sqrt{13}}{2}$ (E)

6) $\log_4(16-x^2)$, $x>0$
$\therefore x = 0, \pm1, \pm2, \pm3$ (C)

7) $\frac{2^{\sqrt{3}}\cdot 2^{6\sqrt{3}}}{2^{2\sqrt{3}}\cdot 2^{\sqrt{3}}} = 2^{4\sqrt{3}}$ (C)

8) $\sqrt{2^{x-5}} = 3^x$
$2^{x-5} = 3^{2x}$
$x\log 2 - 5\log 2 = 2x\log 3$
$x(\log 2 - 2\log 3) = 5\log 2$
$x = \frac{5a}{a-2b}$ (D)

9) $2\log x + \log(x+1) = \log(8x^2-7x-15)$
$x^3-7x^2+7x+15=0$
$(x+1)(x-5)(x-3)=0$
$P/Q = 8/3$ (B)

10) $(2\log_a 6)(\log_5 a) = 6$
$\frac{\ln 6\cdot\ln a}{\ln a\cdot\ln 5} = 3$
$\log_5 6 = 3$ $6 = 5^3 = 125$ (A)

11) $\frac{\log 4}{\log 6}+\frac{\log 9}{\log 6} = \frac{\log 36}{\log 6}$
$= \log_6 6^2$
$= 2$ (A)

12) $4^x - 4^{x-1} = 48$
$4^x(1-\frac{1}{4}) = 48$
$4^x = 64 = 4^3$
$x = 3$ (D)

13) $\log_8 x + \log_8 y = 1/3$
$xy = 8^{1/3} = 2$
$x = 2/y$ (C)

14) $\log_4(2^{1+\frac{3}{5}}) - \log_8\left(\frac{1}{4}\right)^{\frac{1}{3}}$
$\log_{2^2} 2^{8/5} - \log_{2^3} 2^{-2/3}$
$\frac{4}{5}+\frac{2}{9}$
$\frac{46}{45}$ (B)

15) $\frac{a^{3x}\cdot a^{\frac{3}{2}}\cdot b^{\frac{3}{2}}\cdot b^{\frac{4-y}{7}}}{a^{9x+4}\, b^{\frac{5y}{2}}}$
$a^{\frac{-12x-1}{2}}\, b^{\frac{13-33y}{14}}$ (B)

16) $\log_{x^3} 64 = -\frac{1}{2}$
$64 = (x^3)^{-1/2}$
$x = 64^{-\frac{2}{3}} = \frac{1}{16}$ (E)

17) $f^{-1}(0)=0 \Rightarrow e^0 - e^{-0} = 0$
(C)

18) $\log_a 48 = 4\log_a 2 + \log_a 3$
$= 4c + \frac{1}{b}$ (A)

19) $2(\log x)^2 - 5\log x + 2 = 0$
$(2\log x - 1)(\log x - 2) = 0$
$x = 10^{1/2}, 10^2$ (D)

20) $N(x) = 3000e^{.2x}$
$\frac{27}{3} = 9 = e^{.2x}$
$x = 5\ln 9 \approx 10.986$ (C)

21) $\log_{4/9}(9/4) = 3x$
$\left(\frac{4}{9}\right)^{-1} = \frac{4}{9}^{3x}$
$-1 = 3x$
$x = -1/3$ (E)

22) $\ln\left(\frac{x^{12}\sqrt{x-3}}{4}\right)$ (B)

23) $4^{\log_4 5} = 5$ (D)

24) $x^4 = 9 = (\sqrt{3})^4$
$x = \sqrt{3}$ (E)

25) $24 = 3e^{20k}$
$\frac{1}{20}\ln 8 = k$
stress $= 3e^{\frac{5\ln 8}{2}}$
≈ 543.0580 (A)

26) $(\frac{1}{2})^2+(\frac{1}{2})^3+\ldots+(\frac{1}{2})^{n+1}+\ldots$
$S = \frac{a}{1-r} = \frac{\frac{1}{4}}{1-\frac{1}{2}} = \frac{1}{2}$ (A)

27) $.1\overline{6}\log(525\cdot 1000) - 1.5\log(63\cdot 100)$
$.1\overline{6}(\log 525+3) - 1.5(\log 63+2)$ (C)

28) (D)

29) $\log(\log_6(\log_3 x)) = 0$
$\log_6(\log_3 x) = 1$
$\log_3 x = 6$
$x = 3^6 = 729$ (B)

30) $\frac{(\log 6^5)(\log 3^5)(\log 2^{12})(\log 5^4)}{(\log 5^5)(\log 6^3)(\log 3)(\log 2^5)}$
$\frac{5\cdot 5\cdot 12\cdot 4}{5\cdot 3\cdot 3\cdot 5} = 24$ (C)