1. B $1296 = 6^{3t}$ $6^4 = 6^{3t}$ $4 = 3t$ $t = \frac{4}{3}$
2. B $\ln(\frac{4}{7}) = (2\ln(2) - \ln(7)) = (0.28 - 0.17) = 0.11$
3. A We need $x^3 + 1 = 0$ or $x^2 + 5x + 7 = 1$. So, $x = -3, -2, -1$. The sum of the solutions is -6.
4. D $\ln x = e^x$ $e^{e^x} = x$ Since $x > 0$, e^x grows faster than x, and so there are no solutions.
5. A Since $g(x)$ and $h(x)$ are inverses but never intersect, they cannot intersect $y = x$.
6. C $\sum_{i=1}^{\infty} 2(e^{-i}) = \sum_{i=1}^{\infty} \frac{2}{e^i} = \frac{\frac{2}{e}}{1-\frac{1}{e}} = \frac{2}{e-1}$
7. C We have $(1 - \log(2)) < x < (1 + \log(2))$. So, $\log(5) < x < \log(20)$. $\log(20) - \log(5) = \log(4)$
8. A $4^x + 2^{x+1} - 3 = 0$ $2^{2x} + 2 \cdot 2^x - 3 = 0$ $(2^x + 3)(2^x - 1) = 0$ $2^x = 1$ $x = 0$
9. B $\log 2 + \frac{1}{2}\log 2 + ... = \frac{\log 2}{1-\frac{1}{2}} = 2\log 2 = \log 4$
10. C $\sum_{x=0}^{\infty} \frac{7}{8^x} = \frac{7}{1-\frac{1}{8}} = 8.$
11. D $\lim_{n\to\infty}((\log x)^n - \log(x^n)) = (0 + \infty) = \infty$
12. E We need $-1 < r < 1$. So, $-1 < e^x < 1$ so $-\infty < x < 0$
13. D $c\log_{0.5} 0.2 = c\frac{\log 0.2}{\log 0.5} = -c\frac{\log 5}{\log 0.5} = c\frac{\log 5}{\log 2} = c\log_2 5$. So, $c = 1$
14. D $\exp(\sum_{k=2}^{n} \ln(k)) = \exp(\sum_{k=1}^{n} \ln(k)) = \exp(\ln(1 \cdot 2 \cdot ... \cdot n)) = \exp(\ln(n!)) = n!$
15. B $18 + 18r + 18r^2 = 180$ $1 + r + r^2 = 10$ $r = \frac{-1\pm\sqrt{1+36}}{2}$. Since $r > 0$, $r = \frac{\sqrt{37}-1}{2}$. So the measure of the second smallest angle is $18r = 9\sqrt{37} - 9$.
16. C The number of digits in x is given by $\lfloor \log x \rfloor + 1$. $\lfloor \log 9^{2008} \rfloor + 1 = \lfloor 2008\log 9 \rfloor + 1 = \lfloor 1807.2 \rfloor + 1 = 1808$.
17. C $Eh = \sum_{i=1}^{\infty} \frac{\log(2^i)}{2^i} = \sum_{i=1}^{\infty} \frac{i\log(2)}{2^i} = \log(2)\sum_{i=1}^{\infty} \frac{i}{2^i} = \log(2)\sum_{i=0}^{\infty} \frac{1}{2^i} = 2\log(2)$
18. C Since $1 < e < 10$, $a = 0$. Since $10 < 2.5^3 < e^3$ and $e^2 < 3^2 < 10$, $b = 2$.
19. C $\sqrt{2-x} = x$ $x^2 + x - 2 = 0$ $x = 1, -2$. Checking for extraneous solutions, only $x = 1$ works.
20. A $\log(1 + 2 + ... + n) - \log(n) - \log(n+1) = \log(n) + \log(n+1) - \log(2) - \log(n) - \log(n+1) = -\log 2$
21. D $(\log 10^{10})^{\log 10^{10}} = 10^{10}$.
22. C $y = 1$ and $x = \frac{1}{1000}$.
23. B $0 < \log x < 1$ if $1 < x < 10$ so the sum becomes $8 + 7 + 6 + ... + 2 + 1 + 1 = \frac{8\cdot 9}{2} + 1 = 37$
24. C $\log_4(t^2 + 4t + 4) = \log_2(2t + 1)$ $\log_2(t + 2) = \log_4(2t + 1)$ $t + 2 = 2t + 1$ $t = 1$
25. D Reflected across the x-axis: $y_1 = -\ln(b - ax)$. Reflected across $y = x$: $y_2 = y_1^{-1} = \frac{b-e^{-x}}{a}$
26. B $x^{x^2} = x^2$ $x^2\log x = 2\log x$ $(x^2 - 2)\log x = 0$ $x = \pm\sqrt{2}, 1$. $x = -\sqrt{2}$ is extraneous.
27. A A is finite since the maximum value attained by $\sin x$ is 1 so the maximum value attained by $g(x)$ is 0 and the maximum value attained by $h(x)$ is 1.
28. C $\frac{\log x}{\ln x} = \log e$ $\sum_{n=0}^{\infty}(\log e)^n = \frac{1}{1-\log e}$
29. E $\log 3x \geq \log 2x^2$ $3x \geq 2x^2$ $x(2x-3) \leq 0$ $0 \leq x \leq \frac{3}{2}$. $\log 3x$ doesn't exist when $x = 0$ so $0 < x \leq \frac{3}{2}$
30. A $\log(11) + \log(9) + \log(\frac{100}{99}) = \log\frac{11\cdot 9\cdot 100}{99} = 2$