1. **A.** You must multiply the exponents, such that the simple answer is 3^6.

2. **D.** log 500 = log 1000 – log 2 $\approx 3-0.301=2.699$.

3. **D.** The mantissa is the part after the decimal point for the answer…or 0.5740.

4. **A.** The characteristic is the part before the decimal point…or 2.

5. **A.** The antilog is just the inverse log. In this case $10^{1.5740}=10^{2.5740}10^{-1}=375/10=37.5$.

6. **B.** If you start off with the exponent being only 1 you would have 2 terms, go up to an exponent of 2 and you get 3 terms, and for 3 you have 4 terms. Thus for 2007 you have 2008 terms, or ${}_{2008}C_1$. In fact the general formula for *t* terms raised to the *n*th power is ${}_{n+t-1}C_{t-1}$.

7. **C.** Again, with the exponent as 1, the sum of the coefficients is 2 (1,1); for n = 2, the sum is 4 (1,2,1); for n = 3, the sum is 8 (1,3,3,1). Thus the sum for exponent n is 2^n. For this case, 2^{2007}.

8. **B.** $\cot 15=\cos 15 / \sin 15=\left(\left(\sqrt{6}+\sqrt{2}\right)/4\right)/\left(\left(\sqrt{6}-\sqrt{2}\right)/4\right)=\left(\sqrt{6}+\sqrt{2}\right)/\left(\sqrt{6}-\sqrt{2}\right)$.
Multiplying the top and bottom by $\left(\sqrt{6}+\sqrt{2}\right)$ gives $\left(8+4\sqrt{3}\right)/4=2+\sqrt{3}$.

9. **D.** At t = 3 hours, $2=(1)\left(e^{3k}\right)$, so $k=(1/3)\ln 2$. Then $1000=e^{(t\ln 2)/3}$, or $t=(3\ln 1000)/\ln 2$, which also equals $(3\log 1000)/\log 2=9/\log 2$.

10. **A.** $\ln(-16)=\ln(-1)+4\ln(2)$. Now let $e^{\ln(-1)}=e^x$. Then $e^x=-1$. Recall that $e^{i\theta}=\cos\theta+i\sin\theta$. For $\theta=\pi$, the right hand side would be -1. So $\ln(-1)=i\pi$, and the final answer is $i\pi+4\ln 2$.

11. **D.** The problem simplifies to $\sqrt{x^2+9}=9\rightarrow x^2+9=81\rightarrow x^2=72$ or $x=\pm 6\sqrt{2}$.

12. **E.** $\sqrt{5.76}=\sqrt{576/100}=24/10=2.40$.

13. **C.** Factoring 2007 gives 3 squared times 223. Thus $\log 2007=2\log 3+\log 223$.

14. **B.** Each point on the line that is bisects the acute angle will be equidistant from both lines. The distance, d, from a point, (x_1, y_1), to line $Ax+By+C=0$ is given by:
$d=\left(Ax_1+By_1+C\right)/\pm\sqrt{A^2+B^2}$. So for the two lines, $d_{(1)}=d_{(2)}$, or $\dfrac{2x-3y+6}{\pm\sqrt{13}}=\dfrac{3x-y+3}{\pm\sqrt{10}}$. For now will choose the + out of both $\pm$ signs. A simple plot indicates that the slope of the acute angle bisector should be around 1, whereas the obtuse angle bisector's slope will be around -1. Will have to check to see if the line created actually bisects the acute angle and not the other.

When fully expanded, you get $\left(2\sqrt{10}-3\sqrt{13}\right)x+\left(-3\sqrt{10}+\sqrt{13}\right)y+6\sqrt{10}-3\sqrt{13}=0$. The slope of this line is $-\left(2\sqrt{10}-3\sqrt{13}\right)\Big/\left(-3\sqrt{10}+\sqrt{13}\right)$, which is around -1. Thus we should have picked the – for one side, let's say the right one. Then we have $\left(-2\sqrt{10}-3\sqrt{13}\right)x+\left(3\sqrt{10}+\sqrt{13}\right)y-6\sqrt{10}-3\sqrt{13}=0$. The slope for this line is $-\left(-2\sqrt{10}-3\sqrt{13}\right)\Big/\left(3\sqrt{10}+\sqrt{13}\right)$, which is close to 1, so we have the right line, and the correct answer choice just is the negative of the above.

15. **C.** $4132_7=1444_{10}$, and $\sqrt{1444}=38$. 38 converted into base 7 is 53_7.

16. **C.** To get the inverse function, let $f(x) = y$ and then solve for x. The solution will be $f^{-1}(x)$, then just substitute 2 in for the answer. So, raising both sides into exponents of e, you have $e^y=x+\sqrt{x^2+1}$. Moving the x over and then squaring gives, $e^{2y}-2e^yx+x^2=x^2+1$, which leads to $x=(1/2)\left(e^y-e^{-y}\right)$, or $f^{-1}(x)=(1/2)\left(e^x-e^{-x}\right)$. So $f^{-1}(2)=(1/2)\left(e^2-e^{-2}\right)$.

17. **A.** The graph of a function and its inverse are reflections of one another through the line $y=x$, so you want the inverse of $y=4^x$, which is $y=\log_4 x$.

18. **B.** $x^{1/2+1/4-1/3}=x^{5/12}$

19. **C.** $3^{10}-2^{10}=\left(3^5-2^5\right)\left(3^5+2^5\right)=(211)(275)$. 211 is a prime number, and 275 can be factored into smaller numbers, so 211 is the largest prime of $3^{10}-2^{10}=58025$.

20. **A.** When spread out with numerators over denominators, the entire product cancels out to $\frac{\log 101}{\log 2}\bullet\frac{\log 102}{\log 3}=\left(\log_2 101\right)\left(\log_3 102\right)$.

21. **E.** $\ln\left(6x^2-7x+2\right)=\ln 7\rightarrow 6x^2-7x-5=0$, or $(2x+1)(3x-5)=0$. Thus the solutions could be x = -1/2 or 5/3…but the first doesn't work in the original equation, so just 5/3.

22. **A.** $P(t)=P_0\left(1+r/c\right)^{ct}$, where P is the principle at time t years, P_0 is the initial investment, r is the decimal rate, and c is the number of times per year the interest is compounded. Thus the formula gives, for after 1 year, $\$3000\left(1+.048/12\right)^{12(1)}=\$3000\left(1.004\right)^{12}$.

23. **E.** The part under the radical cannot be 0 or less than 0 as the first will make the fraction infinite and the second would be imaginary. Thus $x<4$ is the domain.

24. **B.** Sum of geometric series is $a_0/(1-r)$, where a_0 is the initial number and r is the ratio. For this question $a_0 = 1$ and $r = 1/16$, so the sum is $16/15$.

25. **C.** Cubing the equation gives $x^2 + 2x - 7 = 8$, or $x^2 + 2x - 15 = 0 = (x+5)(x-3)$. So the solutions are $x = \{-5, 3\}$ and both solutions work in the original equation. The sum is -2.

26. **C.** The exponential form of $\log_a b = c$ is $a^c = b$, $y = (7x)^{42x^2}$ is the correct answer.

27. **A.** $44^2 = 1936$ and $45^2 = 2025$, so $\left[\sqrt{2007}\right]$ would have to be 44.

28. **C.** This question is easier if you break it down via logs. Take the log of each answer choice and the largest value after that will be the correct choice. $40\log 2 \approx 40(0.3010) = 12.04$. $25\log 3 \approx 25(0.4771) = 11.9275$. $15\log 7 \approx 15(0.8451) = 12.6765$. $12\log 9 = 24\log 3$, which must be smaller than choice B. So 7^{15} must be the largest.

29. **D.** Use De Moivre's Theorem, $(\text{cis}\,\theta)^n = \text{cis}(n\theta)$, to simplify the problem down to $\cos(15\pi/4) + i\sin(15\pi/4)$, or $\left(\sqrt{2}/2\right)(1-i)$.

30. **D.** $100^2 = 10000$, so you're looking for something equal to 2. $\log_{200} 40000$ is the only correct answer.