1. C
2. C
3. A
4. A
5. D
6. B
7. B
8. A
9. C
10. C
11. A
12. A
13. B
14. D
15. B
16. A
17. D
18. C
19. C
20. A
21. E
22. B
23. D
24. A
25. C
26. D
27. D
28. B
29. B
30. D

1) **C** If F has an inverse, then $F(F^{-1}(x)) = x$. So, $e^{[F^{-1}(x)]^2} = x$ and $\ln x = [F^{-1}(x)]^2$ and $F^{-1}(x) = \sqrt{\ln x}$.

2) **C** The Taylor Series of e^{-2x^2} center at x=1 is $F(x) = 1 - 2x^2 + 2x^4 - \frac{4x^6}{3} \ldots$, which is equal to the summation: $\sum_{n=0}^{\infty} \frac{(-1)^n (2x)^{2n}}{n!}$.

3) **A** Jacob Bernoulli is credited with the discovery of the constant *e* while trying to find the value of the $\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$, which turns out to be the value *e.*

4) **A** $e^{2\ln(6x)-\ln(28)+\ln(2x)} = e^{\ln(36x^2)-\ln(28)+\ln(2x)} = e^{\ln 72x^3/28} = \frac{72x^3}{28}$

5) **D** Sub in $x = 2u$ to change the problem to $\lim_{u\to\infty}\left(1+\frac{1}{u}\right)^{6u} = \left(\lim_{u\to\infty}\left(1+\frac{1}{u}\right)^{6}\right)^{u} = (e)^6$

6) **B** $\frac{d^2y}{dx^2} = n^2e^{nx}, -6\frac{dy}{dx} = -6ne^{nx},\ 5y = 5e^{nx} \rightarrow \frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 5y = n^2e^{nx} - 6ne^{nx} + 5e^{nx} = 0$

$n^2 - 6n + 5 = 0 \rightarrow (n-5)(n-1) = 0 \rightarrow n = 5 \text{ and } 1 \quad sum = 6$

7) **B** $\frac{\ln|\cos(120^0)|^4}{\ln(\sin 30^0)} = \frac{\ln(^1/_2)^4}{\ln ^1/_2} = \frac{\ln 16}{\ln 2} = \frac{4\ln 2}{\ln 2} = 4$

8) **A** # of Faces of a polyhedron + # of Vertices - # of edges = 2

9) **C** $x = 3 - 4e^{y+7} \rightarrow x - 3 = -4e^{y+7} \rightarrow \frac{3-x}{4} = e^{y+7} \rightarrow f^{-1}(x) = \ln\left(\frac{3-x}{4}\right) - 7$

10) **C** $e^x - 12e^{-x} - 1 = 0 \rightarrow e^x(e^x - 12e^{-x} - 1) = 0 * e^x \rightarrow e^{2x} - e^x - 12 = 0$
$(e^x - 4)(e^x + 3) = 0$ $e^x = -3$ can never be true and therefore $e^x = 4 \rightarrow \ln 4 = x$

11) **A** We know that $\lim_{x\to\infty}\left(1+\frac{1}{x}\right)^x = e$. A property of limits tells us that the left side of this special limit changes the right side by the following property: $\lim_{x\to\infty}\left(1+\frac{b}{x}\right)^{x/c} = e^{b/c}$, and therefore $b = -1$. The limit equals $e^{-1} = {}^1/_e$

12) **A** 2.718281828459045230(**5**)3602875

13) **B** Use Integration By Parts: $u = \ln x \quad dv = x^2\,dx$

$du = \frac{1}{x}dx \quad v = \frac{x^3}{3}dx$

$\int x^2 \ln(x)\,dx = \frac{x^3}{3}\ln x - \int \frac{x^2}{3}dx = \frac{x^3}{3}\ln x - \frac{x^3}{9} + C$

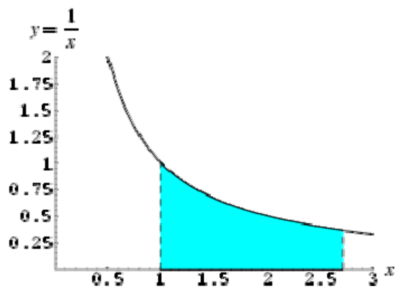
14) **D** Using Newton's Law of Cooling:
$T(t) = T_s + D_0e^{-kt}$ with $T_s = 20, D_0 = 100 - 20 = 80$. Therefore, $T(t) = 20 + 80e^{-kt}$
Since we know $T(15) = 75 \rightarrow 20 + 80e^{-15k} = 75 \rightarrow k = -\frac{1}{15}\ln(^{11}/_{16})$.
And then we substitute in: $T(25) = 20 + 80e^{(^{25}/_{15})\ln(^{11}/_{16})}$

15) **B**
$\ln(2x-1)+\ln(3x+1)=1 \to \ln(6x^2-x-1)=1 \to 6x^2-x-1=e \to 6x^2-x+(-1-e)=0$

Using the quadratic formula: $\frac{-b\pm\sqrt{b^2-4ac}}{2a}=\frac{1\pm\sqrt{1-4*6*(-1-e)}}{12}=\frac{1\pm\sqrt{25+24e}}{12}$, but can only be the "+" because the negative creates a negative value inside one of the ln() and therefore does not work.

16) **A** Since we take $\frac{1}{\infty}=0\ and\ \frac{1}{0}=\infty$, we can switch around $\lim_{x\to 0}(1-x)^{\frac{1}{x}}=\lim_{x\to\infty}\left(1-\frac{1}{x}\right)^x$ which we know from question #11 to be $\frac{1}{e}$.

17) **D**
$\int_1^e \frac{dx}{x}=\ln e=1$



18) **C** By definition

19) **C** On April 29, 2004, Google filed with the SEC to raise $2,718,281,828 t

20) **A** Both the 1st and 2nd derivatives are positive

21) **E** $i^i = e^{-(\frac{\pi}{2}+2k\pi)}\ with\ k=0,\pm1,\pm2,\ldots$

22) **B** $8\sinh(x)\cosh(x)=8*\frac{1}{2}*\frac{1}{2}*(e^x-e^{-x})*(e^x+e^{-x})=2(e^{2x}-e^{-2x})=2e^{2x}-2e^{-2x}$

23) **D** -3-3*i* $z=r\ cis\theta\quad r=\sqrt{3^2+3^2}=\sqrt{18}=3\sqrt{2}$
$\tan\theta=\frac{b}{a}=1 \to \theta=\frac{5\pi}{4}\ since\ in\ 3rd\ quadrant\quad -3-3i=3\sqrt{2}cis\frac{5\pi}{4}=3\sqrt{2}e^{i5\pi/4}$

24) **A** $3x(\ln\sqrt[8]{e^{16}})^x=3x(\ln e^2)^x=3x2^x=192 \to x2^x=64 \to x=4$

25) **C** $y=x^{\frac{1}{\ln x}} \to \ln y=\frac{1}{\ln x}*\ln x \to \ln y=1 \to y=e^{-1}$ and a derivative of a constant is equal to 0

26) **D** $\lim_{n\to\infty}\left(1-\frac{1}{n}\right)^n=\frac{1}{e}$

27) **D** $\ln(x^2-1)-\ln(x^2+1)=-1 \to \ln\frac{x^2-1}{x^2+1}=-1 \to \frac{x^2-1}{x^2+1}=e^{-1} \to x^2-1=e^{-1}x^2+e^{-1}$
$x^2-e^{-1}x^2=1+e^{-1} \to x^2=\frac{1+e^{-1}}{1-e^{-1}} \to x=\pm\sqrt{\frac{1+e^{-1}}{1-e^{-1}}}$

28) **B** Count the number of letters in each word: It (2) enables (7) a (1) numskull (8) to (2) memorize (8) a (1) quantity (8) of (2) numerals (8) =2.718281828

29) **B** All examples of the Logarithmic Spiral

30) **D** Using L'Hospital's rule: $\lim_{x\to\infty}x^4e^{-x}=\lim_{x\to\infty}\frac{4x^3}{e^x}=\frac{12x^2}{e^x}=\frac{24x}{e^x}=\frac{24}{e^x}=\frac{0}{e^x}$