Where applicable, "E) NOTA" indicates that none of the above answers is correct.

1. Answer C: $1+3+5+\cdots+\big(1+(n-1)(2)\big)$
   $a_{2015}=1+2014(2)=4029$
   $S_{2015}=\left(\dfrac{1+4029}{2}\right)(2015)=2015^2$
   The square root of the sum is 2015.

2. Answer C: $[\log_{abc}(a^c)][1+\log_a b+\log_a c]=$
   $[\log_{abc}(a^c)][\log_a a+\log_a b+\log_a c]=[\log_{abc}(a^c)][\log_a abc]$
   $\left[\frac{\log_a a^c}{\log_a abc}\right][\log_a abc]=\log_a a^c=c=340$

3. Answer A: $a_5=5!,\ \ a_6=6!,\ \ r=\frac{6!}{5!}=6$
   Since $a_5=a_4(r)$ *then* $a_4=\frac{a_5}{r}=\frac{5!}{6}=\frac{120}{6}=20$

4. Answer C: $2e^x+e^{-x}=3$
   $(2e^x+e^{-x})(e^x)=3e^x$
   $2e^{2x}+e^0=3e^x$
   $2e^{2x}-3e^x+1=0$
   $(2e^x-1)(e^x-1)=0$
   $e^x=\frac{1}{2}\quad e^x=1$
   The sum of the solutions for e^x is $\frac{1}{2}+1=\frac{3}{2}$

5. Answer C:
   $$\frac{1}{\log_2 100!}+\frac{1}{\log_3 100!}+\frac{1}{\log_4 100!}+\cdots+\frac{1}{\log_{100} 100!}=$$
   $$\frac{\log 2}{\log 100!}+\frac{\log 3}{\log 100!}+\frac{\log 4}{\log 100!}+\cdots+\frac{\log 100}{\log 100!}=$$
   $$\frac{1}{\log 100!}(\log 2+\log 3+\log 4+\cdots+\log 100)=$$
   $$\frac{1}{\log(2\cdot 3\cdot 4\cdot \ldots\cdot 100)}(\log(2\cdot 3\cdot 4\cdot \ldots\cdot 100))=1$$

6. Answer B: $\sqrt[3]{\frac{17\sqrt{7}+45}{4}}=\sqrt[3]{\frac{34\sqrt{7}+90}{8}}=\frac{\sqrt[3]{(3+\sqrt{7})^3}}{2}=\frac{3+\sqrt{7}}{2}=\frac{a+\sqrt{b}}{c}$
   $a+b+c=3+7+2=12$

7. Answer D: $27^x - 9^{x-1} - 3^{x+1} + \frac{1}{3} = 0$

$3^{3x} - 3^{2x-2} - 3^{x+1} + 3^{-1} = 0$

$3^2(3^{3x} - 3^{2x-2} - 3^{x+1} + 3^{-1}) = 3^2(0)$

$9(3^{3x}) - 3^{2x} - 27(3^x) + 3 = 0$

Let $y = 3^x$ $\quad 9y^3 - y^2 - 27y + 3 = 0$

$y^2(9y-1) - 3(9y-1) = 0$

$(y^2-3)(9y-1) = 0$

$y = \pm\sqrt{3} \quad y = \frac{1}{9}$

Since $y = 3^x$ then $3^x = \sqrt{3}$ and $3^x = \frac{1}{9}$. ($3^x = -\sqrt{x}$ is undefined)

Therefore the solutions are $x = \frac{1}{2}$ and $x = -2$ and the sum of solutions is $\frac{1}{2} + (-2) = -\frac{3}{2}$.

8. Answer C: $0 = \ln t$ when $t = e^0 = 1$

$@t = 1 \quad y = e^2$

Hence the y intercept must be at $(0, e^2)$.

9. Answer E: If $x = \frac{2015}{2015+x}$ then $x^2 + 2015x - 2015 = 0$

Using the quadratic formula and discarding the extraneous solution,

$x = \frac{-2015+\sqrt{(2015)^2-4(1)(-2015)}}{2} = \frac{-2015+\sqrt{2015(2015+4)}}{2} = \frac{\sqrt{2015(2019)}-2015}{2} = \frac{\sqrt{ab}-a}{2}$

$a - b = 2015 - 2019 = -4$

10. Answer D: To find $g(3,)$ x must be found by $\sqrt{\frac{x-1}{x+1}} = 3$.

$\frac{x-1}{x+1} = 9$ and therefore $x - 1 = 9x + 9$. Hence $x = \frac{-5}{4}$.

Since $g\left(\sqrt{\frac{x-1}{x+1}}\right) = 3x$ then $g(3) = g\left(\sqrt{\frac{\frac{-5}{4}-1}{\frac{-5}{4}+1}}\right) = 3\left(\frac{-5}{4}\right) = -\frac{15}{4}$

11. Answer A: $\log_2(\log_3(\log_5(\log_7 M))) = 11.$

$2^{11} = \log_3(\log_5(\log_7 M))$

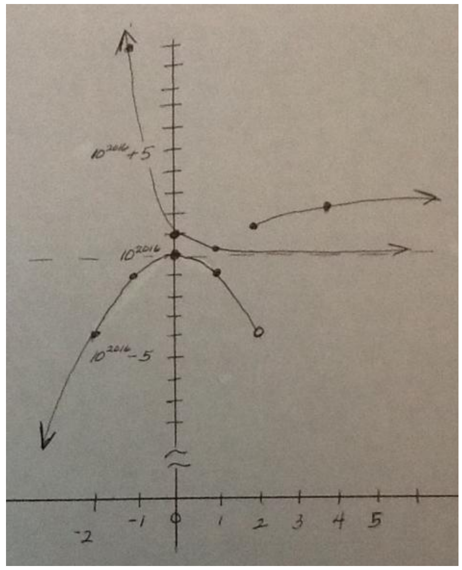
$3^{2^{11}} = \log_5(\log_7 M)$

$5^{3^{2^{11}}} = \log_7 M$

$M = 7^{5^{3^{2^{11}}}} = 7^{330}$ Therefore 7 is the only prime number.

12. Answer A:

There are no points in common.



13. Answer C:

$$\left|\sqrt{n}-5\right| < 1$$
$$-1 < \sqrt{n}-5 < 1$$
$$-4 < \sqrt{n} < 6$$
$16 < n < 36$ There are 19 integers between 16 and 36.

14. Answer D:

$3 = k(2)^r$ and $15 = k(4)^r$
$$\frac{15}{3} = \left(\frac{4}{2}\right)^r$$
$$5 = 2^r$$
$$r = \log_2 5$$

15. Answer C:

$$y^x = \left(\left(1+\frac{1}{n}\right)^{n+1}\right)^{\left(1+\frac{1}{n}\right)^n} = \left(\left(1+\frac{1}{n}\right)^{n+1}\right)^{\left(\frac{n+1}{n}\right)^n} = \left(1+\frac{1}{n}\right)^{\frac{(n+1)(n+1)^n}{n^n}} =$$
$$\left(1+\frac{1}{n}\right)^{\frac{(n)(n+1)^{n+1}}{(n)n^n}} = \left(1+\frac{1}{n}\right)^{\frac{(n)(n+1)^{n+1}}{n^{n+1}}} = \left(1+\frac{1}{n}\right)^{n\left(\frac{n+1}{n}\right)^{n+1}} = \left(1+\frac{1}{n}\right)^{ny} =$$
$$\left[\left(1+\frac{1}{n}\right)^n\right]^y = x^y$$

16. Answer D:

$$\sqrt[3]{L\sqrt[3]{L\sqrt[3]{L}}} = \left(L\left(L(L)^{\frac{1}{3}}\right)^{\frac{1}{3}}\right)^{\frac{1}{3}} = \left(L\left(L^{\frac{4}{3}}\right)^{\frac{1}{3}}\right)^{\frac{1}{3}} = \left(L(L)^{\frac{4}{9}}\right)^{\frac{1}{3}} = \left(L^{\frac{13}{9}}\right)^{\frac{1}{3}} = L^{\frac{13}{27}}$$

17. Answer B: $x^{1+\log_{\frac{1}{2}} x} > \frac{x}{4}$

$\log_x x^{1+\log_{\frac{1}{2}} x} > \log_x \frac{x}{4}$

$1 + \log_{\frac{1}{2}} x > \log_x x - \log_x 4$

$1 + \log_{\frac{1}{2}} x > 1 - \log_x 4$

$\log_{\frac{1}{2}} x > -\log_x 4$

$\frac{\log_2 x}{\log_2 \frac{1}{2}} > -\frac{\log_2 4}{\log_2 x}$

$\frac{\log_2 x}{-1} > -\frac{-2}{\log_2 x}$

$(\log_2 x)^2 < 2$

If $y = \log_2 x$ then $y^2 - 2 < 0$ and $(y - \sqrt{2})(y + \sqrt{2}) < 0$. So $-\sqrt{2} < y < \sqrt{2}$.
Converting back $-\sqrt{2} < \log_2 x < \sqrt{2}$ and $2^{-\sqrt{2}} < x < 2^{\sqrt{2}}$.

18. Answer B: $9 - x^2 \geq 0$ and $9 - |2x + 5| > 0$

$9 - x^2 \geq 0$	$9 - \lvert 2x + 5\rvert > 0$
$x^2 - 9 \leq 0$	$\lvert 2x + 5\rvert < 9$
$(x - 3)(x + 3) \leq 0$	$-9 < 2x + 5 < 9$
$-3 < x < 3$	$-7 < x < 2$

So the domain must be the interval $[-3, 2)$. Since the positive portion of this interval is $(0,2)$ is $\frac{2}{5}$ of the domain, the answer must be 40%.

19. Answer A:

$7.4 = -\log[H]^+$	$7.2 = -\log[H]^+$
$-7.4 = \log[H]^+$	$-7.2 = \log[H]^+$
$[H]^+ = 10^{-7.4}$	$[H]^+ = 10^{-7.2}$

% increase is $\frac{10^{-7.2} - 10^{-7.4}}{10^{-7.4}}(10^2) = \frac{10^{-7.2} - 10^{-7.4}}{10^{-9.4}} = \frac{10^{-7.2}}{10^{-9.4}} - \frac{10^{-7.4}}{10^{-9.4}} = 10^{2.2} - 10^2$

20. Answer D: Here are some facts that will simplify the expression

$x^3 = 1 = x^{2016}$ *and* $x^2 = x^{2015}$

$x^3 - 1 = 0$ *means* $(x - 1)(x^2 + x + 1) = 0$.

$\log\left(x^2 + \frac{1}{x^2} + x^3 + \frac{1}{x^3}\right) = \log\left(x^2 + \frac{1}{x^2} + 1 + 1\right) = \log\left(x^2 + \frac{x^3}{x^2} + 1 + 1\right) =$

$\log(x^2 + x + 1 + 1) = \log(x^2 + x + 1 + 1) = \log(0 + 1) = \log(1) = 0$

21. Answer D: $2^{x^2} = 16^{2x-3}$

$2^{x^2} = (2^4)^{2x-3}$

$2^{x^2} = 2^{8x-12}$

$x^2 = 8x - 12$

$x^2 - 8x + 12 = 0$

$(x - 2)(x - 6) = 0$

$x = 2$ or $x = 6$

The sum of the solutions is $2 + 6 = 8$.

22. Answer C: $\left(\sqrt[3]{x+9}-\sqrt[3]{x-9}\right)^3=3^3$
$x+9-3\sqrt[3]{(x+9)^2}\sqrt[3]{x-9}+3\sqrt[3]{x+9}\sqrt[3]{(x-9)^2}-(x-9)=27$
$-3\sqrt[3]{(x+9)^2}\sqrt[3]{x-9}+3\sqrt[3]{x+9}\sqrt[3]{(x-9)^2}=9$
$\sqrt[3]{(x+9)^2}\sqrt[3]{x-9}-\sqrt[3]{x+9}\sqrt[3]{(x-9)^2}=-3$
$\sqrt[3]{(x^2-81)(x+9)}-\sqrt[3]{(x^2-81)(x-9)}=-3$
$\sqrt[3]{x^2-81}\left(\sqrt[3]{x+9}-\sqrt[3]{x-9}\right)=-3$
$\sqrt[3]{x^2-81}(3)=-3$
$\sqrt[3]{x^2-81}=-1$
$x^2-81=-1$
$x^2=80$

23. Answer C:

$$\sum_{n=1}^{\infty}\left(\frac{1}{\log_2 4^{2^n}}\right)=\sum_{n=1}^{\infty}\left(\frac{1}{\log_2\left(2^2\right)^{2^n}}\right)=\sum_{n=1}^{\infty}\left(\frac{1}{\log_2\left(2\right)^{2^{n+1}}}\right)=\sum_{n=1}^{\infty}\left(\frac{1}{2^{n+1}}\right)=\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\ldots=\frac{\frac{1}{4}}{1-\frac{1}{2}}=\frac{1}{2}$$

24. Answer A: Let $x=\sqrt[3]{26+15\sqrt{3}}$ and $y=\sqrt[3]{26-15\sqrt{3}}$ then $z=x+y$.
$z^3=(x+y)^3=26+15\sqrt{3}+3x^2y+3xy^2+26-15\sqrt{3}$
$z^3=52+3xy(x+y)$
$z^3=52+3\sqrt[3]{(26^2)-(15^2)(3)}(z)$
$z^3=52+3\sqrt[3]{676-675}(z)$
$z^3=52+3(z)$
$z^3-3z-52=0$
$(z-4)(z^2+4z+13)=0$
Since $z^2+4z+13$ has no real roots, $z=4$.

25. Answer C: $x=-\sqrt{5-\sqrt{5-\sqrt{5-\sqrt{5-\cdots}}}}$
$x=-\sqrt{5+x}$
$x^2=5+x$
$x^2-x-5=0$
Using the quadratic formula $x=\frac{1\pm\sqrt{21}}{2}$. However, since x must be negative $x=\frac{1-\sqrt{21}}{2}$

26. Answer D: Let $x = \log_6 16$ and use $a = \log_{12} 27$ to combine expressions using $\frac{\log 3}{\log 2}$.

$a = \log_{12} 27 = \log_{12} 3^3 = 3\log_{12} 3 = \frac{3\log 3}{\log 12} = \frac{3\log 3}{\log 3 + \log 4} = \frac{3\log 3}{\log 3 + 2\log 2}$

$\frac{3}{a} = \frac{\log 3 + 2\log 2}{\log 3} = 1 + 2\frac{\log 2}{\log 3}$

$\frac{\log 2}{\log 3} = \frac{1}{2}\left(\frac{3}{a} - 1\right) = \frac{3-a}{2a}$

$\frac{\log 3}{\log 2} = \frac{2a}{3-a}$

$x = \log_6 16 = \log_6 2^4 = 4\log_6 2 = \frac{4\log 2}{\log 6} = \frac{4\log 2}{\log 3 + \log 2}$

$\frac{4}{x} = \frac{\log 3 + \log 2}{\log 2} = \frac{\log 3}{\log 2} + 1$

$\frac{\log 3}{\log 2} = \frac{4}{x} - 1 = \frac{2a}{3-a}$ from above.

$\frac{4}{x} = \frac{2a}{3-a} + 1 = \frac{2a + 3 - a}{3-a} = \frac{a+3}{3-a}$

$\frac{x}{4} = \frac{3-a}{a+3}$ *so* $x = \frac{4(3-a)}{a+3}$

27. Answer E: The vertical asymptote of $y = \log_2 x$ is $x = 0$ and its domain is $(0, \infty)$. The graph of $y = -1 - 5\log_2(-2x+3)$ can be rewritten in the form
$y = -1 - 5\log_2\left[-2\left(x - \frac{3}{2}\right)\right]$.
Therefore $x = \frac{3}{2}$ is its vertical asymptote.

28. Answer A: $\begin{vmatrix} x & e^{\ln 6} & 2^{e^{\ln 1}} \\ e^{2\ln 3 - 3\ln 2} & 0 & e^{-\ln 5} \\ e^{\ln 5} & 5^{\ln e^2} & e^{\pi i} \end{vmatrix} = \begin{vmatrix} x & 6 & 2 \\ \frac{9}{8} & 0 & \frac{1}{5} \\ 5 & 25 & -1 \end{vmatrix} = -\frac{9}{8}\begin{vmatrix} 6 & 2 \\ 25 & -1 \end{vmatrix} - \frac{1}{5}\begin{vmatrix} x & 6 \\ 5 & 25 \end{vmatrix} = 0$

$-\frac{9}{8}(-6 - 50) - \frac{1}{5}(25x - 30) = 0$. Therefore $63 - 5x + 6 = 0$ and $x = \frac{69}{5}$

29. Answer B: Let $y = \ln x$ and k be an integer.
$\sin(y) + 2\cos(3y)\sin(2y) = 0$ can be rewritten using a product to sum identity.

$$\sin(y) + 2\left(\frac{\sin(3y+2y) - \sin(3y-2y)}{2}\right) = 0$$

$$\sin(y) + \sin(5y) - \sin(y) = 0$$

$\sin(5y) = 0$; $5y = \pi k$; $y = \frac{\pi k}{5}$; $y = \ln x = \frac{\pi k}{5}$; $x = e^{\frac{\pi k}{5}}$.
Since x must the be smallest value greater than 1,
$x = e^{\frac{\pi}{5}}$ which makes $a = 1, b = 5$ and $ab = 5$.

30. Answer D: Let $x = \sqrt{a + \sqrt{a + \cdots}}$ and $y = \frac{1}{a + \frac{1}{a+\cdots}}$.

$$x = \sqrt{a + x}$$
$$x^2 = a + x$$
$$x^2 - x = a$$
$$x^2 - x + \frac{1}{4} = a + \frac{1}{4}$$
$$\left(x - \frac{1}{2}\right)^2 = a + \frac{1}{4}$$
$$\left(x - \frac{1}{2}\right) = \sqrt{a + \frac{1}{4}}$$
$$x = \sqrt{a + \frac{1}{4}} + \frac{1}{2}$$

$$y = \frac{1}{a + y}$$
$$ay + y^2 = 1$$
$$y^2 + ay + \left(\frac{a}{2}\right)^2 = 1 + \left(\frac{a}{2}\right)^2$$
$$\left(y + \frac{a}{2}\right)^2 = 1 + \frac{a^2}{4}$$
$$y + \frac{a}{2} = \sqrt{1 + \frac{a^2}{4}}$$
$$y = \sqrt{1 + \frac{a^2}{4}} - \frac{a}{2}$$

$$x - y = \sqrt{a + \tfrac{1}{4}} + \tfrac{1}{2} - \left(\sqrt{1 + \tfrac{a^2}{4}} - \tfrac{a}{2}\right)$$

$$2(x - y) = 2\sqrt{a + \frac{1}{4}} + 1 - 2\sqrt{1 + \frac{a^2}{4}} + a$$

$$2(x - y) = \sqrt{4a + 1} + 1 - \sqrt{4 + a^2} + a = a + 1 + \sqrt{4a + 1} - \sqrt{4 + a^2}$$

So, we are looking for the solution to:
$a + 1 + \sqrt{4a + 1} - \sqrt{4 + a^2} > 14$ or
$a + \sqrt{4a + 1} - \sqrt{4 + a^2} > 13$

By guess and check, $a = 43$.