1) B: $23^{2x+27} = 1980$: (2x + 27) ln 23 = ln 1980 : x = $(\ln 1980 - 27\ln 23) \div 2\ln 23$

$\log_3 20.03y = 0.725$: $3^{0.725} = 20.03y$: $y = (3^{0.725}) \div 20.03$

$x + y \approx (-12.2895) + (0.1107) \approx -12.18$

2) A: $(x^3y^2)^{\frac{7}{n}}$: 7 is the power and n is the root

3) C: $\log_6 5(2y-3) = \log_6 25$: both are log base 6, so 5(2y - 3) = 25: y = 4

4) C: $\log_3 5 + \log_5 125 = \log_3 x$: $\log_3 5 + 3\log_5 5 = \log_3 x$: $\log_3 5 + \log_3 3^3 = \log_3 x$

all log base 3, therefore: x = (5)(3^3) = 135

5) D: $10^{.0036} \approx 1.0083$

6) A: $\left(\sqrt[3]{4^5}\right)^{\sqrt[3]{-8}} \approx 0.0098 = 17$

7) C: $\log\left(\frac{y^2}{x^3}\right)$: log of the top - log of the bottom, finally bring down exponents in front of the logs.

8) (E, $x(4^x)$): $x(\ln\sqrt{e^8})^x$: $x(\ln e^4)^x$: $x(4\ln e)^x$

9) D: log 9 = r & log 5 = s, log 450=: log 450 = log (10*9*5) = log10+log9+log5= 1 + r + s

10) B: $y = \ln(x-1)$: x = ln (y - 1) : y = $e^x + 1$: R(36) = $e^{36} + 1$

11) A: First, foil the top: $\frac{(\log x)^2 + \log y \log x - \log y \log x - (\log y)^2}{\log x \log y}$ =

$\frac{(\log x)^2}{\log x \log y} - \frac{(\log y)^2}{\log x \log y}$ = $\frac{\log x}{\log y} - \frac{\log y}{\log x}$, change of base formula $\log_y x - \log_x y$.

12) A: $\frac{1}{27} = 9^{(x+4)}$: $3^{-3} = 3^{2^{(x+4)}}$: -3 = 2(x + 4) : $x = \frac{-11}{2}$: A = 11, B = 2: A + B = 13

13) D: $y = \frac{1}{2}e^{(x+1)} - 8$: for x intercept(s) solve y = 0, get $16 = e^{(x+1)}$ or $x = \ln 16 - 1$

for y intercept(s) solve x = 0, get $y = \frac{1}{2}e - 8$: [ln 16 -1 + $\frac{1}{2}e - 8$ ≈ -4.87]

14) B: 2log 5 + 3log x -+2log y: $\log 5^2 + \log x^3 + \log y^2 = \log 25x^3y^2$

15) A: $4^{\log_4 32}$: as a property $b^{\log_b x} = x$: x = 32

16) C: $\log_x 25 > 2$: $x^2 < 25$: This yields tests points of -5, 1, and 5 (1 because you cannot divide by zero): bases must be in the interval (0, 1) U (1, ∞): Only interval that works is between 1 and 5. When x is less than 1 but greater than 0 you left side being negative and when x is 5 or greater the left side is equal to and then less than 2.

17) (E, **7**): $\log_3(x-5)+\log_3(x+2)=\log_3 18$: $\log_3(x-5)(x+2)=\log_3 18$: (x-5)(x+2)=18:
$x^2-3x-28=(x-7)(x+4)=0$: -4 will not work therefore the only solution is 7.

18) B: $(x^2y^4)^{ABC} = (x^3y^6)^{8AB^2C^2}$: $Let\ z=(xy^2)$: $(z^2)^{ABC}=(z^3)^{8AB^2C^2}$: $z^{2ABC}=z^{24AB^2C^2}$:
therefore $2ABC=24AB^2C^2$: Divide both sides by 24ABC: BC = $\frac{1}{12}$

19) D: $\log_2(7x-5)-\log_2(x+1)=2$: $\log_2\left(\frac{7x-5}{x+1}\right)=2$: $\frac{7x-5}{x+1}=4$: (7x-5) = 4(x+1): x = 3

20) C: 2003.2004 = $xe^{(0.02003)(12)}$: $x\approx 1575.21$, sum of digits = 21

21) D: $20=5(1+\frac{0.005}{12})^{(12x)}$: $x\approx 277.3: 2+7+7=16$

22) A: $3P=P\left(1+\frac{R}{4}\right)^{(4*36)}$: $\ln 3=(4*36)\ln\left(1+\frac{R}{4}\right)$: $\frac{\ln 3}{144}=\ln\left(1+\frac{R}{4}\right)$: $e^{\ln 3\left(\frac{1}{144}\right)}=e^{\ln\left(1+\frac{R}{4}\right)}$:
$3^{\left(\frac{1}{144}\right)}=1+\frac{R}{4}$: $R=4\left(3^{\left(\frac{1}{144}\right)}-1\right)\approx 0.301=3+1=4$

23) D : $\log x > \log(x+5)$: true when x > x + 5, never...

24) B: $9^{x+1}=8^{2x}$: (x + 1)ln9=(2x)ln8: $x=\frac{\ln 9}{2\ln 8-\ln 9}\approx 1.120=1+1+2=4$

25) C: $\left(2x^{\sqrt{3}}y^7\right)^3$: $8x^{3\sqrt{3}}y^{21}$: Power to a power makes you multiply

26) B: 2003^{2004}: 2004 log 2003 then round up the next integer = 6617

27) (E, $(-\infty,-4)\cup(5,\infty)$): $f(x)=\frac{\log(x^2-2x-15)}{\sqrt{x^2-16}}$: From the top; the domain of a log must be greater than zero. From the bottom, the value inside the radical must be greater than zero to accommodate both division by zero and not allowing negative values under a radical. $(x^2-2x-15)=(x-5)(x+3)>0$: therefore x < -3 and x > 5. $x^2-16>0$: (x - 4)(x + 4) > 0: therefore x < -4 and x > 4. Combining both parts together and taking the more restrictive answer yields: $(-\infty,-4)\cup(5,\infty)$

28) B: $f(x)=b^x$: b<0 implies that b can be negative and values less than 0 only work for even exponents. As an example lets let b= -3, (-3)^0 = 1 while (-3)^2 = 9 which is increasing at best. Also the values where x is odd do not work at all, therefore b must be less than one as well as greater than zero.

29) D: $8\log_R\left(\frac{BC^2}{(D)(\sqrt[4]{E})}\right)$: $M\log_R B + A\log_R C - T\log_R D - H\log_R E$: Find M + A + T + H.

$$8(\log_R B + 2\log_R C - \log_R D - \frac{1}{4}\log_R E) = 8\log_R B + 16\log_R C - 8\log_R D - 2\log_R E$$

M = 8, A = 16, T = -8, H = -2: M+A+T+H= 14

30) B: $e^{4x}+4e^{2x}-45=0$: $(e^{2x}+9)(e^{2x}-5)=0$: $e^{2x}+9\neq 0$: $e^{2x}=5$: 2x lne = ln5:

$x=\frac{\ln 5}{2}\approx .804=.80$, sum of digits is 8.