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

1. $5^{x+2}-5^x<5 \qquad 5^x\left(5^2-1\right)<5 \qquad 5^x\left(24\right)<5 \qquad 5^x<\dfrac{5}{24}$ The largest x is -1.

2. $A=\left(\dfrac{1}{2}-\dfrac{1}{3}\right)^{-1}=\left(\dfrac{1}{6}\right)^{-1}=6 \quad B=\left(\dfrac{5}{6}\right)^{-1}=\dfrac{6}{5} \quad C=\left[3\left(5\sqrt{5}\right)-2\left(3\sqrt{5}\right)-4\sqrt{5}\right]^2=\left[15\sqrt{5}-6\sqrt{5}-4\sqrt{5}\right]^2$

$=\left[5\sqrt{5}\right]^2=125 \qquad D=\left(3\sqrt{5}+3\right)\left(3\sqrt{5}-3\right)=45-9=36 \qquad \dfrac{ABC}{D}=\dfrac{6\left(\dfrac{6}{5}\right)(125)}{(36)}=25$

3. $\left[\dfrac{x^{3k-2}}{x^{2k+1}}\right]\left[\dfrac{x^{k-3}}{x^{2k+2}}\right]=\dfrac{x^{4k-5}}{x^{4k+3}}=x^{-8}=x^y \qquad \therefore y=-8$

4. $\log 10+\log A-\log B+3\log A-\log 100-\log C=1+2.5-1.2+7.5-2-3.6=4.2$ or $\dfrac{21}{5}$

5. Let x $=\sqrt[3]{y}$, then $y=x^3$ and $\left(\sqrt[3]{y}\right)^y=3$, cubing $y^y=3^3$, or $y=3$ and $x=\sqrt[3]{3}$

6. $2^x=1*2^3=8, \;\; 5^y=1*5^{-2}=\dfrac{1}{25}, \qquad 2^x*5^y=\left\{\dfrac{8}{25}\right\}$

7. $(x+1)=(x-1)^2, \quad x+1=x^2-2x+1, \quad x^2-3x=0, \quad x=3,0 \qquad$ only $x=3$

8. $\log_8 144-\log_8 9=\log_8\dfrac{144}{9}=\log_8 16=\dfrac{\log 16}{\log 8}=\dfrac{4\log 2}{3\log 2}=\dfrac{4}{3}$

9. $(1+t)^x=\dfrac{b}{a} \qquad x\log(1+t)=\log\left(\dfrac{b}{a}\right) \qquad x=\dfrac{\log\left(\dfrac{b}{a}\right)}{\log(1+t)}$

10. log (0.75) = log $\dfrac{3}{2^2}$ = log 3 -2 log 2= 0.477 – 0.602 = - 0.125

11. $2^x=2^{2y+2}, \quad x=2y+2, \quad , \quad x=(y+1)^2, \quad x=y^2+2y+1,$

$2y+2=y^2+2y+1 \qquad y^2=1, \;\; y=\pm 1, \quad$ if $y=-1, \; x=0, \;$ if $y=1, \;$ x=4, the sum is 4

12. M(4) → $4=2^2$ → log 2; M(6) → 0 ; M(9) → $9=3^2$ → log 3
Log 2 + 0 + log 3 = log 6

13. $\log\dfrac{50}{7}=\log\dfrac{2(5)^2}{7}=\log 2+2\log 5-\log 7=a+2b-c$

14. $\dfrac{9^{x+2}}{\left(3^{x-1}\right)^x}\div\dfrac{\left(27^x\right)^{x+1}}{81^{x^2-1}}=\dfrac{3^{2x+4}}{3^{x^2-x}}*\dfrac{3^{4x^2-4}}{3^{3x^2+3x}}=\dfrac{3^{4x^2+2x}}{3^{4x^2+2x}}=1$

15. $\log_3\left(9\sqrt{27}\right)\left(\sqrt[3]{3}\right)=\log_3\left(3^2\cdot 3^{\frac{3}{2}}\cdot 3^{\frac{1}{3}}\right)=\log_3 3^{\frac{23}{6}}=\dfrac{23}{6}$

16. $\left[27^{\frac{2}{3}}+64^{\frac{2}{3}}\right]^{\frac{3}{2}}-10^2=\left[9+16\right]^{\frac{3}{2}}-100=25^{\frac{3}{2}}-100=125-100=25$

17. $8^{3x+2} = 4^{5x-1} \rightarrow 2^{9x+6} = 2^{10x-2}$ $9x + 6 = 10x - 2$ $x = 8$

18. $3^x + 3^{-x} = \frac{10}{3} \rightarrow 3^{2x} + 1 - \frac{10}{3}\left(3^x\right) = 0$ If $y = 3^x$ then $y^2 - \frac{10}{3}y + 1 = 0 \rightarrow$

(3y-1)(y-3)=0 → y = 1/3 and y = 3 $\frac{1}{3} = 3^x$ $x = -1$, $3^x = 3$ $x = 1$ sum = 0

19. $6x^{\frac{-1}{2}} - 17x^{\frac{-1}{4}} = -5$ $6x^{\frac{-1}{2}} - 17x^{\frac{-1}{4}} + 5 = 0$ $\left(3x^{\frac{-1}{4}} - 1\right)\left(2x^{\frac{-1}{4}} - 5\right) = 0$

$x^{\frac{-1}{4}} = \frac{1}{3}$ $x = 81$; $x^{\frac{-1}{4}} = \frac{5}{2}$ $x = \frac{16}{625}$

20. $x = \left(\frac{1}{2}\right)^4 = \frac{1}{16}$, $\log_4 \frac{1}{16} = -2$

21. $2\ln x = (\ln x)^2$ $(\ln x)^2 - 2\ln x = 0$ $\ln x(\ln x - 2) = 0$

$\ln x = 0$ $x = 1$ or $\ln x = 2$, $x = e^2$

22. $A = \frac{\log 225}{\log 8} = \frac{2\log 15}{3\log 2} = \frac{2}{3}(\log_2 15) = \frac{2}{3}B$, $\frac{A}{B} = \frac{2}{3}$

23. $\frac{e^x + \frac{1}{e^x}}{e^x - \frac{1}{e^x}} = \frac{\frac{e^{2x}+1}{e^x}}{\frac{e^{2x}-1}{e^x}} = \frac{e^{2x}+1}{e^{2x}-1} = 2$ $e^{2x} + 1 = 2e^{2x} - 2$ $e^{2x} = 3$ $2x = \ln 3$ $x = \frac{1}{2}\ln 3$

24. $3^{20} > (32)^x$ $3^{20} > 2^{5x}$ $\sqrt[5]{3^{20}} > \sqrt[5]{2^{5x}}$ $3^4 > 2^x$ $81 > 2^x$ $2^6 = 64$ $2^7 = 128$ $\therefore x = 6$

25. $(\ln x)^3 - 4\ln x = 0$ $\ln x\left((\ln x)^2 - 4\right) = 0$ $\ln x = 0$ $x = 1$ or $\ln x = \pm 2$ $x = e^2, \frac{1}{e^2}$

26. $\log_b 14 - \log_b 3 - \log_b b = \log_b 2 + \log_b 7 - \log_b 3 - 1 = 0.2789 + 0.7831 - 0.4421 - 1 = -0.3801$

27. $\ln(x-2) - \ln(e) = \ln(x+2)$, $\ln\left(\frac{x-2}{e}\right) = \ln(x+2)$, $x - 2 = e(x+2)$, $x(1-e) = 2 + 2e$,

$x = \frac{2+2e}{1-e}$

28. $y = 9 - 4x$ $4 + 2y = 3x$ $4 + 18 - 8x = 3x$ $22 = 11x$ $x = 2$ y=1

29. $8e^{2x} + 27 = 35e^x$ $8e^{2x} - 35e^x + 27 = 0$ $\left(8e^x - 27\right)\left(e^x - 1\right) = 0$ $e^x = \frac{27}{8}$

$x = \ln\left(\frac{27}{8}\right)$, $e^x = 1$ $x = 0$ sum= $\ln\left(\frac{27}{8}\right)$

30. $\log_x 3 + \log_x 4 + \log_x 5 = \log_x 60 = \frac{1}{\log_{60} x}$