

Theta Logs and Exponents
2008 National Convention

1. C

2. A

3. B

4. B

5. C

6. A

7. C

8. B

9. A

10. B

11. D

12. A

13. A

14. C

15. E (-448)

16. A

17. B

18. B

19. D

20. C

21. D

22. E (18)

23. B

24. A

25. E (8)

26. B

27. C

28. B

29. E ($x \neq 5, -5$)

30. A

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1. $\log \frac{4x^{\frac{1}{2}}}{y^2} = \log \frac{4\sqrt{x}}{y^2}$ **C**
 $e^x = 5e^x - 5$
2. $-4e^x = -5$ **A**
 $e^x = \frac{5}{4}$
 $x = \ln \frac{5}{4}$
 $90 = 75 + 5e^{\frac{\ln 3}{8}t}$
3. $3 = e^{\frac{\ln 3}{8}t}$ **B**
 $t = 8$
4. $1.5P = Pe^{1t}$ **B**
 $1.5 = e^{1t}$
 $\frac{\ln 1.5}{0.1} = t$
5. $9^3 = 3^2 9^2$ **C**
 $2 + 3 = 5$
6. $\frac{1}{3}[\log_b 4 + 5 \log_b x + 7 \log_b y]$ **A**
7. *characteristic* = 2 **C**
mantissa = 0.6385
8. $y = 2e^{-0.21t}$ **B**
 $f(x) = -\log_3(x+2) - 4$
9. $x + 2 = 0$ **A**
 $x = -2$
10. $\frac{(\log 3^5)(\log 5^4)(\log 6^3)}{(\log 6^2)(\log 3^6)(\log 5^2)} = \frac{(5 \log 3)(4 \log 5)(3 \log 6)}{(2 \log 6)(6 \log 3)(2 \log 5)} = \frac{60}{24} = \frac{5}{2}$ **B**
 $3^{-x}(9^{2x^2}(27^{-7x}(243^{-\frac{2}{5}})))$
 $3^{-x}(9^{2x^2}((3^3)^{-7x}(3^{-2})))$
11. $3^{-x}(9^{2x^2}((3^{-21x})(3^{-2})))$ **D**
 $3^{-x}((3^2)^{2x^2}((3^{-21x-2})))$
 $3^{-x}((3^{4x^2})(3^{-21x-2})) = 3^{4x^2-22x-2}$

$$2^8 \approx 250, 3^5 \approx 250$$

$$2^{2008} \geq 250^{251}, 3^{1004} \approx 250^{201}$$

12. $\frac{1}{8}^{-502} = 2^{-3(-502)} = 2^{1506}$ **A**

$$\frac{1}{9}^{-251} = 3^{-2(-251)} = 3^{502}$$

$$(2^6)^{-x} = 2^{10}$$

13. $-6x = 10$ **A**

$$x = \frac{-5}{3}$$

$$4x^2 + 43x - 62 = 2$$

14. $4x^2 + 43x - 64 = 0$ **C**

$$\frac{c}{a} = \frac{-64}{4} = -16$$

15. $C(8,3)(2x)^3(-y)^5$ **E = -448**
 $-448x^3y^5$

16. $\left(-\frac{i}{2}\right)^{2008} = \left(\frac{-1}{2}\right)^{2008} i^{2008}$ **A**

$$\frac{1}{2^{2008}}(1) = \frac{1}{2^{2008}}$$

$$6^x(6^{2x}) = 54$$

17. $6^{3x} = 54$ **B**
 $3x \log 6 = \log 54$

$$x = \frac{\log 54}{3 \log 6}$$

18. $\left(x^{\frac{2}{3}} - 27\right)\left(x^{\frac{2}{3}} - 64\right) = 0$ **B**

$$x^{\frac{2}{3}} = 27, 64$$

$$x = 27^{\frac{3}{2}}, 64^{\frac{3}{2}}$$

$$\sum x = 27^{\frac{3}{2}} + 64^{\frac{3}{2}}$$

$$8x^2(2x-1) + 15(2x-1) \text{ grouping}$$

19. $(8x^2 + 15)(2x - 1) > 0$ **D**

$$8x^2 + 15 \neq 0, 2x - 1 = 0, x = \frac{1}{2}$$

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

20. $\left[\frac{(x^2 - y^2)^{-3}}{-(x+y)^{-4}}\right]^{\frac{-2}{3}} = \left[\frac{-(x+y)^4}{(x^2 - y^2)^3}\right]^{\frac{-2}{3}} = \left[\frac{-(x+y)(x+y)(x+y)(x+y)}{(x-y)(x+y)(x-y)(x+y)(x-y)(x+y)}\right]^{\frac{-2}{3}}$ **C**

$$\left[\frac{-(x+y)}{(x-y)(x-y)(x-y)}\right]^{\frac{-2}{3}} = \left[\frac{(x-y)^3}{-(x+y)}\right]^{\frac{2}{3}} = \frac{(x-y)^2}{-(x+y)^{\frac{2}{3}}}$$

- $a = 10, (1, \frac{1}{10})$
 $a = 100, (\frac{1}{2}, \frac{1}{100})$
 $a = 1000, (\frac{1}{3}, \frac{1}{1000})$
21. **D**
- $$\frac{6+3+2}{6} + \frac{100+10+1}{1000} = \frac{5833}{3000}$$
22. AB has to be a multiple of 11 since the first and last digit of DED are the same. $22^2 = 484$
18 E
23. Lions = 64 (4 legs) = 256 , Tigers = 625 (4 legs)=2500 , Bears = 100,000 (4 legs) = 402,756 **B**
24. Let $x = a^{2b} = 5$, So $3a^{6b} + 8 = 3(x^3) + 8 = 3(5)^3 + 8 = 383$ **A**
25. $4^0 = 1, 3^1 = 3, 2^3 = 8$ **E**
26. $6(6^6) = 6^7$ **B**
27. $i-1+1-(-i) = 0 + 2i = 2$ **C**
28. $120e^{.02(100)} = 120(2.72^2) = \$887.808 \approx \$888$ **B**
29. Because of the absolute value, the only values in the domain that will not work are 5 and -5. **E**
30. $\frac{\log b^2 \cdot \log a}{\log a \cdot \log 5} = 6, 5^6 = b^2, b = 5^3 = 125$ **A**