9.7

SM3 Solving Logarithmic Equations 2019-2020

23pt

Name Key Date ______ Period ______

Find the exact solution algebraically, and check it by substituting into the original equation. Show work!

1. $32\left(\frac{1}{4}\right)^{x/3}=2$

$\left(\frac{1}{4}\right)^{x/3}=\frac{1}{16}$

$4^{-1(\frac{x}{3})}=4^{-2}$

$\left(-\frac{x}{3}=-2\right)\cdot -3$

$\boxed{x=6}$ +1

2. $2\cdot 5^{x/4}=250$

$5^{x/4}=125$

$5^{x/4}=5^3$

$\frac{x}{4}=3$

$\boxed{x=12}$ +1

3. $3\left(5^{-x/4}\right)=15$

$5^{-x/4}=5^1$

$-\frac{x}{4}=1$

$\boxed{x=-4}$ +1

4. $\log_2 x=5$

$2^5=x$

$\boxed{32=x}$ +1

5. $\log x=3$

$10^3=x$

$\boxed{1000=x}$ +1

6. $\log_4(x-5)=-1$

$4^{-1}=x-5$

$\frac{1}{4}=x-5$

$\boxed{5\frac{1}{4}=x}$ +1

Solve each equation. If necessary, obtain a numerical approximation for your solution by rounding to the nearest ten thousandths. Check your solution by substituting into the original equation. Show work!

minus ½ if you round wrong

7. $3^x=25$

$\log_3 25=x$

$\frac{\log 25}{\log 3}=x$

$\boxed{x\approx 2.9299}$ +1

8. $0.95^x=1.3$

$\log_{.95}1.3=x$

$\frac{\log 1.3}{\log .95}=x$

$\boxed{x\approx -5.1150}$ +1

9. $40e^{0.025x}=200$

$e^{.025x}=5$

$\ln 5=.025x$

$\frac{\ln 5}{.025}=x$ +1

$\boxed{x\approx 64.3775}$

10. $3+2e^{-x}=11$

$2e^{-x}=8$

$e^{-x}=4$

$\ln 4=-x$

$-\ln 4=x$ +1

$\boxed{x\approx -1.3863}$

11. $4^{5-x}-2=13$

$4^{5-x}=15$

$\log_4 15=5-x$

$\frac{\log 15}{\log 4}-5=-x$

$\frac{-\log 15}{\log 4}+5=x$ +1

$\boxed{x\approx 3.0466}$

12. $\ln x^2=6$

$\sqrt{e^6}=\sqrt{x^2}$

$\boxed{x=\pm 20.0855}$

OR

$\frac{2\ln x}{2}=\frac{6}{2}$ +1

$\ln x=3$

$e^3=x$ $\boxed{x\approx 20.0855}$

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13. $\log_{10} x^2 = 4$ or $\frac{2\log x}{2} = \frac{4}{2}$

$\sqrt{10^4} = \sqrt{x^2}$

$\boxed{x = \pm 100}$ +1

$\log x = 2$

$10^2 = x$

$\boxed{x = 100}$

14. $\log_3(3x - 2) = 3$

$3^3 = 3x - 2$

$27 = 3x - 2$

$29 = 3x$

$\boxed{x = \frac{29}{3}}$ +1

15. $\log_3 x = \log_3 7$

$\boxed{x = 7}$ +1

16. $\log_5 x = \log_5(2x - 3)$

$x = 2x - 3$

$-x = -3$

$\boxed{x = 3}$ +1

17. $\log_{10} 2 + \log_{10}(x + 21) = 2$

$\log_{10} 2(x + 21) = 2$

$\log_{10} 2x + 42 = 2$

$10^2 = 2x + 42$

$100 = 2x + 42$

$58 = 2x$

$\boxed{x = 29}$ +1

18. $\log_9 5 + \log_9(n + 1) = \log_9 6n$

$\log_9 5(n+1) = \log_9 6n$

$\log_9 5n+5 = \log_9 6n$

$5n + 5 = 6n$

$\boxed{5 = n}$ +1

19. $\log_3 2 + \log_3 8 = \log_3 2x$

$\log_3 (2 \cdot 8) = \log_3 2x$

$16 = 2x$

$\boxed{x = 8}$ +1

20. $\log_5 42 - \log_5 7 = \log_5(3x - 1)$

$\log_5 \frac{42}{7} = \log_5 (3x - 1)$

$6 = 3x - 1$

$7 = 3x$

$\boxed{\frac{7}{3} = x}$ +1

21. The value of a Honda Civic DX that is *t* years old can be modeled by $V(t) = 16{,}775(0.905)^t$.

According to the model, when will the car be worth \$15,000? \$8,000? \$4,000? Show work!

a) $\frac{15000}{16775} = \frac{16775(.905)^t}{16775}$

$.89417779 = .905^t$

$\log_{.905} .89417779 = t$

$\boxed{t \approx 1.12 \text{ years}}$ +1

b) $8000 = 16775(.905)^t$

$.476900149 = .905^t$

$\log_{.905} .476900149 = t$

$\boxed{t \approx 7.42 \text{ years}}$ +1

c) $4000 = 16775(.905)^t$

$.2384500745 = .905^t$

$\log_{.905} .2384500745 = t$

$\boxed{t \approx 14.36 \text{ years}}$ +1

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