Evaluate each of the following.

1. $\log_3 3 =$ *1*

2. $\log_3 9 =$ *2*

3. $\log_3 27 =$ *3*

4. $\log_3 1 =$ *0*

5. $\log_3 \dfrac{1}{3} =$ *-1*

6. $\log_3 \dfrac{1}{9} =$ *-2*

7. $\ln(1) =$ *0*

8. $\log_2 2 =$ *1*

9. $\ln(2) \approx$ *0.693*

10. $\log_2 1 =$ *0*

11. $\ln(e) =$ *1*

12. $\log_2 \dfrac{1}{4} =$ *-2*

Change the following from exponential form to logarithmic form.

13. $5^2 = 25$ $\log_5(25) = 2$

14. $5^{-2} = \dfrac{1}{25}$ $\log_5\left(\dfrac{1}{25}\right) = -2$

15. $A^B = C$ $\log_A(C) = B$

16. $3^0 = 1$ $\log_3(1) = 0$

17. $e^x = 5$ $\ln(5) = x$

18. $e^0 = 1$ $\ln(1) = 0$

Change the following from logarithmic form to exponential form.

19. $\log_3 9 = 2$ $3^2 = 9$

20. $\log_3 \dfrac{1}{9} = -2$ $3^{-2} = \dfrac{1}{9}$

21. $\log_4 8 = \dfrac{3}{2}$ $4^{3/2} = 8$

22. $\log_B C = A$ $B^A = C$

23. $\ln(x) = \dfrac{1}{2}$ $e^{1/2} = x$

24. $\ln(1) = 0$ $e^0 = 1$

Simplify.

25. $e^{3\ln x}$ x^3

26. $e^{\ln(x+4)}$ $x+4$

27. $\ln e^x$ x

28. $\ln e^{x-8}$ $x-8$

KEY

29. The population of whooping cranes was about 22 in 1940 and grew at an exponential rate to about 194 in 2003.

a. Use the exponential growth function $A(t) = Pe^{rt}$ to determine the growth rate.

$R = 0.034553$ $194 = 22e^{R(63)}$ $\ln\left(\frac{194}{22}\right) = \ln\left(e^{R(63)}\right)$
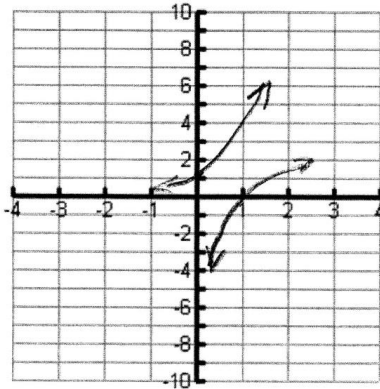
3.46%

b. If the flock continues to grow at the same rate, how large will it be in 2020?

$t = 80$ 349 CRANES

30. Graph the following inverse functions on the same graph. Then find the following characteristics about each graph. Write "**none**" if it does not exist.

$y = 4^x$

Domain _All REALS_

Range _y > 0_

x-intercept _None_

y-intercept _1_

Equation of asymptote _y = 0_

End behavior
As $x \to -\infty$, $f(x) \to$ _0_
As $x \to +\infty$, $f(x) \to$ _+∞_

$y = \log_4 x$

Domain _x > 0_

Range _All REALS_

x-intercept _1_

y-intercept _None_

Equation of asymptote _x = 0_

End behavior
As $x \to 0$, $f(x) \to$ _-∞_
As $x \to +\infty$, $f(x) \to$ _+∞_