Write an equivalent exponential or logarithmic function.

1. $e^x = 30$

2. $\ln x = 42$

3. $e^3 = x$

4. $\ln 18 = x$

Write each as a single logarithm.

5. $3 \ln 2 + 2 \ln 4$

6. $5 \ln 3 - 2 \ln 9$

7. $3 \ln 6 + 2 \ln 9$

8. $3 \ln 5 + 4 \ln x$

Solve each equation. Round to the nearest ten-thousandth.

9. $5e^x - 24 = 16$

10. $-3e^x + 9 = 4$

11. $3e^{-3x} + 4 = 6$

12. $2e^{-x} - 3 = 8$

Solve each equation or inequality. Round to the nearest ten-thousandth.

13. $\ln 3x = 8$

14. $-4 \ln 2x = -26$

15. $\ln (x + 5)^2 < 6$

16. $\ln (x - 2)^3 > 15$

17. $e^x > 29$

18. $5 + e^{-x} > 14$

19. **SCIENCE** A virus is spreading through a computer network according to the formula $v(t) = 30e^{0.1t}$, where v is the number of computers infected and t is the time in minutes. How long will it take the virus to infect 10,000 computers?

1. $e^x = 30$

ANSWER:
$\ln 30 = x$

2. $\ln x = 42$

ANSWER:
$e^{42} = x$

3. $e^3 = x$

ANSWER:
$\ln x = 3$

4. $\ln 18 = x$

ANSWER:
$e^x = 18$

5. $3 \ln 2 + 2 \ln 4$

ANSWER:
$7 \ln 2$

6. $5 \ln 3 - 2 \ln 9$

ANSWER:
$\ln 3$

7. $3 \ln 6 + 2 \ln 9$

ANSWER:
$\ln 17496$

8. $3 \ln 5 + 4 \ln x$

ANSWER:
$\ln 125\, x^4$

9. $5e^x - 24 = 16$

ANSWER:
2.0794

10. $-3e^x + 9 = 4$

ANSWER:
0.5108

11. $3e^{-3x} + 4 = 6$

ANSWER:
0.1352

12. $2e^{-x} - 3 = 8$

ANSWER:
-1.7047

13. $\ln 3x = 8$

ANSWER:
993.6527

14. $-4 \ln 2x = -26$

ANSWER:
332.5708

15. $\ln (x + 5)^2 < 6$

ANSWER:
$\{x \mid -25.0855 < x < 15.0855, x \neq -5\}$

16. $\ln (x - 2)^3 > 15$

ANSWER:
$\{x \mid x > 150.4132\}$

17. $e^x > 29$

ANSWER:
$\{x \mid x > 3.3673\}$

18. $5 + e^{-x} > 14$

ANSWER:
$\{x \mid x < -2.1972\}$

19. **SCIENCE** A virus network according $v(t) = 30e^{0.1t}$, whe infected and t is th take the virus to in

ANSWER:
about 58 min