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10.5. Advanced Algebra Base e and Natural Logarithms

DATE: 12/13

Target 4E. Solve exponential and logarithmic equations.

e , the natural base: the irrational number 2.71828...

e^x - key

Evaluate Natural Base Expressions

Use a calculator to evaluate each expression to four decimal places.

1. $e^2 \approx 7.3891$ 2. $e^{-1.5} \approx 0.2231$ 3. $e^{-8} \approx 0.0003$ 4. $e^{0.5} \approx 1.6487$

\ln , the natural logarithm: $\log_e x = \ln x$

$$\log_e = \ln x$$

ctrl e^x

Evaluate Natural Logarithmic Expressions

Use a calculator to evaluate each expression to four decimal places.

5. $\ln 4 \approx 1.3863$ 6. $\ln 0.05 \approx -2.9957$ 7. $\ln 3 \approx 1.0986$ 8. $\ln \frac{1}{4} \approx -1.3863$

Inverse Property of Base e and Natural Logarithms

Evaluate each expression.

$$\log_e e^{4x+3}$$

$$e^{\log_e 21}$$

$$\log_e e^{\frac{1}{5}}$$

$$e^{\log_e 7}$$

9. $e^{\ln 7} = 7$

10. $\ln e^{4x+3} = 4x+3$

11. $e^{\ln 21} = 21$

12. $\ln e^{\frac{1}{5}} = \frac{1}{5}$

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Solve Base e Equations

Solve each equation.

13. $5e^{-x} - 7 = 2$

$$\frac{+7+7}{5e^{-x} = \frac{9}{5}}$$

$$e^{-x} = \frac{9}{5}$$

$$e^{-x} = \frac{9}{5}$$

$$\log_e \frac{9}{5} = -x$$

$$\frac{\ln \frac{9}{5}}{-1} = -x$$

$$\therefore x = -0.5878$$

14. $3e^{-2x} + 4 = 10$

$$\frac{-4-4}{3e^{-2x} = \frac{6}{3}}$$

$$e^{-2x} = 2$$

$$e^{-2x} = 2$$

$$\log_e 2 = -2x$$

$$\frac{\ln 2}{-2} = -2x$$

$$\therefore x = -0.3466$$

15. $2e^x - 5 = 1$

You try it!

16. $3 + e^{-2x} = 8$

You try it!

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Solve Natural Log Equations

Solve each equation.

17. $\ln 5x = 4$

$$\log_e 5x = 4$$

$$\frac{e^4}{5} = \frac{5x}{5}$$

$$\underline{10.9196} \approx x$$

19. $\ln 3x = 0.5$

You try it!

18. $\ln(x-1) = -2$

$$\log_e x-1 = -2$$

$$e^{-2} = x-1$$

$$e^{-2} + 1 = x$$

$$\underline{1.1353} \approx x$$

20. $\ln(2x-3) = 2.5$

You try it!