Solving Logarithmic & Exponential Equations

Coloring Sheet

Solve each equation. Remember to show your work. You may use scratch paper if necessary. Match an answer from an exponential equation with an answer from a logarithmic equation. Then color accordingly. Enjoy! 😊

A. $4^{-4x+5} + 2 = 18$	Green $\log_5(3x+8) = \log_5(6x-5)$
B. $2 + 81^{x-2} = 11$	Purple $\log_4(12x+4) = 3$
C. $25^{x+3} + 10 = 35$	Yellow $\log_7(16x+9) = 2$
D. $6^{3x+7} = 36^{x+6}$	Red $\log_3(8x-3) = 3$
E. $4^{x+3} = 16^{2x-5}$	Pink $(4x-1)\log_9 4 = \log_9 16$
F. $8^{x-6} = \frac{1}{2^{5x-12}}$	Brown $\log_2(8) + \log_2(2-7x) = 7$

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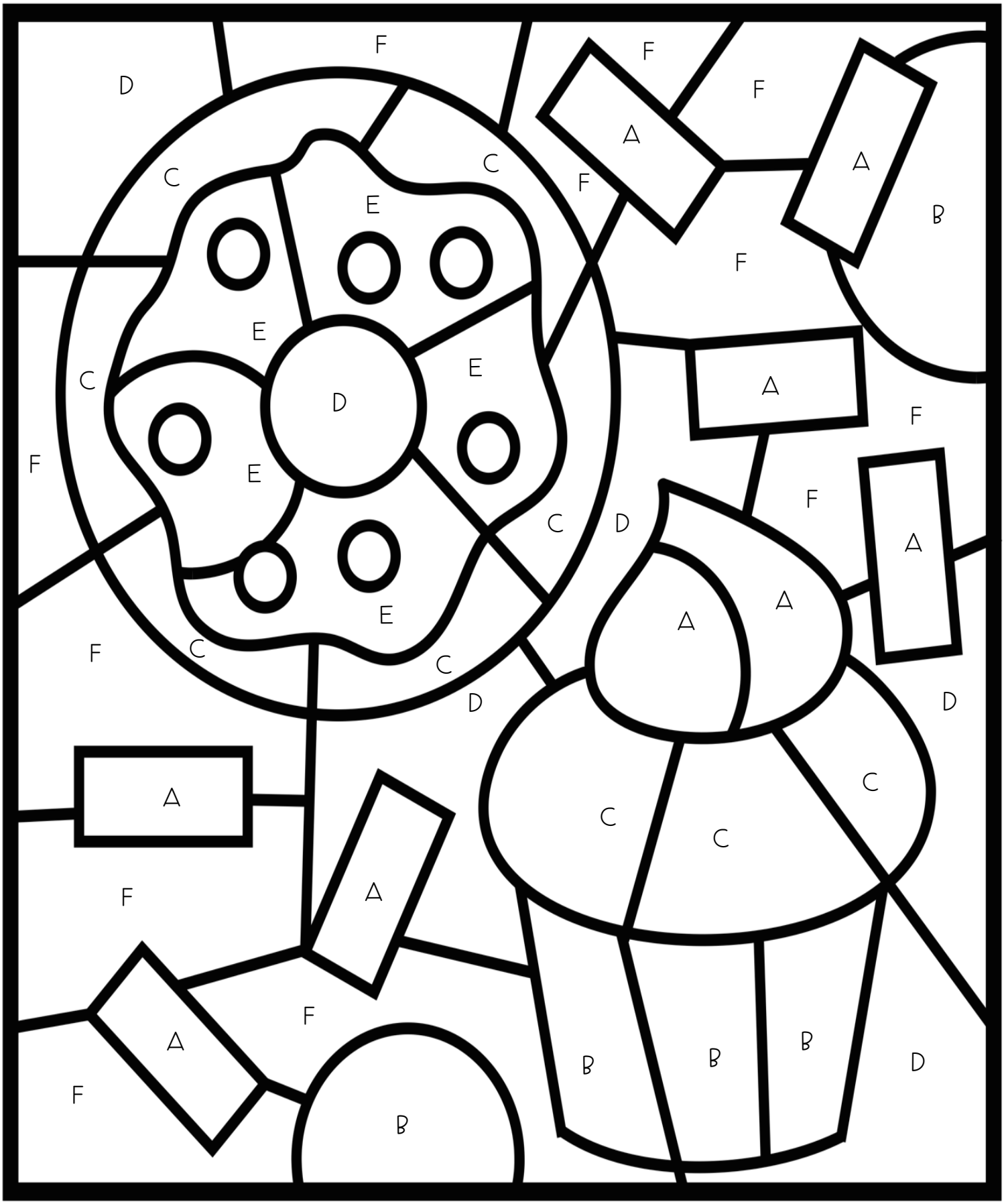


Solving Logarithmic Equations

Type 1: log=log

❶	Condense the logarithms on each side of the equation.
❷	Use the one-to-one property: **If $\log_b x = \log_b y$, then**
❸	Solve and check for extraneous solutions.

$\log_3(7x-1) = \log_3(5x+17)$

$\ln(x^2 - 4x) = \ln(x - 14)$

Type 2: log=number

❶	Condense and isolate the logarithm.
❷	Rewrite the equation in exponential form.
❸	Solve and check for extraneous solutions.

$\log_2(3x-4) = 7$

$\ln 2x = 9$

Solving Exponential Equations

Using Logarithms

1. Isolate the exponential expression.
2. Take the logarithm of each side.
3. Expand the logarithms if necessary using the power rule.
4. Solve and check for extraneous solutions.

$3^x = 80$

$e^x = 140$

$5^{x+1} = 18$

$\left(\frac{1}{3}\right)^{2x-5} = 18$

Using a Common Base

1. Rewrite the equation using a common base.
2. Use the properties of exponents to simplify each side of the equation.
3. Use the one-to-one property: If $b^x = b^y$, then $x = y$
4. Solve!

$3^{2x-9} = 3^7$

$e^{4x-1} = e^{5-2x}$

$9^{4x-26} = 81$

$2^{x-9} = 32^{x+3}$

LOGARITHMIC & EXPONENTIAL EQUATIONS Raviay!

LOGARITHMIC EQUATIONS

1. $\log_7(x+13) = \log_7(3-x)$

2. $\log_2(n^2+13) = \log_2(n-1) + \log_2(n+3)$

3. $2 \cdot \ln(a+3) = \frac{1}{4} \cdot \ln 16 + \ln(a+7)$

4. $\log(3c+4) - \log(c-6) = \log(c+6)$

5. $\log_2(5v+23) - 9 = -2$

6. $\log_{16}(p+5) - \log_{16}(p-2) = \frac{1}{2}$

7. $\ln(r+1) + 3 \cdot \ln 2 = 7$

8. $\frac{1}{3} \cdot \log_9 64 + 2 \cdot \log_9 n = 2$

EXPONENTIAL EQUATIONS

9. $\left(\frac{1}{27}\right)^{2x-6} = 9^{x-1}$

10. $4^{3m+1} = \left(\frac{1}{8}\right)^{m+4} \cdot 32^{m-2}$

11. $5^{w-1} = 90$

12. $e^{3r-2} - 16 = 120$

13. $-4 \cdot 9^{2k+5} + 14 = 6$

14. $\frac{2}{3} \cdot 5^{m-8} - 9 = 21$

15. $3^{4x+1} = 8^{x-5}$

16. $4^{2x+3} = 7^{15-2x}$

MONETARY GROWTH

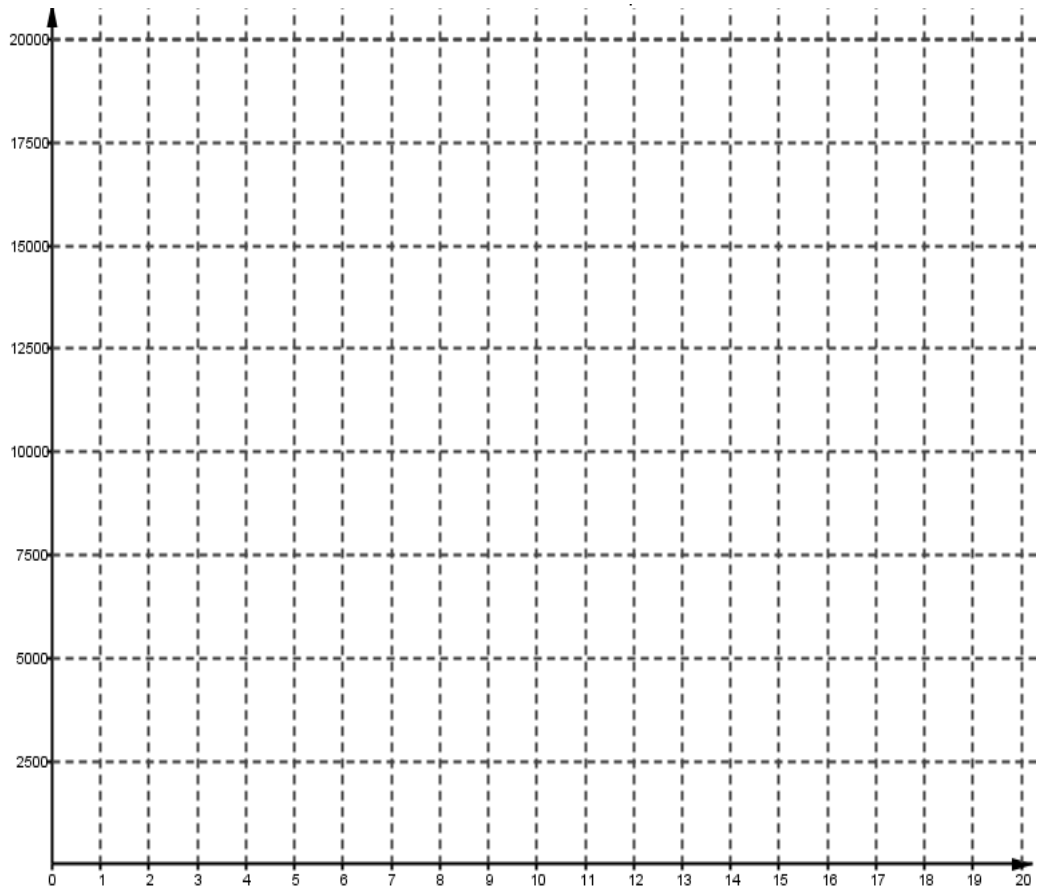
You inherit $5,000 from your long lost Uncle Harold. The bad news is that the money must sit in a bank account for the next ten years until you can use it. The account earns 7.2% interest, compounded annually. This means that you will need to multiply the amount of money by 1.072 to determine how much money remains at the end of the next year.

Fill in the chart below to determine how much money is in the account at the end of each year.
Round to the nearest penny!

# of years	0	1	2	3	4	5	6
$ in account							

Use the chart above to create a graph.

Uncle Harold's Cash Graph

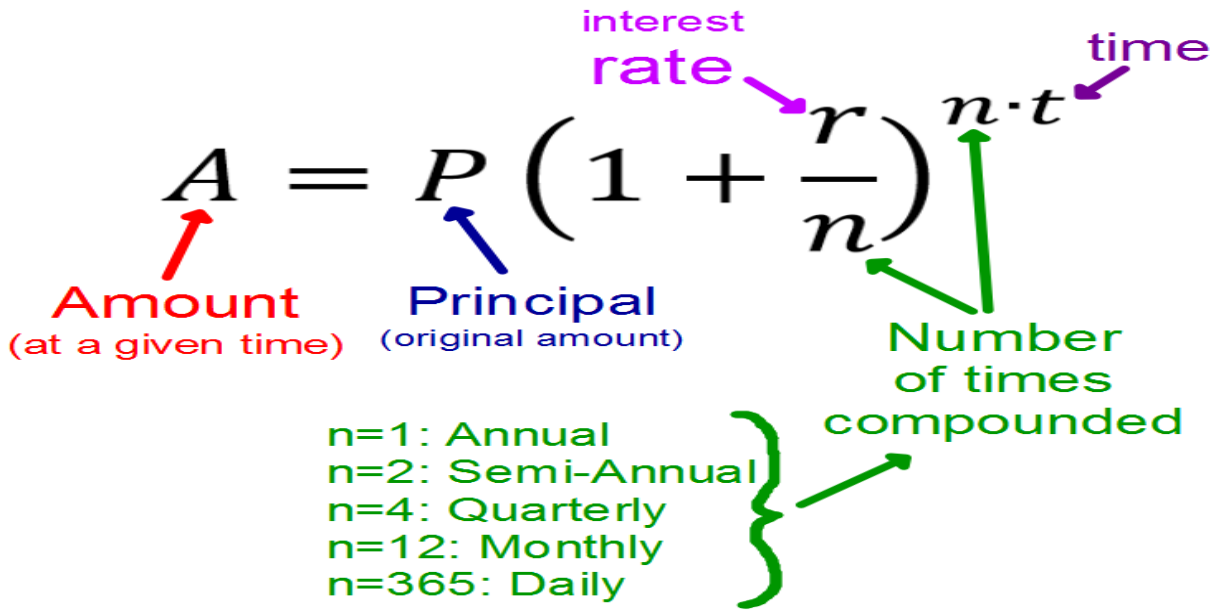


- According to the chart, approximately when will your original inheritance double in size? _____ years

The compound interest formula is pictured on the following page.

- Create a formula using the information from the Uncle Harold story.

_____



Uncle Harold Formula: _____

Use this formula to find the balance (the amount of money that would be in the account) at the end of ten years.

equation: _____ balance: $_____

Use this formula to find the balance if you let all of the money earn interest for 20 years. (Show work below.)

equation: _____ balance: $_____

Plot these two points on the Uncle Harold's Cash Graph and connect all of the points on the graph. Label this line: "My Money"

You are surprised to learn that your brother also received money from Uncle Harold. He only received $4000, but his account is earning 12% interest, compounded monthly.

Write the equation that represents the money in your brother's account over time.

_____

Fill in the chart below, using the equation above. Remember that you should type (n·t) in parenthesis!

# of years	0	2	4	6	8	10	12
$ in account							

Plot the points on the Uncle Harold's Cash graph. Connect the points with a line, and label it: "BRO'S MONEY".

Approximately when will your brother's account have more money than yours?

Between _____ and _____ years.

How much more money will your brother's account have than yours if you both leave the money in the accounts for 20 years?

$_____