

WITHOUT A CALCULATOR

For questions 1 and 2, write your answer as a power of 3.

1. $3^3 \cdot 27$

2. $81 \cdot 9$

For questions 3 and 4, evaluate when $x = 3$.

3. $12(2^x)$

4. $1024\left(\frac{1}{2}\right)^x$

For questions 5 – 16, simplify using the properties of exponents.

5. 7^{-3}

6. 19^0

7. $27^{\frac{2}{3}}$

8. $25^{-\frac{3}{2}}$

9. $81^{-\frac{3}{4}}$

10. $121^{\frac{1}{4}} \cdot 121^{\frac{3}{4}}$

11. $8^{\frac{3}{2}} \cdot 8^{\frac{1}{2}}$

12. $\frac{16^{\frac{3}{2}}}{16^2}$

13. $8^{\frac{5}{3}} \cdot 8^{-\frac{2}{3}}$

14. $\frac{36^{\frac{7}{4}}}{36^{\frac{3}{4}}}$

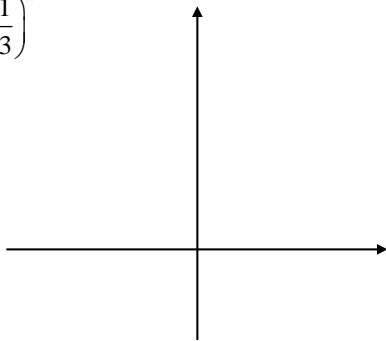
15. $(4^6)^{\frac{1}{3}}$

16. $(125^{\frac{1}{4}})^{\frac{2}{3}}$

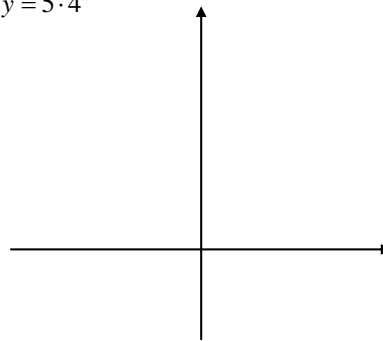
For questions 17 and 18, do the following 3 things:

- a) Find the y – intercept of the graph.
- b) Tell whether the graph represents exponential growth or exponential decay.
- c) Sketch the graphs. LABEL at least 2 points.

17. $y = \left(\frac{1}{3}\right)^x$



18. $y = 5 \cdot 4^x$



For questions 19 and 20, write an exponential equation to model each situation.

19. You purchased a painting for \$1900. It has been increasing in value by 8% each year.

20. Your car was worth \$24,000 when it was purchased new. It has been decreasing in value by 12% each year.

CALCULATOR ALLOWED

You may use your calculator to ANSWER each question, but you MUST SHOW what you did on the calculator to arrive at your solution.

1. Coca-Cola has been increasing its sales in Colorado by 3% per year. In 2000, there were \$438,000 in sales.
 - a) Write an exponential equation to model this situation. Let $t = 0$ be 2000.
 - b) Use the equation in part *a* to estimate the amount of sales in 1995 and 2010. Round your answer to the nearest dollar.

2. A certain pain relieving medication is eliminated from the bloodstream at the rate of about 4% per hour in adults. The original dosage of the medication is 60 mg.
 - a) Write an exponential equation for the amount of medication that remains in the bloodstream after x hours.
 - b) How much is left in your body after 10 hours?
 - c) How many hours will it take for half the medication to be eliminated? *Explain* how you arrived at this answer.
 - d) ~~Write the equation of the form $y = a\left(\frac{1}{2}\right)^{\frac{x}{h}}$ for the amount remaining after x hours.~~

For questions 3 – 7, use the table below which shows the amount of the US national debt per US citizen.

Year	1980	1981	1982	1983	1984	1985	1986
Debt per Citizen	\$3985	\$4338	\$4918	\$5870	\$6640	\$7598	\$8774

- ~~3. Find the average growth rate for the debt. Round your answer to 3 decimal places.~~
4. Write an exponential equation that models the growth of the debt as a function of the number of years after 1980.
5. Use the equation you found in question 5 to predict the debt in 1995.
6. Use the equation you found in question 5 to predict the debt in 1975.
7. Use the equation you found in question 5 to predict when the debt will reach \$120,000 per citizen.

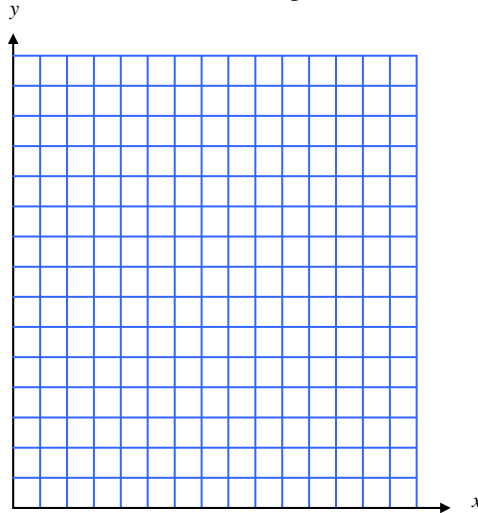
For questions 8 - 10, use the equations $B = P\left(1 + \frac{r}{n}\right)^{nt}$ and $B = Pe^{rt}$.

8. You invested \$1500 into a bank account that promises to give you 5% interest compounded monthly. How much is in your account after 2 years?
9. How long will it be until your money doubles?
10. Suppose your bank decides to change to a rate of 4.5% interest compounded continuously. How much is in your account after 3 years?

11. 100 mg of Neptunium-236 decays radioactively according to the equation $y = 100e^{-0.0308x}$ where x is in hours.
- ~~Use a graphing calculator to graph this function.~~
 - ~~Write an equation in the form $y = ab^x$.~~
 - Calculate how many hours it takes for the Neptunium-236 to be reduced by half.
 - ~~Write an equation in the form $y = a(\frac{1}{2})^{x/h}$ where h is the half life of Neptunium 236.~~
12. The table below gives the per person (per capita) expenditure for health care in the U.S. during selected years.

Year	1960	1965	1970	1975	1980	1985	1990
Health Care Expenditure	\$143	\$204	\$346	\$592	\$1064	\$1701	\$2601

- a. ~~Let x = number of years after 1960. Draw a scatter plot of the data.~~



- Use the health care data for 1965 and 1970 to write an exponential function that models the data. (DO NOT USE YOUR CALCULATOR TO RUN A REGRESSION FOR THIS!!!) Show your work below.
- Now, enter your data into the calculator and find the exponential regression equation that fits.
- Use the equation you found in part (c) to estimate the per capita health care expenditures in 1957 and 2003.