Name: _____ Date: _____ Period: _____   **ID: 1**

) 9 Review – Exponents & Logarithms

Unit 9 Equations Any other equations not listed will be given in the application problem	Exponential Growth or Decay $y = ab^x$	Compounding Interest $A = Pe^{rt}$ or $A = P\left(1 + \frac{r}{n}\right)^{nt}$

Part 1 – #1-11 No graphing calculator.

1. Under each function, write "yes" if it is an **exponential** function. If the answer is "no", write an explanation why not.

   a) $y = 3x^5$

   No, x isn't the exp.

   b) $y = -2\left(\frac{3}{4}\right)^x$

   yes

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2. Tell whether the equation represents an exponential growth or exponential decay function.

   a) $y = -0.5\left(\frac{3}{2}\right)^x$ growth

   b) $y = -3(e)^{-x}$ growth decay

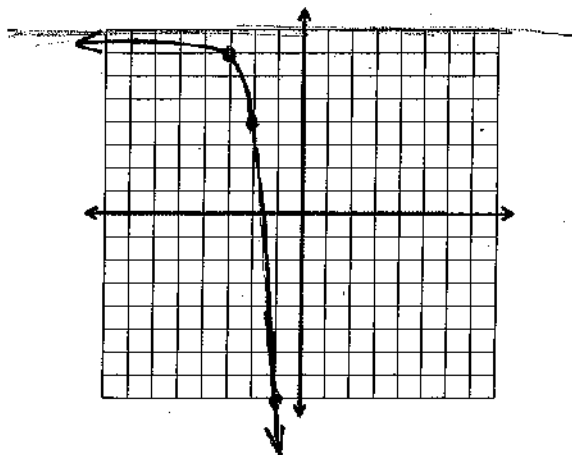| 3. Rewrite $\log_{16}\frac{1}{4} = -\frac{1}{2}$ in exponential form. $16^{-1/2} = 1/4$	4. Rewrite $3^{-4} = \frac{1}{81}$ in logarithmic form. $\log_3 1/81 = -4$	5. Evaluate $\log_{36} 6$ $36^? = 6$ $? = 1/2$

For 6-7, sketch the graph of each exponential function by doing the following: Sketch the asymptote, label at least two distinct coordinate points on each graph, and write the domain and range of each function.
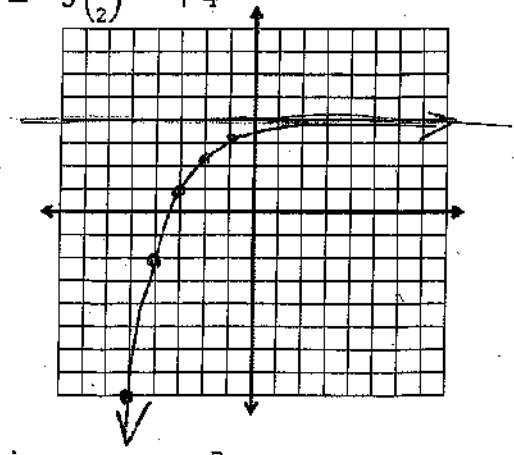
6. $y = -4(4)^{x+2} + 8$	7. $y = -3\left(\frac{1}{2}\right)^{x+3} + 4$

Domain: $\mathbb{R}$ Range: $y < 8$

Domain: $\mathbb{R}$ Range: $y < 4$

8. Sketch the graph of the given function by doing the following: Sketch the asymptote, label at least **two distinct coordinate points**, and write the domain and range.
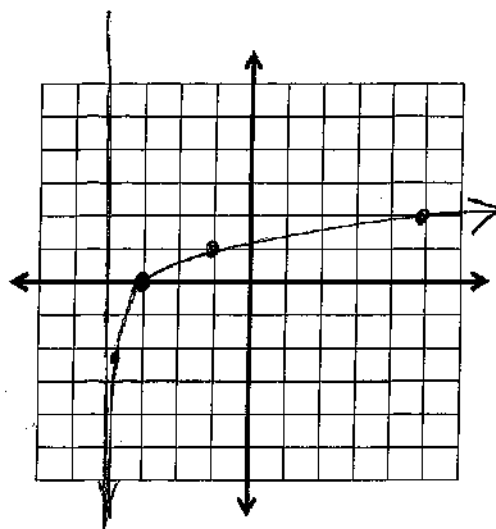
$$f(x) = \log_3(x+4)$$

HA

VA

Domain:

$$X 7 -4$$

Range:

$$\mathbb{R}$$

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9. Simplify $\dfrac{e^x}{(e^{2x})^{-3}}$. Your answer should contain only positive exponents.

$$\frac{e^x}{e^{-6x}} = e^x \cdot e^{6x} = \underline{e^{7x}}$$

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10. Expand $\ln \dfrac{x}{\sqrt{y}}$

$$\ln x - \tfrac{1}{2}\ln y$$

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

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11. Condense to a single logarithm:

$$2\log a + \tfrac{1}{3}\log b - \log c$$

$$\log \frac{a^2 \sqrt[3]{b}}{c}$$

Part 2 – #12-21 Graphing calculator is allowed.

12. Give the **percent increase** or percent **decrease** for each equation.

a) $y = 3(1.13)^x$

$$13\% \text{ Increase}$$

b) $y = 0.3(0.938)^x$

$$6.2\% \text{ Decrease}$$

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13. Use a calculator to approximate $\log_2 9$ to three decimal places. *Show your work by using the change-of-base formula.*

change of base $\left\{ \dfrac{\log 9}{\log 2} = 3.169 \right.$

For #14-16, solve each equation. If necessary, round answers to three decimal places.

14. $5 + \log_2 a = 3$

$$-5 \qquad -5$$

$$\log_2 a = -2$$

$$2^{-2} = a$$

$$\underline{a = \tfrac{1}{4}}$$

15. $-4\log_6(9x) - 7 = -23$

$$+7 \qquad +7$$

$$-16/-4$$

$$\log_6 9x = 4$$

$$6^4 = 9x$$

$$\underline{x = 144}$$

16. $7 \cdot 9^{2p-4} + 3 = 45$

$$-3 \qquad 42/7$$

$$9^{2p-4} = 6$$

$$\log_9 6 = 2p - 4$$

$$\underline{p = 2.408}$$

17. Dennis just inherited $10,000 from a distant relative who passed away. After spending $2,000 on new tank-tops, he puts the rest into a savings account that earns 4.5% interest compounded monthly. How much money will he have after 5 years?

$$8,000 \left(1 + \frac{.045}{12}\right)^{12(5)}$$

$$\boxed{\$10,014.37}$$

18. The value of a new car purchased for $20,000 decreases by 10% per year. Write an exponential decay model for the value of the car. Use the model to estimate the value after 4 years.

$$20,000 \left(1 - .10\right)^{4}$$

$$\boxed{\$13,122}$$

19. Audrey just won the mega-millions lottery! She decided to take a lump sum payment of $250 million dollars. While thinking about what to do with the money, she wondered how much she could earn from the interest each year if it was all put into a savings account that compounded (continuously). She found an account that would pay 2.25% interest. How much **interest** will she gain after one year?

$$250,000,000 e^{.0225(1)}$$

$$-\ \$255,688,758.50$$

$$\boxed{\text{Interest } \$5,688,758.54}$$

20. The magnitude of an earthquake can be modeled by $M = 0.29(\ln E) - 9.9$ where E is the amount of energy released (in ergs). During Mr. Bean's senior year in high school, he woke up to an earthquake that released 8.18×10^{22} ergs. E Mr. Bean's skis actually fell off the wall and he thought there was a monster truck outside his bedroom window...seriously...it was scary! What was the magnitude of this earthquake?

$$0.29 \left(\ln 8.18 \times 10^{22}\right) - 9.9$$

$$\boxed{M = 12.429}$$

21. The decibel level of a sound is given by $D = 10 \log \frac{I}{10^{-12}}$ where I is the intensity of the sound measured in watts per square meter.

   a) What is the decibel level of a police siren if the sound intensity is 3.162×10^{-2} watts per square meter? I

$$10 \log \frac{3.162 \times 10^{-2}}{10^{-12}}$$

$$\boxed{D = 104.999}$$

   b) If an NBA arena has a decibel level (dB) of 120. What is the sound intensity? How many times greater is that sound than a police siren (from part *a*)?

$$120 = 10 \log \frac{x}{10^{-12}}$$

$$12 = \log \frac{x}{10^{-12}}$$
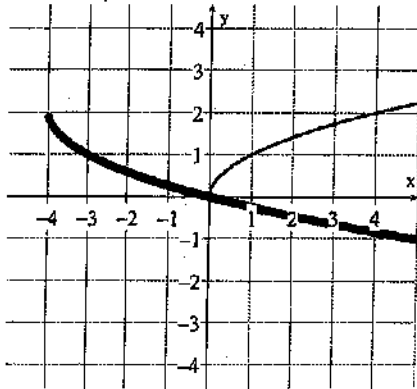
$$10^{12} = \frac{x}{10^{-12}}$$

$$x = 10^{12} \cdot 10^{-12}$$

$$x = 1$$

$$\boxed{.96838 \text{ greater}}$$

1. Below are graphs of $f(x) = \sqrt{x}$ (thin line) and its translation (bold line). Write an equation of the translation.

Simplify the fraction by rationalizing the denominator.

2. $\dfrac{3}{\sqrt{2}}$

3. $\dfrac{21}{5\sqrt{7}}$

Solve by factoring.

4. $x^3 + 2x^2 - 48x = 0$

5. $6x^2 - 23x + 21 = 0$

1. Simplify: $(5^{x-1})(5^{2x+1})^x$

(A) $(5)^{4x}$

(B) $(5)^{3x^2}$

(C) $(5)^{2x^3}$

(D) $(5)^{2x^2+2x-1}$

2. If $f(x) = 6(2)^{3x+1} + 4$, find $f(-1)$.