Unit 3: Study Guide
Math 3

Name: **Key!**

Without graphing, determine whether each equation represents exponential growth or exponential decay. Then find the rate of growth or decay and the initial amount (y-intercept).

1. $y = 0.5(1.67)^x$

Growth

67%

2. $y = 1.14^x$

Growth

14%

3. $y = 2\left(\dfrac{9}{10}\right)^x$

Decay

10%

4. $y = 4.1(0.72)^x$

Decay

28%

5. Mr. Andersen put $1000 into an account that earns 4.5% annual interest. The interest is compounded annually and there are no withdrawals. How much money will be in the account at the end of 30 years?

$$y = a(1+r)^t$$

$$y = 1000(1+0.045)^{30}$$

$$y = 1000(1.045)^{30}$$

$3745.32

6. A manufacturer bought a new rolling press for $48,000. It has depreciated in value at an annual rate of 15%. What is its value 5 years after purchase? Round to the nearest hundred dollars.

$$y = a(1-r)^t$$

$$y = 48000(1-0.15)^5$$

$$y = 48000(0.85)^5$$

$21300

7. You place $900 in an investment account that earns 6% interest compounded continuously. Find the balance after 5 years.

$$y = Pe^{rt}$$

$$y = 900e^{(0.06)(5)}$$

$1214.87

Graph each function as a transformation of its parent function. Identify the end behavior, asymptote, domain, and range.
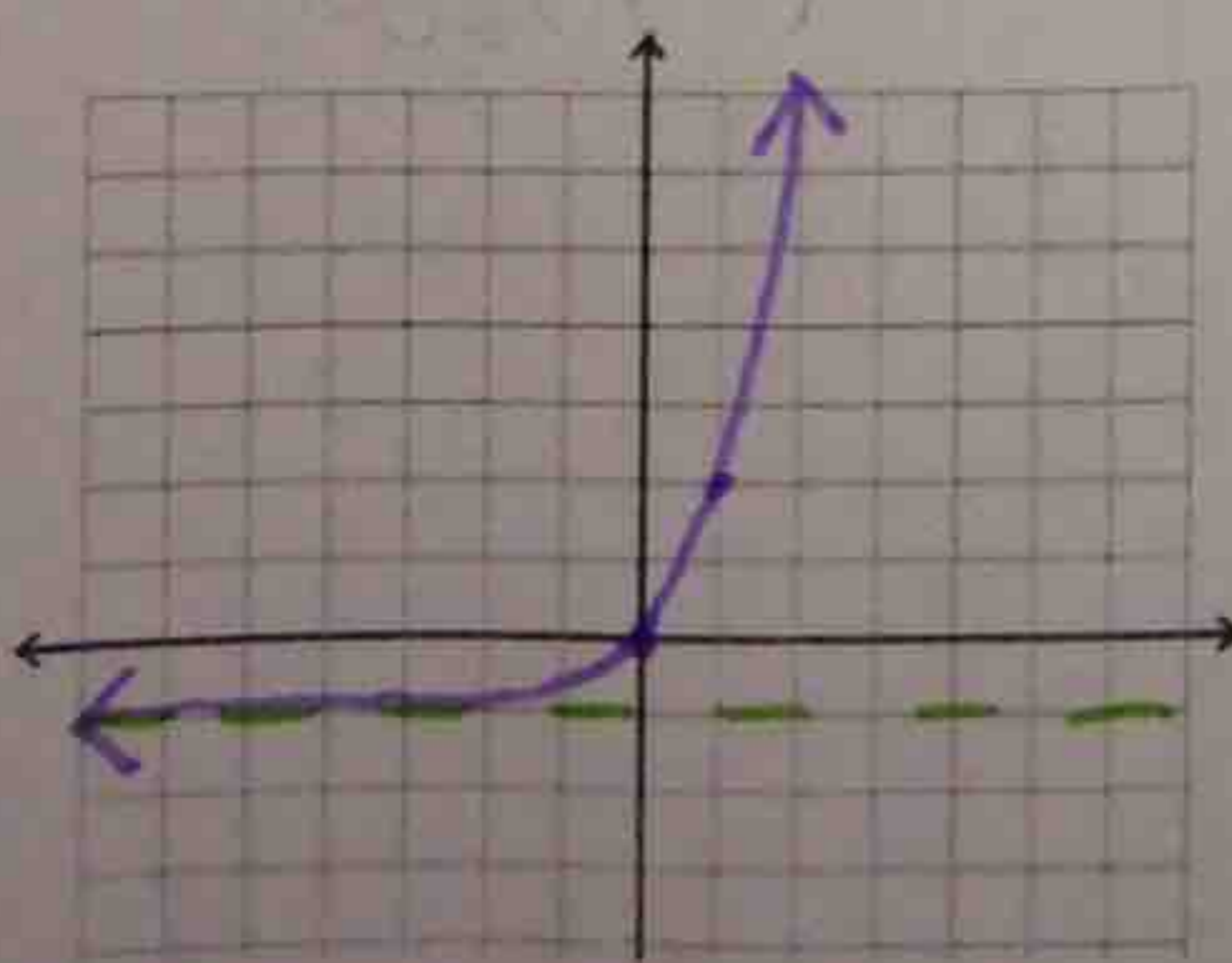
8. $f(x) = 3^x - 1$

Asymptote: $y = -1$

Domain: $(-\infty, \infty)$

Range: $(-1, \infty)$

$f^{-1}(x) = \log_3(x+1)$

$3^{x-1} = y$
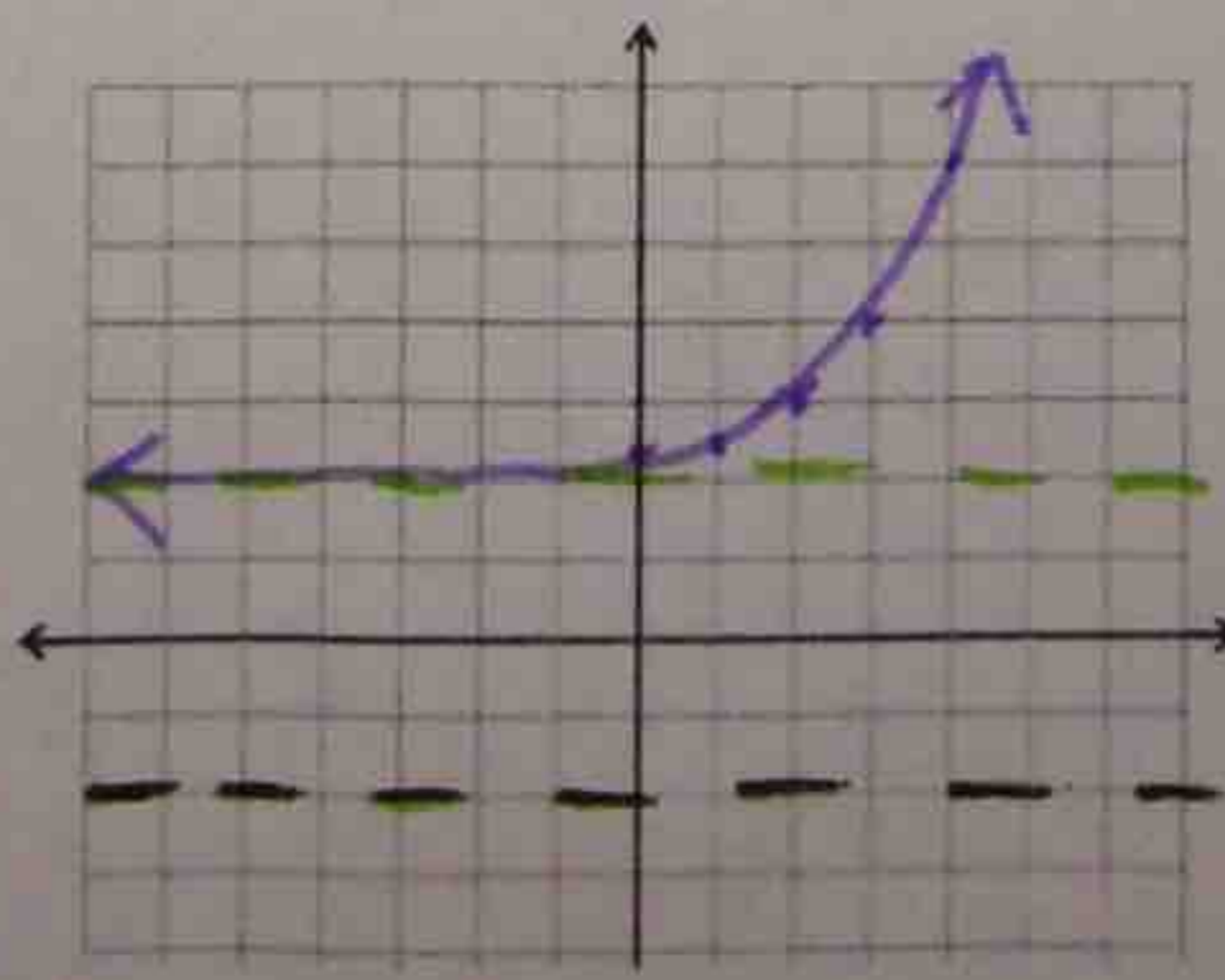$3^{y-1} = x$
$\log_3(x+1)$

9. $f(x) = (2)^{x-2} + 2$

Asymptote: $y = 2$

Domain: $(-\infty, \infty)$

Range: $(-2, \infty)$

$f^{-1}(x) = \log_2(x-2) + 2$

$2^{y-2} + 2 = y$
$2^{y-2} = y-2$
$\log_2(x-2) = y-2$
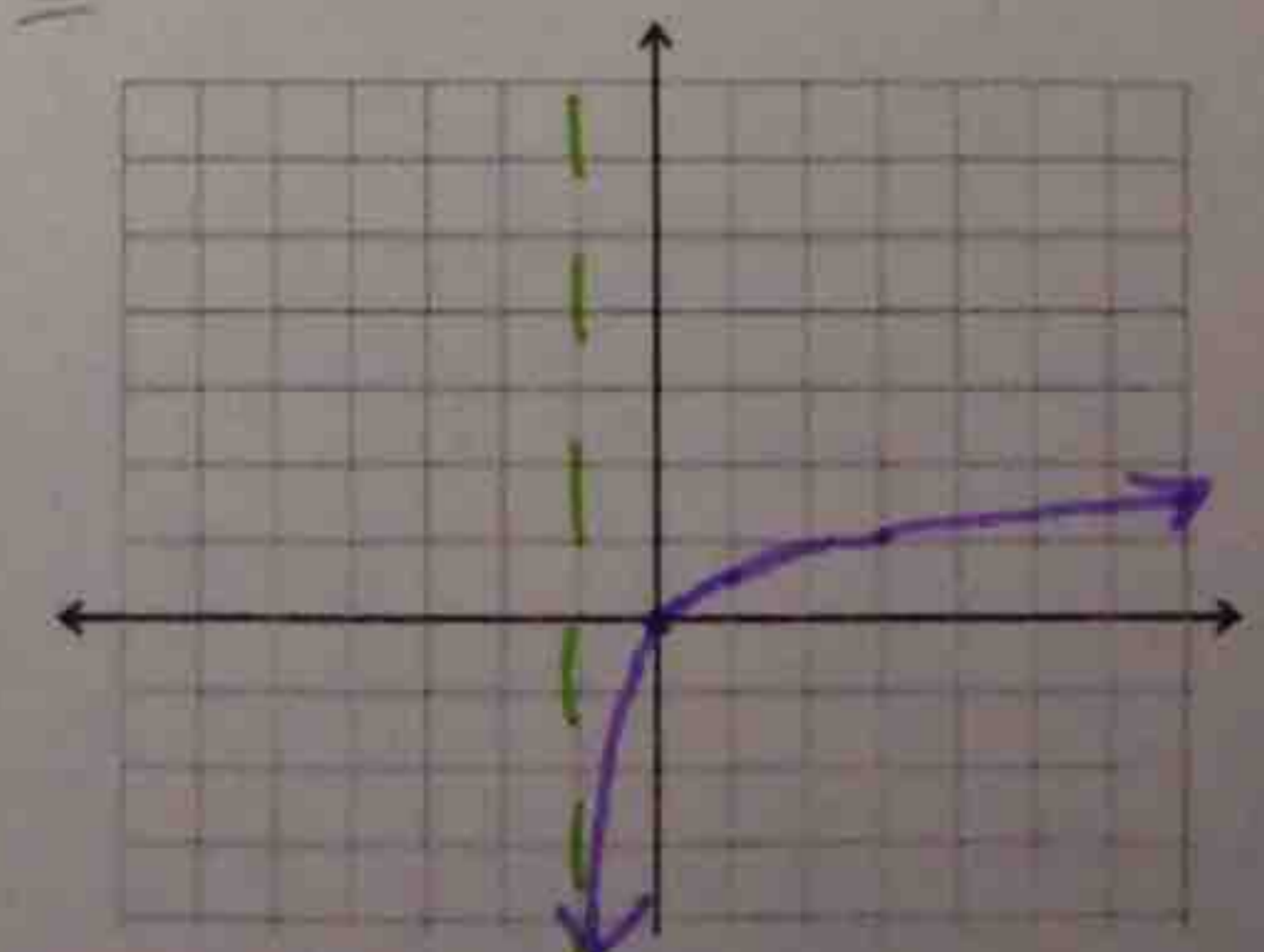$\log_2(x-2) + 2 = y$

10. $f(x) = \log_4(x+1)$

Asymptote: $x = -1$

Domain: $(-1, \infty)$

Range: $(-\infty, \infty)$

$f^{-1}(x) = 4^x - 1$

$\log_4(x+1) = y$
$\log_4(y+1) = x$
$4^x = y+1$

Write each equation in logarithmic form.

11. $100 = 10^2$

$$\log 100 = 2$$

12. $9^3 = 729$

$$\log_9 729 = 3$$

13. $64 = 4^3$

$$\log_4 64 = 3$$

Evaluate each logarithm.

14. $\log 1000$

$$3$$

15. $\log_4 256$

$$4$$

16. $\log_{27} 9$

$$2/3$$

Solve each equation.

17. $\log_3 (x + 1) = 4$

$\log_3 4 = x + 1$

$1.2619 = x + 1$

$$x = 0.2619$$

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

$\log_e 5 = \frac{x}{4}$ $x = 4 \ln 5$

$\ln 5 = \frac{x}{4}$ $x = 6.4378$

19. $\log x + \log 2 = 5$

$\log 2x = 5$ $100000 = 2x$

$10^5 = 2x$ $x = 50000$

20. $\ln x - \ln 4 = 7$

$\ln \frac{x}{4} = 7$ $x = 4e^7$

$e^7 = \frac{x}{4}$ $x = 4386.5326$

21. $6^{3x+2} = 18$

$\log_6 18 = 3x + 2$ $x = -0.129$

$1.6131 = 3x + 2$

$-0.3869 = 3x$

22. $e^{3x}e^{2x} = 20$

$e^{5x} = 20$ $x = \frac{\ln 20}{5}$

$\log_e 20 = 5x$

$\ln 20 = 5x$ $x = 0.5991$

24. $5e^{2x} - 1 = 9$

$5e^{2x} = 10$ $\log_e 2 = 2x$ $x = 0.3466$

$e^{2x} = 2$ $\ln 2 = 2x$

25. $\log 3 + \log x = \log 12$

$\log (3x) = \log 12$

$3x = 12$ $x = 4$

26. Radium has a half-life of 1660 years. If the initial amount of radium is 200 grams, how much will remain after 500 years?

$$y = 200(0.5)^{500/1660}$$

$$y = 162.3$$

162.3 grams

Simplify.

27. $\ln e^6$

$$6$$

28. $e^{\ln 3}$

$$3$$

29. $\log_2 2$

$$1$$

30. $3^{\log_3 8}$

$$8$$