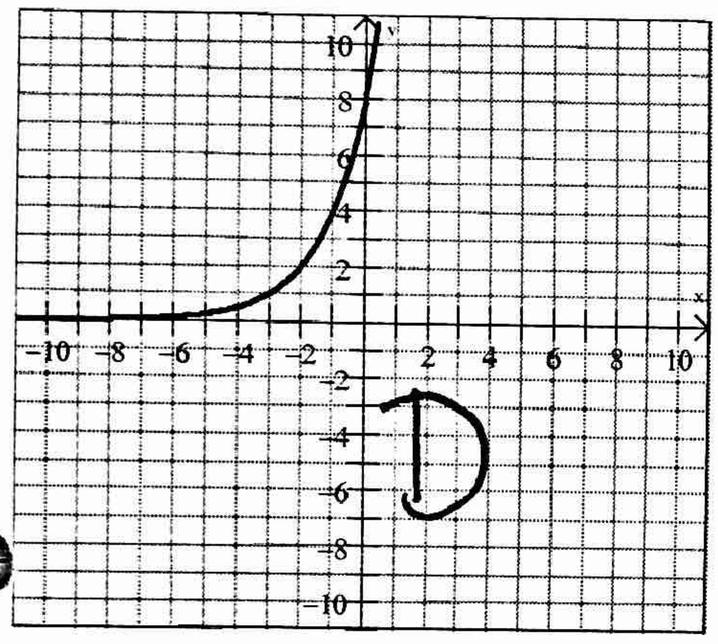
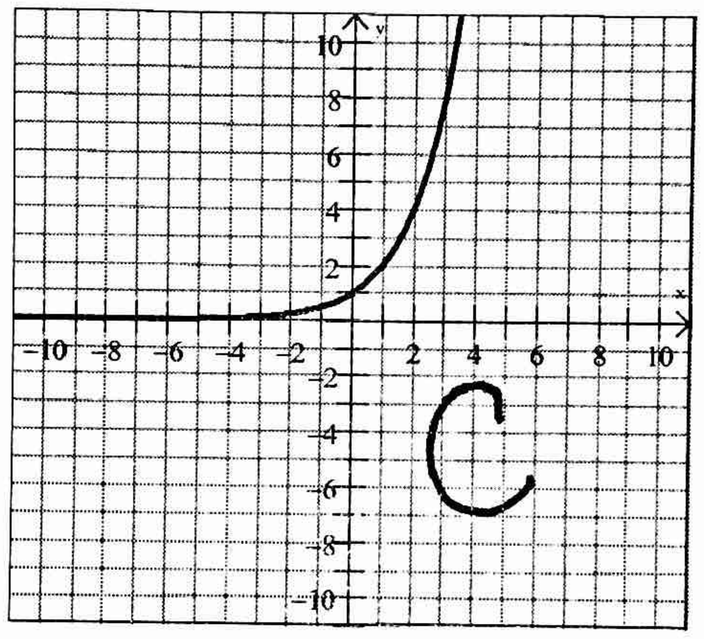
Learning Target 1A

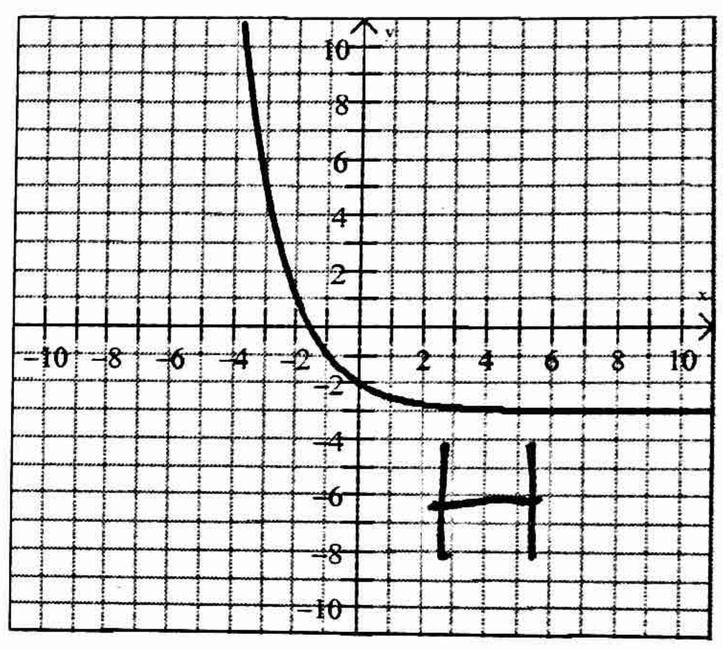
Match each exponential function with its graph. ***HINT:*** *There is one extra equation!*
Write the letter on top of the corresponding graph for each set of graphs.

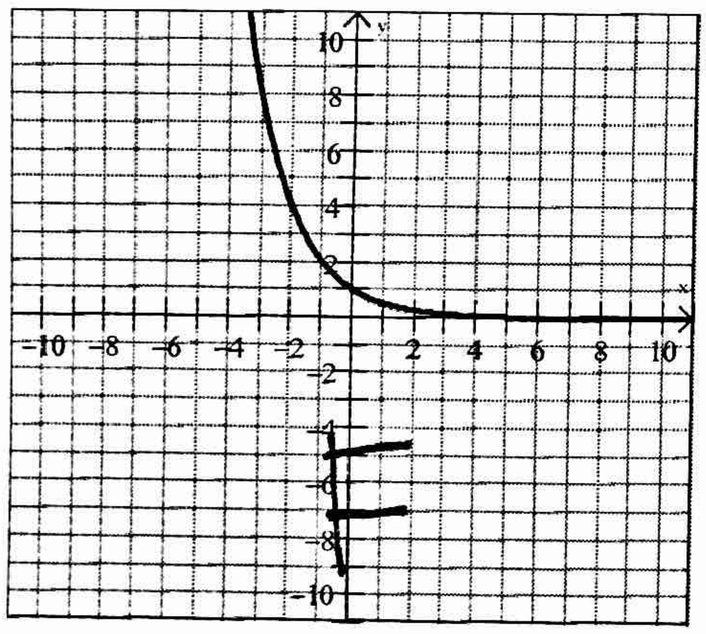
A. $f(x) = 2^{x-3}$ No match
B. $f(x) = 2^x - 3$
C. $f(x) = 2^x$
D. $f(x) = 2^{x+3}$
E. $f(x) = 2^x + 3$

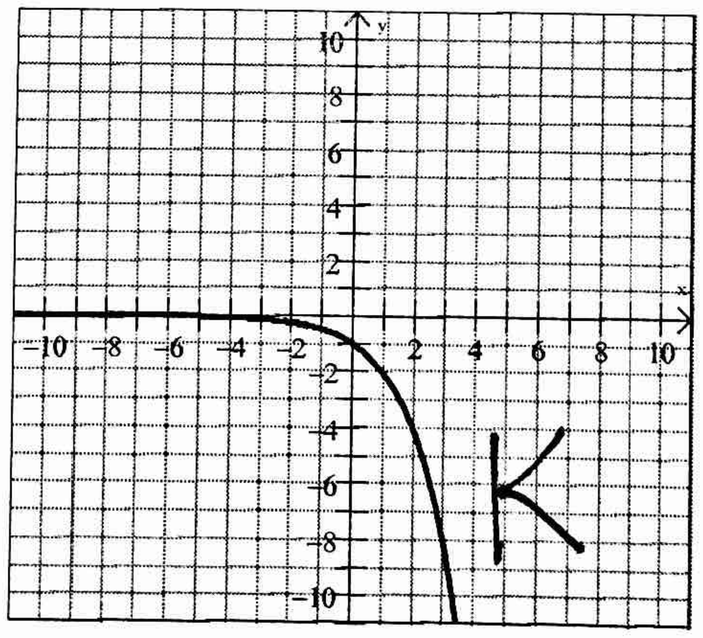
F. $f(x) = (\frac{1}{2})^x$
G. $f(x) = (\frac{1}{2})^{x-3}$
H. $f(x) = (\frac{1}{2})^x - 3$
J. $f(x) = -(\frac{1}{2})^x$
K. $f(x) = -2^x$

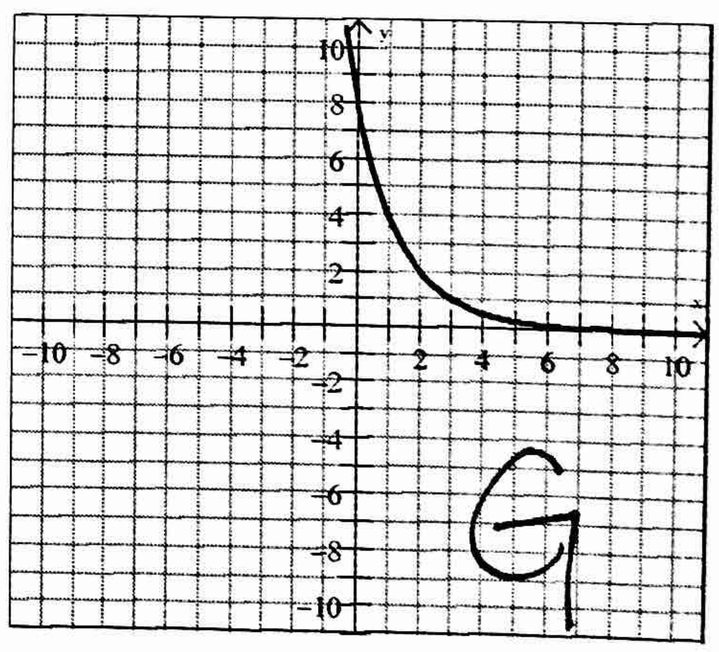


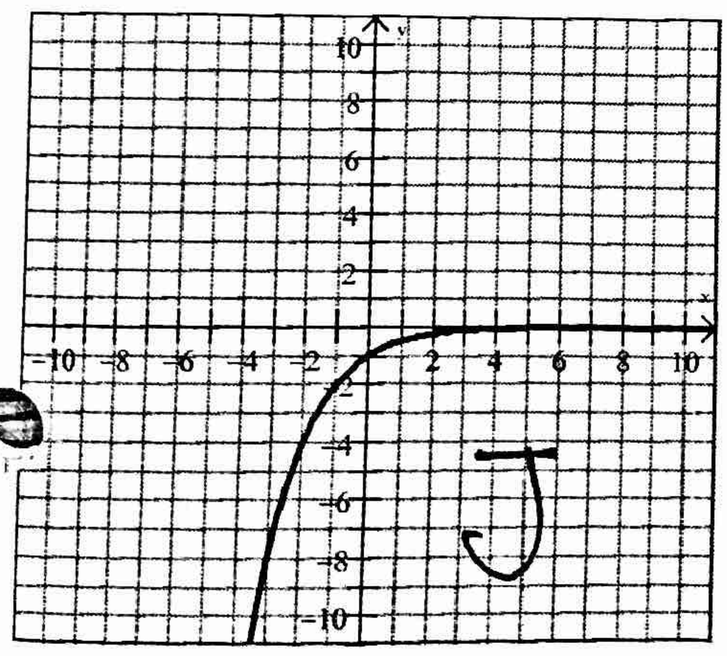


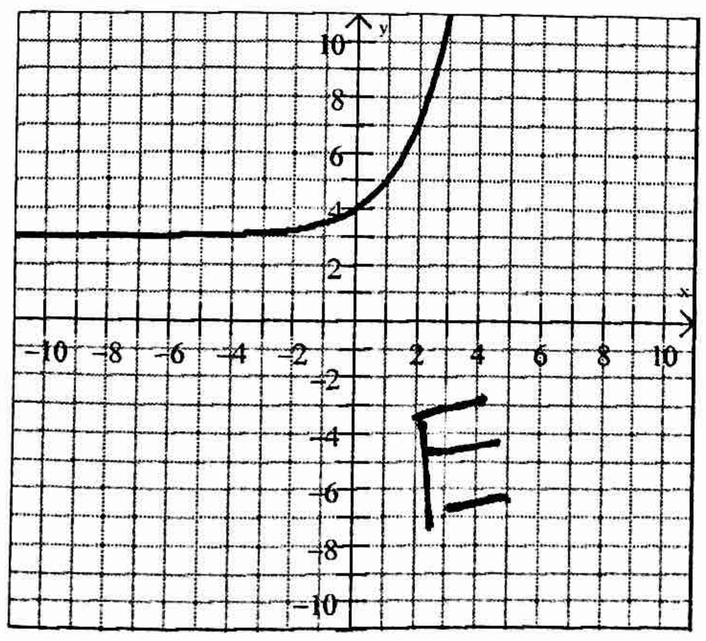


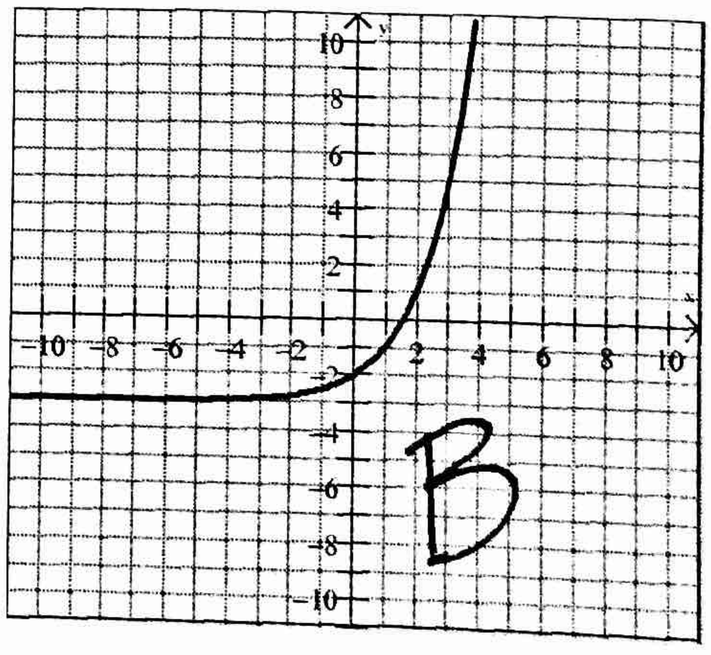












Master

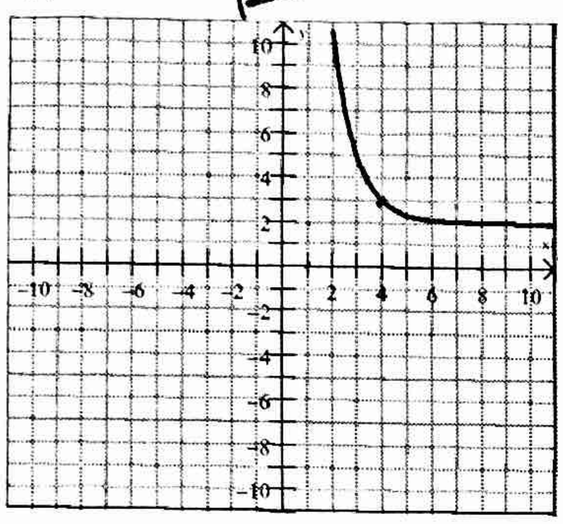
Learning Target 1B: Match each logarithmic or exponential function with its graph.

Write the letter on top of the corresponding graph for each set of graphs.

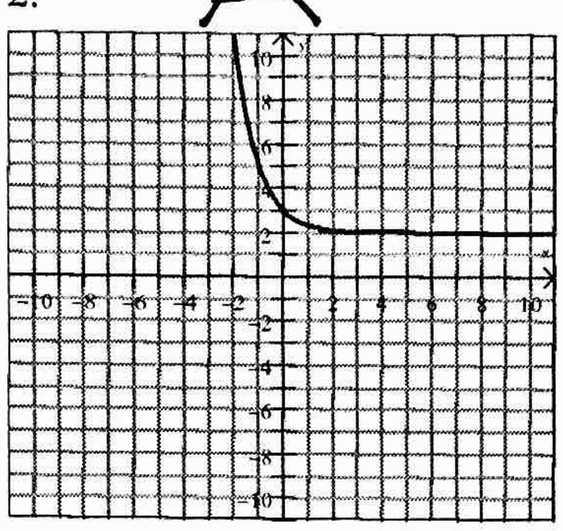
Part 1:

A. $f(x) = \left(\frac{1}{3}\right)^x + 2$ B. $f(x) = (3)^{x-4} + 2$ C. $f(x) = -\log_3 x + 2$ D. $f(x) = -\log_3 x$ E. $f(x) = \left(\frac{1}{3}\right)^{x-4} + 2$

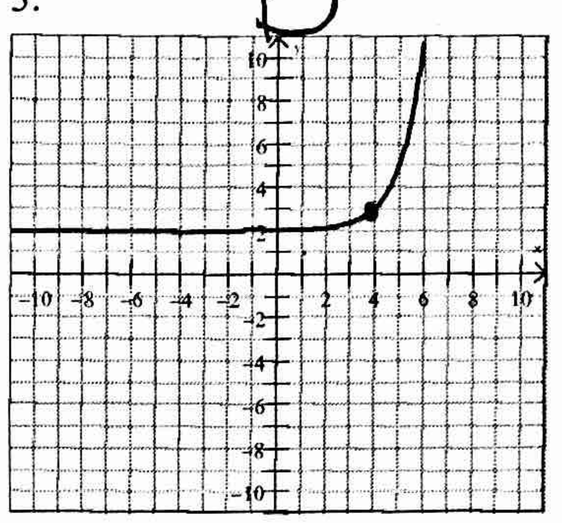
1. E



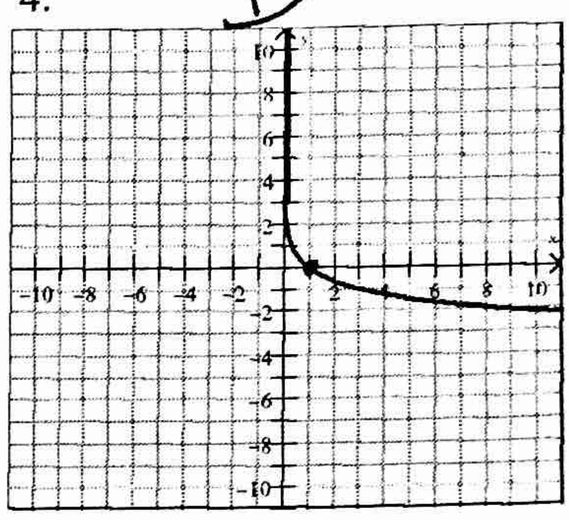
2. A



3. B



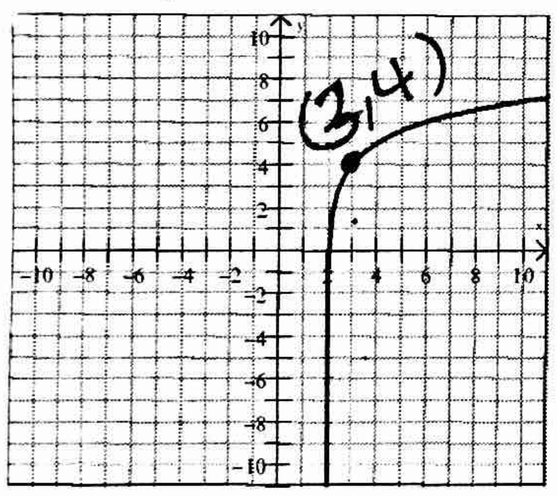
4. D



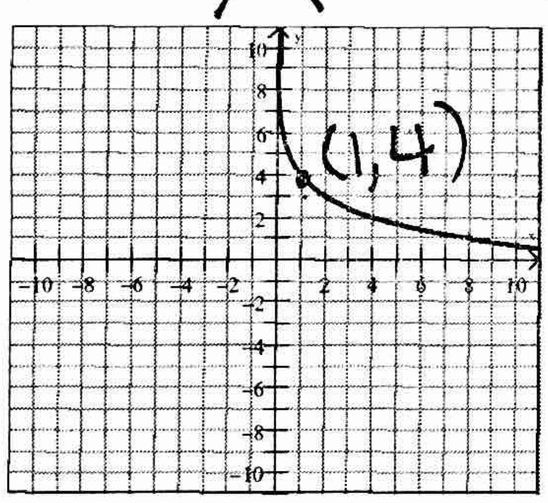
Part 2:

A. $f(x) = \log_{\frac{1}{2}} x + 4$ B. $f(x) = \log_2(x-2) + 4$ C. $f(x) = \log_2(x-4) + 2$ D. $f(x) = \log_{\frac{1}{2}}(x+2)$

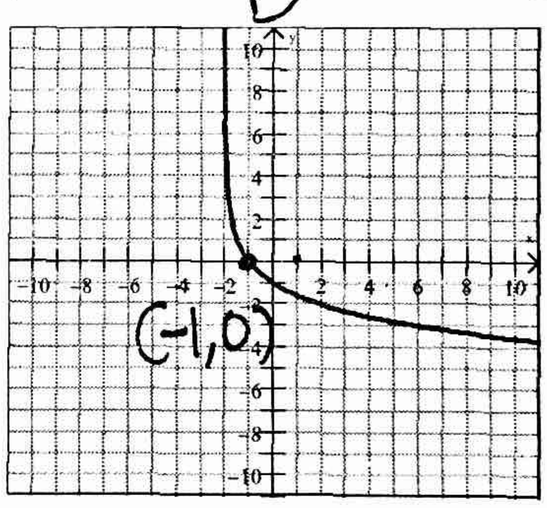
5. B



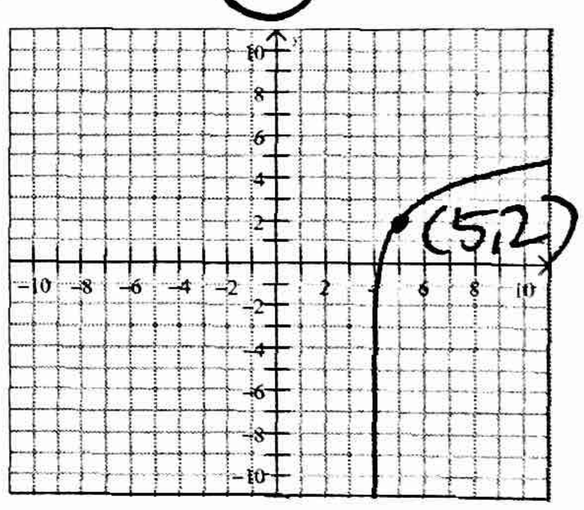
6. A



7. D



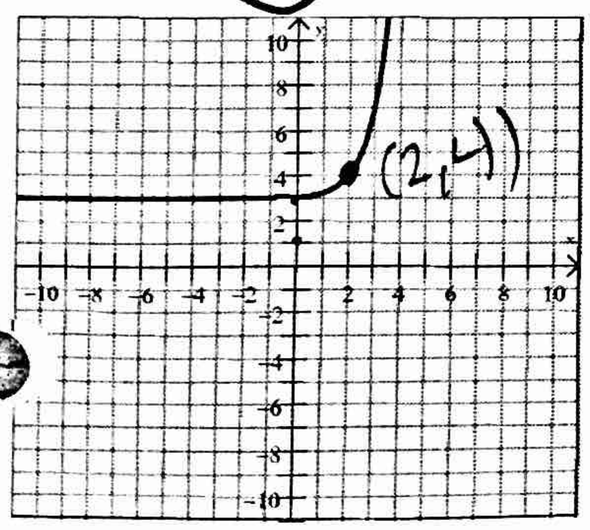
8. C



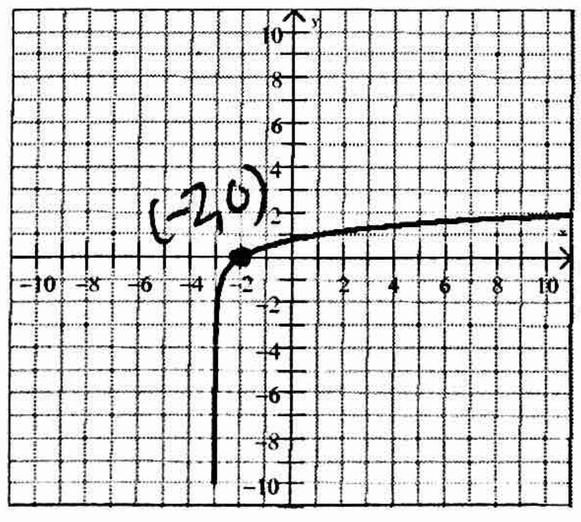
Part 3:

A. $f(x) = 4^{x+2} - 3$ B. $f(x) = \log_4 x + 3$ C. $f(x) = 4^{x-2} + 3$ D. $f(x) = \log_4(x-3)$ E. $f(x) = \log_4(x+3)$

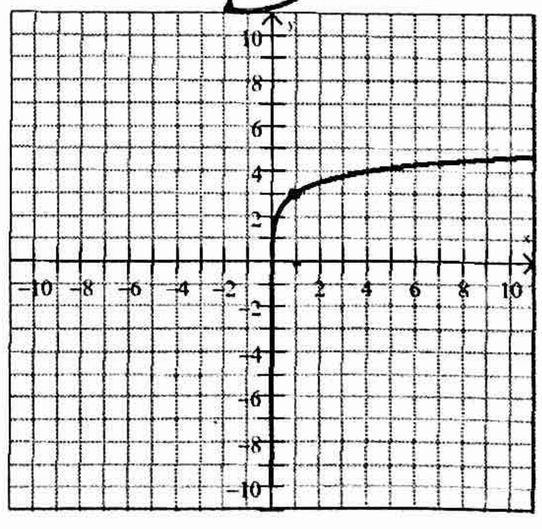
9. C



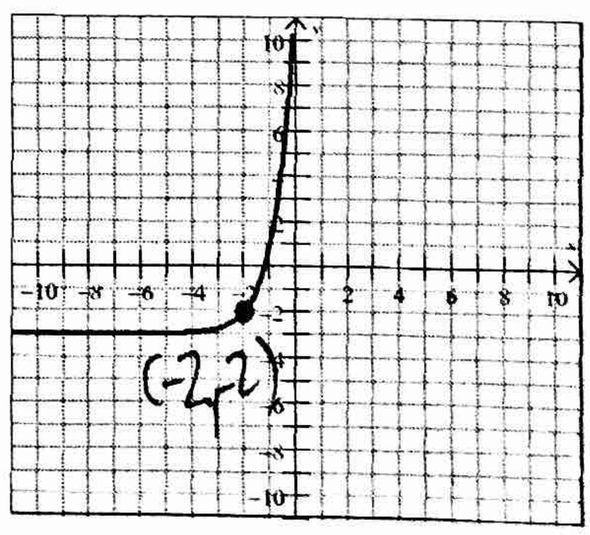
10. E



11. B



12. A



Learning Target 2

Cut up these cards and disperse them to students.

The first to student say the bottom statement will also be the last one to have an answer.

I have -2. **Who has $\log_2 8$?** 3	**I have 3.** **Who has $\log_3 \frac{1}{27}$?** -3
I have -3. **Who has $\log_4 16$?** 2	**I have 2.** **Who has $\log_2 32$?** 5
I have 5. **Who has $\log_5 625$?** 4	**I have 4.** **Who has $\log_{27} 27$?** 1
I have 1. **Who has $\log_2 128$?** 7	**I have 7.** **Who has $\log 6.5$?** 0.813
I have 0.813. **Who has $\log_{11} \frac{1}{11}$?** -1	**I have -1.** **Who has $\log_5 7$?** 1.209

I have 1.209. Who has $\log_2 64$? 6	I have 6. Who has $\log_8 -64$? Ø
I have "no solution". Who has $\log_{39} 1$? ○	I have 0. Who has the expanded form of $\log_6 \frac{x}{5}$? $\log_6 x - \log_6 5$
I have $\log_6 x - \log_6 5$. Who has the expanded form of $\log_8 y^3$? $3\log_8 y$	I have $3\log_8 y$. Who has the expanded form of $\log_7 12x$? $\log_7 12 + \log_7 x$
I have $\log_7 12 + \log_7 x$. Who has the exponential form of the equation $\text{Log}_3 81 = 4$? $3^4 = 81$	I have $3^4 = 81$. Who has the logarithmic form of the equation $7^3 = 343$? $\log_7 343 = 3$
I have $\log_7 343 = 3$. Who has the logarithmic form of the equation $\left(\frac{1}{2}\right)^2 = \frac{1}{4}$? $\log_{\frac{1}{2}} \frac{1}{4} = 2$	I have $\log_{\frac{1}{2}}\left(\frac{1}{4}\right) = 2$. Who has $\log_{25} 55$? 1.245

I have 1.245. Who has $\log_{17} 2$? 0.245	I have 0.245. Who has the logarithmic form of the equation $8^{-2} = \frac{1}{64}$? $\log_8 64 = -2$
I have $\log_8 \frac{1}{64} = -2$. Who has the condensed form of 2 log 4 + log y? log 16y	I have log 16y. Who has the condensed form of 3 log 5 – 7 log y? $\log \frac{125}{y^7}$
I have $\log \left(\frac{125}{y^7} \right)$. Who has the expanded form of $\log \sqrt[5]{x^2}$? $\frac{2}{5} \log x$	I have $\frac{2}{5} \log x$. Who has the last word of the statement "A logarithm is an _____!"? exponent
I have "exponent". Who has the value of x for the equation $3^x = 3^{427}$? 427	I have 427. Who has the value of x for the equation $\text{Log}_{13} x = \log_{13} 45$? 45
I have 45. Who has $\log_2 \frac{1}{16}$? -4	I have -4. Who has $\log_5 \frac{1}{25}$? -2

Target 2

Master Ee"

Putting it All Together!

CONDENSING LOGS

Directions: Rewrite as a single logarithm. Simplify if possible.

19. $2 \cdot \log 6 - \log 9$

$\log \frac{36}{9} = \log 4$

20. $4 \cdot \log_4 a + 2 \cdot \log_4 b$

$\log_4 a^4 \cdot b^2 = \log_4 a^4 b^2$

21. $7 \cdot \log_4 u - 3 \cdot \log_4 v^2$

$\log_4 \frac{u^7}{v^6}$

22. $\log_2 15 + \log_2 4 - \log_2 6$

$\log_2 \frac{15 \cdot 4}{6} = \log_2 10$

23. $\log_3 4 + \log_3 y + \frac{1}{2} \cdot \log_3 49$

$\log_3 4 \cdot y \cdot 7 = \log_3 28y$

24. $\frac{1}{3}(\log_5 8 + \log_5 27) - \log_5 3$

$\log_5 \frac{(8 \cdot 27)^{\frac{1}{3}}}{3} = \log_5 \frac{2 \cdot 3}{3} = \log_5 2$

25. $3 \cdot \log_2 4 - \log_2 32$

$\log_2 \frac{4^3}{32} = \log_2 2 = 1$

26. $2 \cdot \log 6 - \frac{1}{4} \cdot \log 16 + \log 3$

$\log \frac{6^2 \cdot 3}{16^{\frac{1}{4}}} = \log \frac{36 \cdot 3}{2} = \log 54$

EXPANDING LOGS

Directions: Expand each logarithm.

27. $\log_6 (xyz^4)$

$\log_6 x + \log_6 y + 4\log_6 z$

28. $\log_4 \left(\frac{a^9}{b}\right)$

$\log_4 a^9 - \log_4 b$

$9\log_4 a - \log_4 b$

29. $\log_7 (q^4 r^2)^2$

$\log_7 q^8 + \log_7 r^4$

$8\log_7 q + 4\log_7 r$

30. $\log_2 \left(\frac{y}{z^5}\right)^2$

$\log_2 y^2 - \log_2 z^{10}$

$2\log_2 y - 10\log_2 z$

31. $\log \sqrt{7x^3}$

$\log 7^{\frac{1}{2}} + \log (x^3)^{\frac{1}{2}}$

$\frac{1}{2}\log 7 + \frac{3}{2}\log x$

32. $\log_3 \sqrt[4]{m^5 n^2}$

$\log_3 m^{\frac{5}{4}} n^{\frac{1}{2}}$

$\frac{5}{4}\log_3 m + \frac{1}{2}\log_3 n$

Master Ex.

Target 3: Finding Inverses

Write the inverse of each function showing all proper steps.

1. $f(x) = \log_4(x-3)$

$x = \log_4(y-3)$

$4^x = y-3$

$\boxed{f^{-1}(x) = 4^x + 3}$

2. $f(x) = 3^x + 5$

$x = 3^y + 5$

$x-5 = 3^y$

$\log_3(x-5) = y$

$\boxed{f^{-1}(x) = \log_3(x-5}$

3. $f(x) = \log_2 x + 1$

$x = \log_2 y + 1$

$x-1 = \log_2 y$

$2^{x-1} = y$

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

4. $f(x) = \left(\frac{1}{2}\right)^{x-4}$

$x = \left(\frac{1}{2}\right)^{y-4}$

$\log_{\frac{1}{2}} x = y-4$

$\boxed{f^{-1}(x) = \log_{\frac{1}{2}} x + 4}$

Master E

Learning Target 4

Solve each equation.

1) $9^{-3x+1} = 27^{-2x-2}$

A) $\left\{-\frac{13}{7}\right\}$

B) { All real numbers. }

C) $\{-2\}$

D) No solution.

$3^{2(-3x+1)} = 3^{3(-2x-2)}$

$-6x+2 = -6x-6$

$0 = -8$

2) $\frac{1}{64} \cdot \left(\frac{1}{4}\right)^{-k} = \left(\frac{1}{32}\right)^{-3k}$

A) $\{8\}$ B) $\{0\}$

C) $\left\{-\frac{6}{13}\right\}$ D) $\{-9\}$

$2^{-6} \cdot 2^{-2(-k)} = 2^{-5(-3k)}$

$2^{-6+2k} = 2^{15k}$

$-6+2k = 15k$

$-6 = 13k$

3) $-6 + \log_2 9b = -3$

A) $\left\{\frac{1}{32}\right\}$ B) $\left\{\frac{8}{9}\right\}$

C) $\left\{\frac{1}{16}\right\}$ D) $\left\{\frac{1}{28}\right\}$

$\log_2 9b = 3$

$2^3 = 9b$

$\frac{8}{9} = b$

4) $9\log_{12}(x-4) = 18$

A) $\{148\}$ B) $\left\{\frac{1}{6}\right\}$

C) $\{-216\}$ D) $\left\{-\frac{71}{12}\right\}$

$\log_{12}(x-4) = 2$

$144 = x-4$

$148 = x$

5) $\log_{15}(4x^2+10x) = \log_{15}(-21+3x^2)$

A) $\{-7\}$ B) $\{-3,-4\}$

C) $\{-3,-7\}$ D) $\{-3\}$

$4x^2+10x = -21+3x^2$

$x^2+10x+21 = 0$

$(x+7)(x+3) = 0$

$-7, -3$

6) $\log_5 10 + \log_5 2x^2 = 1$

A) $\{1,-1\}$ B) $\left\{\frac{1}{2},-\frac{1}{2}\right\}$

C) $\{1\}$ D) $\{2\}$

$\log_5 20x^2 = 1$

$5 = 20x^2$

$\frac{1}{4} = x^2$

7) $\log_7(x+5) + \log_7 x = \log_7 50$

A) $\{5\}$ B) $\{-10\}$

C) $\{-10,4\}$ D) $\{5,-10\}$

$\log_7 x^2+5x = \log_7 50$

$x^2+5x = 50$

$x^2+5x-50 = 0$

$(x+10)(x-5) = 0$

$-10 \quad 5$

8) $\log_5 9 - \log_5 3x = 2$

A) $\left\{\frac{3}{62}\right\}$ B) $\left\{\frac{3}{25}\right\}$

C) No solution. D) $\left\{\frac{126}{31}\right\}$

$\log_5 \frac{9}{3x} = 2$

$25 = \frac{9}{3x}$

$75x = 9$

$x = \frac{9}{75} = \frac{3}{25}$

*9) $\log_7(x+2) = 5$

$7^5 = x+2$

$16807 = x+2$

$x = 16805$

*10) $\log_5 3x = 8$

$5^8 = 3x$

$390625 = 3x$

$x = 13208.33$

Condense each expression to a single logarithm.

11) $12\log_8 x + 2\log_8 y$

A) $\log_8(y^2x^6)$ B) $\log_8 \sqrt{zyx}$

C) $\log_8 \frac{x^6}{y^2}$ D) $\log_8(y^2x^{12})$

12) $6\log_5 x - 3\log_5 y$

A) $\log_5 \frac{x^6}{y^3}$

B) $\log_5(z^6\sqrt[3]{x})$

C) $\log_5(y^{18}x^3)$

D) $\log_5(z\sqrt[3]{yx})$

Master Eq...

Target 5: Applications of Exponentials and Logarithms

Write an equation and show your work to solve each word problem.

$$A = P\left(1 + \frac{r}{n}\right)^{nt} \qquad y = a(1+r)^t \qquad y = a(1-r)^t \qquad y = Pe^{rt}$$

1. Your parents invested $2800 in a saving account on the day you were born.

   a. The account yields 4.7% interest compounded monthly. How much money will be in the account after 16 years?

$A = 2800\left(1 + \frac{.047}{12}\right)^{(12 \cdot 16)} =$ **$5930.75**

   b. What would the amount be if the interest had been compounded continuously at the same rate for the same period of time?

$A = Pe^{rt} = 2800e^{(.047 \cdot 16)} =$ **$5939.47**

2. In 1990 the population of Winnemucca, Nevada, was 6,191. The population continued to grow by 4% every year.

   a. Write a function to model this information.

$y = 6191(1+.04)^x$ **$y = 6191(1.04)^x$**

   b. What is the value of the growth factor?

1.04

   c. Assuming this rate of increase continued, what was the population in Winnemucca in 2010?

1990: $x=0$
2010: $x=20$

$y = 6191(1.04)^{20} =$ **13,565.24**

3. During normal breathing, about 12% of the air in the lungs is replaced after one breath.

   a. Write an exponential decay model for the amount of the original air left in the lungs if the initial amount of air in the lungs is 500 mL.

$y = 500(1-.12)^x$ **$y = 500(.88)^x$**

   b. How much of the original air is present after 240 breaths?

$y = 500(.88)^{240}$ **2.37×10^{-11}**