

7/12/19

**Show all work. Answers without adequate justification will not receive full credit.** Solve problems algebraically whenever possible. Simplify to the lowest terms.

1) (9pts) Match the graphs with the equations.

$y = \log x$  Letter A

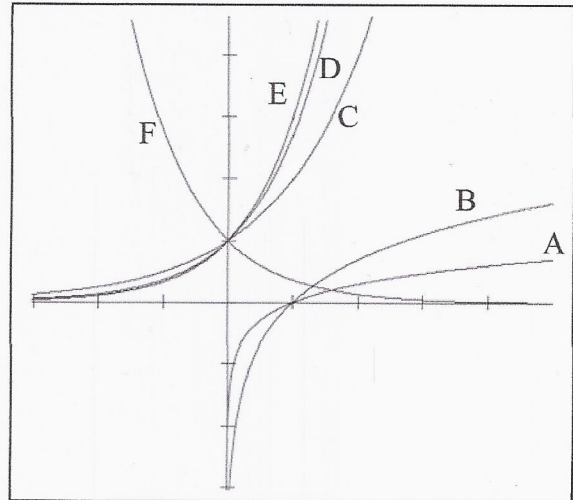
$y = \ln x$  Letter B

$y = 2^x$  Letter C

$y = 3^x$  Letter ~~D~~ E

$y = (0.4)^x$  Letter F

$y = e^x$  Letter ~~E~~ D



2) (10pts) Fill in the following table:

Function	y-intercept	Growth or decay?	Growth or decay rate
$y = 20(0.94)^x$	(0, 20)	Decay	6% annual rate
$y = 13(1.4)^x$	(0, 13)	Growth	40% annual rate
$y = 17e^{0.35x}$	(0, 17)	Growth	35% continuous rate
$y = 5e^{0.07x}$	(0, 5)	Growth	7% continuous rate

3) (8pts) Granny wants to start a college account for her newborn granddaughter. How much money does she need to deposit now into an account earning 2.5% compounded quarterly so it will be worth \$20,000 in 18 years?

$P = \$12,770.43$

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

$$20,000 = P \left(1 + \frac{0.025}{4}\right)^{4(18)}$$

$$20,000 = P(1.00625)^{72}$$

$$20,000 = P(1.5661743)$$

$$\frac{20,000}{1.5661743} = P = \$12,770.43$$

4) (8pts) The population,  $P$ , of a group of rabbits  $t$  years after being released in a new habitat is given by  $P(t) = 500(1.03)^t$

a) How many rabbits were initially released?

500

b) Fill in the blank: The rabbit population is growing by 3 % per year

c) How many rabbits will there be in 2 years?

530

$$P(t) = 500(1.03)^2 = 530$$

d) When will there be 600 rabbits?

$$600 = 500(1.03)^t$$

$$\frac{600}{500} = 1.03^t$$

$$\ln 1.2 = \ln 1.03^t$$

$$\ln 1.2 = t \ln 1.03$$

$$t = \frac{\ln 1.2}{\ln 1.03} = 6.17 \text{ years}$$

6.17 years  $\approx$  6 years + 2 months  
 $\frac{17}{100} \times 365 \approx 62 \text{ days}$

5) (15pts) Solve the following for  $x$ . Give exact answers.

a)  $2 \log_3(2x-3) = 4$

$$2 \log_3(2x-3) = 4$$

$$\log_3(2x-3) = 2$$

$$2x-3 = 3^2$$

$$2x-3 = 9$$

$$2x = 12$$

$$x = 6$$

$x = 6$

$$2 \log_3(2x-3) = 4$$

$$2 \log_3(12-3) = 4$$

$$2 \log_3(9) = 4$$

$$2(2) = 4$$

b)  $3(4)^{x+2} = 21$

$$3(4)^{x+2} = 21$$

$$4^{x+2} = 7$$

$$\log_4 7 = x+2$$

$$x = \log_4 7 - 2$$

EXACT

$x \approx 0.596323$

$3(4^{1.403677}) = 21$

$x = \log_4 7 - 2$

c)  $4e^{12x} + 3 = 19$

$$4e^{12x} + 3 = 19$$

$$4e^{12x} = 16$$

$$e^{12x} = 4$$

$$\ln 4 = 12x$$

$$x = \frac{\ln 4}{12}$$

$x \approx 0.1155245$

$x = \frac{\ln 4}{12}$

6) (10pts) Find a formula for an exponential function such that  $f(1) = 3$  and  $f(-1) = 12$

$$y = Ab^x \quad 3 = Ab^1 \quad 3 = Ab$$

$$y = Ab^x \quad 12 = Ab^{-1} \quad 12 = \frac{A}{b} = A = 12b$$

$$f(x) = 6 \left(\frac{1}{2}\right)^x$$

$$3 = 12b(b) \quad 3 = 12b^2$$

$$b = \frac{1}{2} \quad a = 6$$

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

$$b = \pm \frac{1}{2}$$

$$\begin{aligned} \textcircled{1} 3 &= 6 \left(\frac{1}{2}\right)^1 \checkmark \\ \textcircled{2} 12 &= 6 \left(\frac{1}{2}\right)^{-1} \\ 12 &= 6 \left(\frac{1}{\frac{1}{2}}\right) = 6 \left(\frac{2}{1}\right) = 12 \checkmark \end{aligned}$$

7) (4pts) Rewrite as a single logarithm:  $2 \log x - \frac{1}{2} \log y + 3 \log z$

$$\log \frac{x^2 z^3}{y^{1/2}} = \log \frac{x^2 z^3}{\sqrt{y}}$$

$$\log_{10} \frac{x^2 z^3}{\sqrt{y}}$$

8) (4pts) Use logarithm properties to expand:  $\ln \left( y \sqrt{\frac{y}{1-y}} \right)$

$$\ln y + \ln \left( \frac{y}{1-y} \right)^{1/2}$$

$$\ln y + \frac{1}{2} [\ln y - \ln(1-y)]$$

$$\ln y + \frac{1}{2} (\ln y - \ln(1-y))$$

9) (4pts) Solve for x.  $\log(x+4) + \log(x) = 9$

$$\log(x+4) + \log(x) = 9$$

$$\log x^2 + 4x = 9$$

$$\log_{10} 9 = x^2 + 4x$$

$$0 = x^2 + 4x - \log_{10} 9$$

Desmos

$$x = 0.2258$$

$$x = 0.2258 \checkmark$$

$$x = 0.2258$$

Ti-36x-PRO

$$x = 0.225812775$$

$$\textcircled{0.22547901249}$$

Ti-36xPRO/Polk solve