

## PRECALCULUS PROBLEM SESSION #7

### Exponential Functions

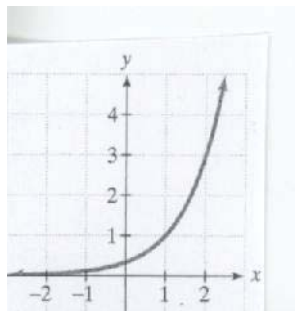
1. Compare and contrast  $y = 2x$  and  $y = 2^x$ .
2. Use transformations of  $f(x) = 2^x$  to graph the following functions. Be sure to graph and give equations of the asymptotes, and find the domain and range.

(a)  $h(x) = 2^{x+2} - 1$       (b)  $g(x) = 2^{x+2}$       (c)  $g(x) = 2^{-x}$

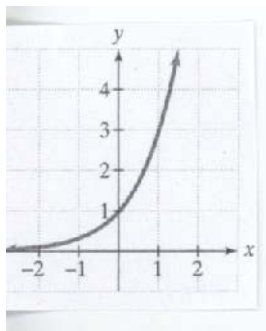
3. Match the following graphs of exponential functions to the equations:

$f(x) = 3^x$ ,  $g(x) = 3^{x-1}$ ,  $h(x) = 3^x - 1$ ,  $f(x) = -3^x$ ,  $g(x) = 3^{-x}$ ,  $h(x) = -3^{-x}$

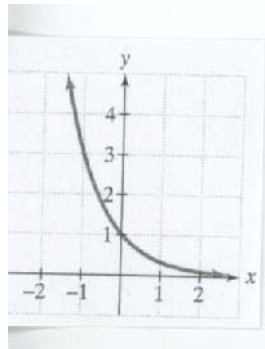
a



b



c



4. The 1986 explosion at the Chernobyl nuclear power plant in the former Soviet Union sent about 1000 kilograms of radioactive cesium-137 into the atmosphere. The function  $f(x) = 1000(0.5)^{\frac{x}{30}}$  describes the amount,  $f(x)$ , in kilograms of cesium-137 remaining in Chernobyl  $x$  years after 1986. If even 100 kilograms of cesium-137 remain in Chernobyl's atmosphere, the area is considered unsafe for human habitation. Find  $f(80)$  and determine if Chernobyl will be safe for human habitation by 2066.
5. In 1626, Peter Minuit convinced the Wappinger Indians to sell him Manhattan Island for \$24. If the Native Americans had put the \$24 into a bank account paying 5% interest, how much would the investment have been worth in the year 2005 if interest were compounded a) monthly? b) continuously?
6. How many years, to the nearest year, will it take money to quadruple if it is invested at 20% compounded annually?  
Use the formula  $A = P\left(1 + \frac{r}{n}\right)^{nt}$ .
7. The definition of an exponential function makes the restriction that  $b$  is not equal to 1. Explain the significance of this restriction.

(OVER)

## Logarithmic Functions

- Write the equation in logarithmic form:  $\sqrt[3]{64} = 4$
- Evaluate:

(a)  $\log_3 \frac{1}{9}$

(b)  $\log_7 49$

(c)  $\log_6 \frac{1}{6}$

(d)  $\log_{81} 9$

(e)  $\ln e$

(f)  $\ln 1$

(g)  $\ln e^5$

(h)  $e^{\ln 7}$

- Find the domains and graph the following functions:

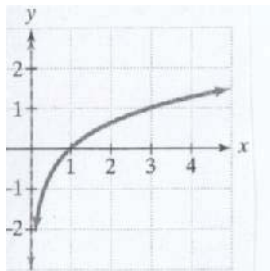
(a)  $g(x) = \log_2(x - 2)$

(b)  $h(x) = \ln(6 - 2x)$

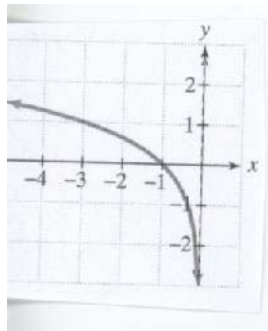
(c)  $f(x) = \log_5(x + 6)$

- Use transformations of  $f(x) = \log_2 x$  to graph  $g(x) = \log_2(x + 2)$
- If  $\log b < 0$ , what can you say about  $b$ ?
- Graph  $f(x) = 5^x$  and  $g(x) = \log_5 x$  in the same rectangular coordinate system.
- Select the function for each graph from the following options:

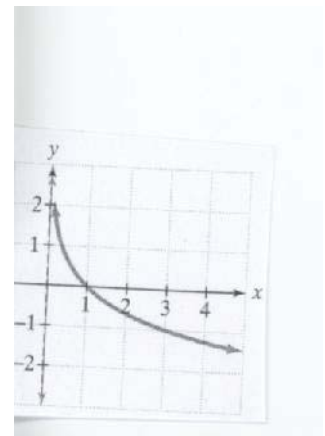
a.



b.



c.



$$f(x) = \log_3 x, g(x) = \log_3(x - 1), h(x) = \log_3 x - 1, F(x) = -\log_3 x, G(x) = \log_3(-x), H(x) = 1 - \log_3 x$$

- The percentage of adult height attained by a girl who is  $x$  years old can be modeled by  $f(x) = 62 + 35 \log(x - 4)$ , where  $x$  represents the girl's age (from 5 to 15) and  $f(x)$  represents the percentage of her adult height. Approximately what percentage of her adult height has a girl attained at age ten?