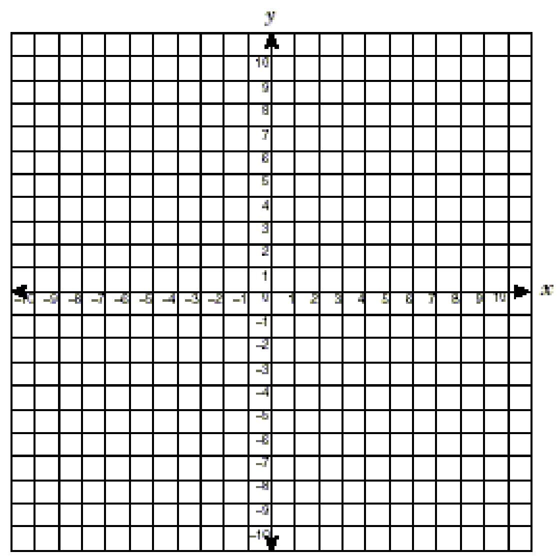
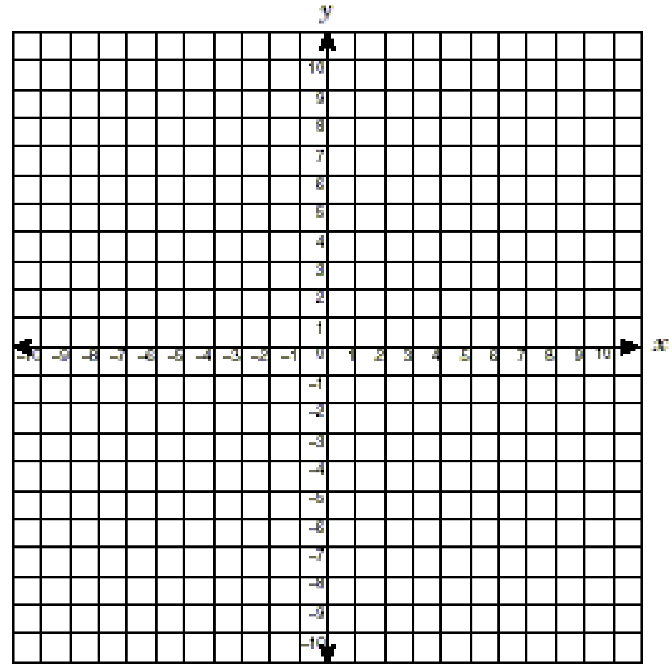
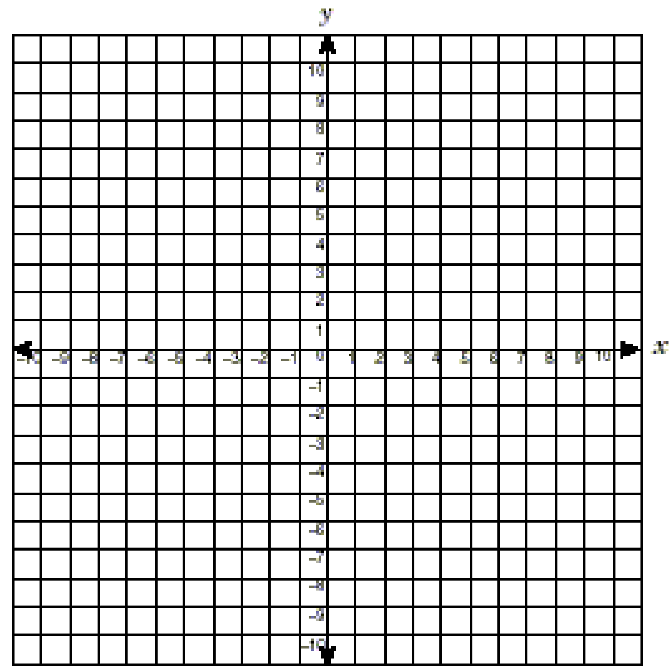
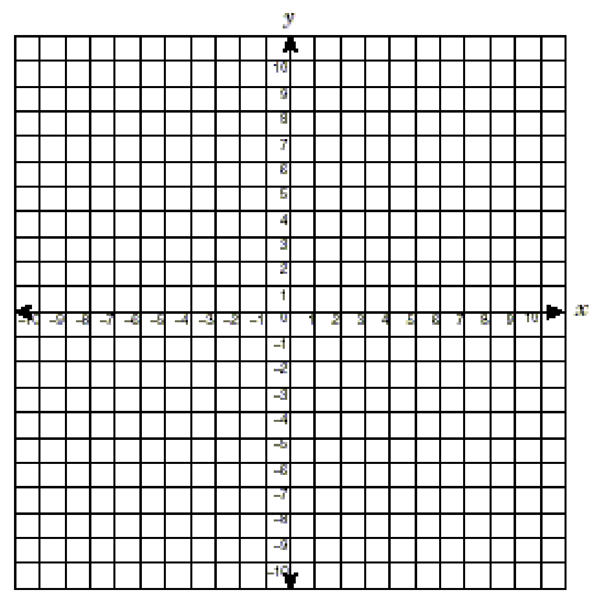
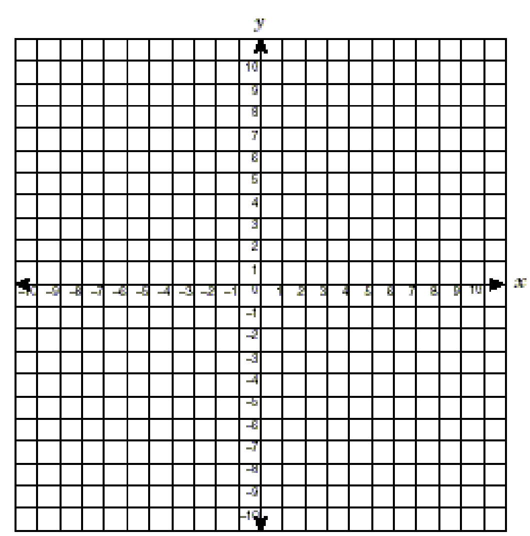
8.1	**Exponential Growth**
Objective	1. Graph exponential growth functions. 2. Use exponential growth functions to model real life situations.
Key Terms	Exponential Function Asymptote Exponential Growth Function
Basic Exponential Function	$f(x) = 2^x$  Y intercept______ Asymptote_______ Domain _________ Range __________ End Behavior ___________ ___________

Graph the exponential functions.	$f(x) = \frac{1}{3} 2^x$  $f(x) = 3 \cdot 2^x$ $f(x) = -3 \cdot 2^x$ Summary for $f(x) = a \cdot 2^x$ End Behavior: Asymptote: y-intercept: Domain: Range:

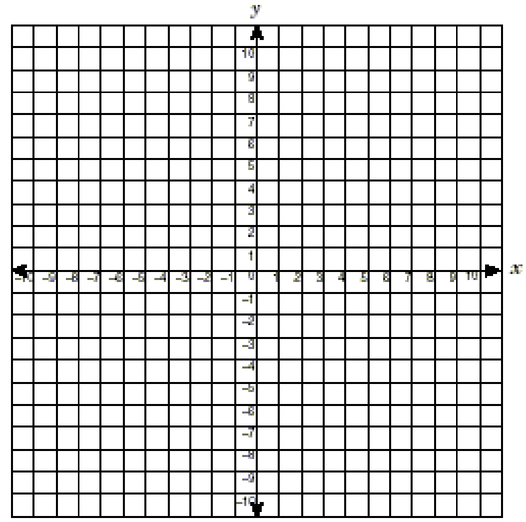
Exponential Growth Functions $\boldsymbol{y = a \cdot b^x}$ **If a>0 and b>1** $\boldsymbol{y = a \cdot b^{x-h} + k}$ **h moves the graph left and right.** **k moves the graph up and down.**	Graph $y = 2 \cdot 3^{x-1} - 3$ 
	Exponential Growth Model $y = a(1+r)^t$ a *is the intial amount* r *in the percent increase written as a decimal* t *is time period* $1 + r$ *is the growth factor*
In the last ten years an initial population of 44 dear grew by 8% per year, how many were in the park after 5 years?	

	Compound Interest $A = P\left(1+\frac{r}{n}\right)^{nt}$ *A is the amount n years* *P is the Principle initial amount* *n is the number of times compounded per year* *r is rate as a decimal* *t is time in years*
You deposit $1400 in an account that pays 4% annual interest. Find the balance after 2 years. If the interest is compounded **a) Annually** **b) Quarterly** **c) Daily**	

8.2	**Exponential Decay**
Objectives	1. Graph exponential decay functions. 2. Use exponential decay functions to model real life situations.
Key Terms	Exponential Decay Function
Exponential Decay Functions $\boldsymbol{y = a \cdot b^x}$ **If a>0 and 0<b<1**	Graph $f(x) = 2\left(\frac{1}{3}\right)^x$ State the domain and range. 
Exponential Decay Functions $\boldsymbol{y = a \cdot b^{x-h} + k}$ **If a>0 and 0<b<1** **h moves the graph left and right.** **k moves the graph up and down.**	Graph $f(x) = 5\left(\frac{1}{2}\right)^{x-3} + 4$ State the domain and range. 

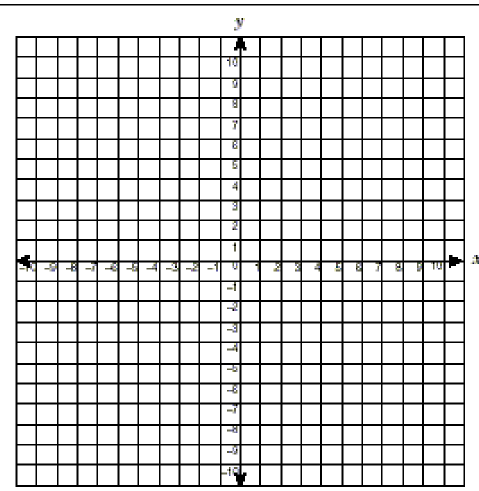
	Exponential Decay Model $y = a(1 - r)^t$ $\quad$ *a is the intial amount* *r in the percent decrease written as a decimal* *t is time period* $1 - r$ *is the decay factor*
You purchase a car for $20,000. The value of the car decreases by 15% each year. What is the value of the car after 5 years?	
You have $1000 and you lose half your money each day. How much money will you have after 10 days?	

8.3	**The Number *e***
Objectives	1. Use the number e as a base of an exponential function. 2. Use the natural base e in real life situations.
Key Terms	Natural Base *e*
Simplify the Natural Base Expression	e^6e^8 $\frac{6e^4}{2e^3}$ $(-4e^{3x})^2$ $\frac{12e^x}{e^{4x}}$ $\sqrt[3]{8e^{9x}}$
Evaluate the Natural Base Expressions (Round Answers to Three Decimal Places)	e^3 e^{-3} $e^{0.7}$
Tell whether the functions is an example of exponential growth or exponential decay	$y = 5e^{-3x}$ $y = \frac{1}{4}e^{2x}$ $y = e^{-5x}$

Graph the function. State the domain and range.	$y = e^{-2x}$  Domain:____________ Range:_____________
	Continuously Compounded Interest $$\boldsymbol{A = Pe^{rt}}$$ $A = Amount\ after\ t\ years$ $P = Original\ Amount$ $r = interest\ rate\ (decimal)$ $t = time\ in\ years$
Find the amount in an account after five years at 5.5% annual interest compounded continuously, if the original amount was $2500. **Find the amount in the account if the interest was compounded quarterly.**	

8.4	**Logarithmic Functions**
Objectives	1. Evaluate logarithmic functions. 2. Graph logarithmic functions.
	Definition of a Logarithm with Base b Let b and y be positive numbers, b ≠ 1. The logarithm of y with base b is denoted by $\log_b y$ and defined as follows: $\boldsymbol{\log_b y = x \quad if\ and\ only\ if \quad b^x = y}$
	Logarithmic Form $\boldsymbol{\log_b y = x}$ **Exponential Form** $\boldsymbol{b^x = y}$ **Example:** $\log_3 81 = 4$ $3^4 = 81$
Fill in the table.	

Logarithmic Form	Exponential Form
$\log_3 9 = 2$	
$\log_5 5 = 1$	
	$2^3 = 8$
	$10^2 = 100$
$\log_8 1 = 0$	
$\log_{\frac{1}{4}} 16 = -2$	
	$5^{-2} = \frac{1}{25}$
	$\left(\frac{1}{3}\right)^{-2} = 9$

Special Logarithm	Let b be a positive real number such that b≠1. **Logarithm of 1** $\log_b 1 = 0$ *because* $b^0 = 1$ **Logarithm of Base b** $\log_b b = 1$ *because* $b^1 = b$
Evaluate the Expressions	$\log_2 64$ $\log_5 125$ $\log_7 49$ $\log_{\frac{1}{2}} 0.25$ $\log_{\frac{1}{3}} 27$ $\log_{\frac{1}{4}} 256$ $\log_4 2$ $\log_{32} 2$ $\log_{81} 3$
	Common Logarithm $\log_{10} x = \log x$ **Natural Logarithm** $\log_e x = \ln x$
Evaluate using your Calculator (Round answers to three decimal places)	$\log 7$ $\log 150$ $\ln 0.5$ $\ln 40$
Graphing Logarithmic Functions	**Exponential and Logarithmic Functions are inverses of each other.** Graph: $y = 3^x$ *and* $y = \log_3 x$ 

	By definition of a logarithm, the logarithmic function $\boldsymbol{g(x) = \log_b x}$ is the **inverse** of the exponential function $\boldsymbol{f(x) = b^x}$
Find the inverse of the function. (Follow the process used in 7.4)	$y = \log_5 x$ $y = \ln x + 3$ $\mathrm{y} = \log(x-2)$ $y = \ln(x-2)$ $y = \log_8 x - 4$ $y = \ln 3x$

8.5	Properties of Logarithms
Objective	1. Use properties of logarithms. 2. Use properties of logarithms to solve real life problems.
Key Terms	Change of Base Formula
Properties of Logarithms	**Product Property** $\log_b uv =$ ________________ **Quotient Property** $\log_b \frac{u}{v} =$ ________________ **Power Property** $\log_b u^n =$ ________________
Use the Properties of Logarithms to Evaluate the Expression.	$\log_3(3 \cdot 9)$ $\qquad$ $\log_2 4^5$ $\log_5 \left(\frac{1}{5}\right)^3$ $\qquad$ $\ln e^{-2}$

Use $\log_3 4 \approx 1.262$ and $\log_3 5 \approx 1.465$ to approximate the value of the expression using the properties of logarithms.	$\log_3 \frac{4}{5}$ $\log_3 20$ $\log_3 16$
Expand the expression using the properties of logarithms.	$\ln 22x$ $\log_6 \frac{6}{5}$ $\log_5 2x^6$ $\ln \frac{3y^4}{x^3}$
Condense the expression using the properties of logarithms.	$\ln 16 - \ln 4$ $2\log x + \log 5$ $\log_5 3 + 3\log_5 x - \log_5 4$ $3(\ln 3 - \ln 3) + (\ln x - \ln 9)$

Change of Base Formula	Let u, b, and c be positive numbers with b≠1 and c≠1. Then: $$\log_c u = \frac{\log_b u}{\log_b c}$$ In particular $\log_c u = \frac{\log u}{\log c}$ and $\log_c u = \frac{\ln u}{\ln c}$
Evaluate using the change of base formula. Round answer to three decimal places.	$\log_3 7$ $\log_7 55$ $\log_4 64$ $\log_{16} 4$ $\log_5 100$
The Richter magnitude M of an earthquake is based on the intensity *I* of the earthquake and the intensity *I_o* of an earthquake that can be barely felt. $$M = \log \frac{I}{I_o}$$	If the intensity of the 1994 LA earthquake was $10^{6.8}$ times the I_0, what was the magnitude? If the intensity of an earthquake is 1000 times the I_0, what is the magnitude?

8.6	**Solving Exponential and Logarithmic Equations**
Objectives	1. Solve exponential equations. 2. Solve logarithmic equations.
	If two powers with the same base are equal, then their exponents must be equal. **For b > 0 and b ≠ 1,** $\boldsymbol{If\ b^x = b^y, then\ x = y}$. If two logarithms have the same base, **For positive numbers b, x, and y where b ≠ 1,** $\boldsymbol{\log_b x = \log_b y\ \ if\ and\ only\ if\ x = y}$.
Solve the Equation.	$2^{4x} = 32^{x-1}$ $27^{2x} = 9^{x+2}$ $4^{3x-2} = 16^x$ $4^x = 21$ $5^x = 18$ $7^x = 350$ $8 + 10^{5x+4} = 35$ $3^{5x-2} - 4 = 3$

Solve the Equation.	$\log_7(3x-1)=\log_7(2x+2)$ $\log_5(x+6)=\log_5(3x-4)$ $\log_3(2x+3)=4$ $16\ln x=30$ $\log 2x+\log(5x+15)=2$ $\ln x+\ln(x-2)=1$
You deposit $5000 into an account that pays 6% annual interest compounded quarterly. How long will it take for the balance to reach $10,000?	
You have $1,000,000. You lose half of it each day. How many days will it take until you have $1?	

8.7	**Modeling with Exponential and Power Functions**
Objectives	1. Model data with exponential functions. 2. Model data with power functions.
	Exponential Function $y = ab^x$
Write an exponential function $y = ab^x$ whose graph passes through (1, 8) and (2, 32).	
Write an exponential function $y = ab^x$ whose graph passes through (-1, 0.0625) and (3, 256).	

	Power Function $y = ax^b$
Write a power function $y = ax^b$, whose graph passes through (3, 4) and (6, 7).	
Write a power function $y = ax^b$, whose graph passes through (4, 11) and (8, 14).	