Name	Date	Class
	Date	Class

LESSON Reteach

The Natural Base, e

The **natural logarithmic function**, $f(x) = \ln x$, is the inverse of the exponential function with the natural base *e*, $f(x) = e^x$.

The constant *e* is an irrational number. $e \approx 2.71828...$

Properties of logarithms apply to the natural logarithm.

In particular:

 $\ln 1 = 0$ The base is e and $e^0 = 1$. $\ln e = 1$ Think: $e^1 = e$. $\ln e^x = x$ The natural logarithm and the
exponential function are inverses,
so they undo each other.

Use properties of logarithms to simplify expressions with e or "In."



Simplify each expression.

1. In <i>e</i> ^{-6x}	2. In <i>e</i> ^{<i>t</i> - 3}	3. $e^{2 \ln x}$
−6 <i>x</i> ln <i>e</i>	(<i>t</i> – 3) In <i>e</i>	e ^{ln x²}
4. In <i>e</i> ^{1.8}	5. $\ln e^{x+1}$	6. $e^{7 \ln x}$

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Use the formula $A = Pe^{rt}$ to solve.

Name

7. What is the total amount for an investment of \$500 invested at 4.5% and compounded continuously for 10 years?

P = r =	<i>t</i> =
 8. Randy deposited \$1000 into an account that paid 2.8% with continuous compounding. What was her balance after 6 years? 	
9. a. Martin borrows \$5500. The rate is set at 6% with continuous compounding. How much does he owe at the end of 2 years?	
b. Martin found a bank with a better interest rate of 5.5%. How much less does he owe at the end of 2 years?	



	- Reteach									
LESS0	The Natur	al Base	. e (con	tinued)				7-5 Exploring the N	umber e	
The	natural base, e, a	opears in th	ne formula f	for interest	compound	ed continu	ously.	John Napier, the inventor of loga	arithms in 1614, based h	is work on a
	$A = Pe^{rt}$							of e is the irrational number 2.71	n Leonard Euler later ca 1828	lied <i>e</i> . The value
	A = total among B = principal	ount	mount					As you have seen, one way to a	pproximate the value of	e is to let the
	r = principal r = annual in	terest rate	mount					value of <i>n</i> become very large in $(a + 1)^n$	the sequence of number	rs obtained from
	t = time in y	ears						the expression $1(1 + \frac{1}{n})$. You conclusion evaluating <i>e</i> .	an explore some other n	nethods for
Wh	at is the total amou tinuously for 5 year	int for an in 's?	vestment o	of \$2000 inv	rested at 39	% and com	pounded	Consider the sequence 1 $\frac{1}{2}$ –	<u>1_1_</u>	
Ste	p 1 Identify the va	alues that c	orrespond	to the varia	ables in the	formula.		1, Write the 9th term of the sec	• 1' 3 • 2 • 1' auence.	1
	P = initial inv	estment =	\$2000					2. Using a calculator, determin	ie	<u>8 · / · 0 · 5 · 4 · 3 · 2 · 1</u>
	r = 3% = 0.0	3						a. the sum of the first 5 term	ms of the sequence.	2.7083
	<i>t</i> = 5							b. the sum of the first 7 tern	ms of the sequence.	2.718055556
Ste	p 2 Substitute the	e known val	lues into the	e formula.				c. the sum of the first 10 ter	rms of the sequence.	2.718281526
	$A = Pe^{10}$ $A = 2000e^{0.0}$	13(5)						3. Use what you know about th	ne value of e and the	$e = 1 + \frac{1}{1} + \frac{1}{2 \cdot 1}$
Ste	p 3 Use a calcula	tor to solve	o for A, the	total amou	nt.			in terms of the given sequer	e an expression for e	$+\frac{1}{3\cdot 2\cdot 1}+\cdots$
	$A = 2000e^{0.0}$	13(5)					_	A continued fraction is • E	Example To evaluate, sta	art with the last denominator.
	$A\approx 2323.67$	-		Use 2000	the <i>e</i> * key De ^(.03*5) =	on a calcu 2323.6684	lator: 85	added to a fraction whose 1+-	$\frac{1}{2} = 1 + \frac{1}{2}$	$= 1 + \frac{1}{2} = 1 + \frac{1}{30} = 1 + \frac{13}{30} = \frac{4}{3}$
The	total amount is \$2	323.67.						denominator is a fraction	$2 + \frac{1}{3 + \frac{1}{4}}$ $2 + \frac{1}{\frac{13}{4}}$	$2 + \frac{1}{13}$ $\frac{1}{13}$
Use	the formula $A = F$	Pe ^{rt} to solv	e.					denominator is a fraction,	Start.	
7. \	What is the total an	nount for ar	n investmer	nt of \$500 i	nvested at	4.5% and		and so on, forming a pattern.		
0	compounded contir	uously for	10 years?	0.045		+_	10	Complete the continued fraction	on by finding the missi	ing denominator.
		_	/ =	\$704 4C	_	<i>i</i> –		4. 2 ± <u>1</u>	5.1+	2
-				\$784.16				$1 + \frac{1}{2}$		$1 + \frac{1}{2}$
8. 1	Randy deposited \$ 2.8% with continuo	1000 into a us compou	n account t nding. Wha	hat paid t was her				$2 + \frac{-}{3 + \frac{-}{3}}$		$6 + \frac{1}{10 + \frac{1}{10}}$
ł	balance after 6 yea	rs?	-			\$118	2.94	4 + 4		14 + —
9. i	a. Martin borrows s continuous com	\$5500. The bounding. H	rate is set	at 6% with does he				$5+\frac{5}{3},\frac{5760}{2}\approx 2.71$	18263332 18	$+\frac{1}{1}$; $\frac{1,084,483}{2} \approx 2.71828182$
	owe at the end of	of 2 years?				\$620	1.23	<u>6' 2119</u>		<u>22' 398,959</u>
I	 Martin found a b of 5.5% How m 	ank with a	better inter	est rate				Possible answer: Bo	th of the given conti	nued fractions can be used to
	end of 2 years?			at the		\$61	.70		determine the value	ue of <i>e</i> .
Copyrigh All rights	t © by Holt, Rinehart and Winston reserved.			47			Holt Algebra 2	Copyright © by Holt, Rinehart and Winston. All rights reserved.	48	Holt Algebra
Irene	Problem The Natur reads that the 20	Solvir al Base	ng , e of whoop	ing cranes	s tallied .			Reading Stra	tegies Organizer	
Irene 213 I the 2	Problem The Natur reads that the 20 birds at one wildlin 2003 record by 19.	Solvin al Base 04 census fe refuge in If the pop	1g , <i>e</i> of whoop n Texas. Th ulation of y	ing cranes his number whooping	s tallied r exceeded cranes ca	d In		LESSON Reading Stra 7-6 Use a Graphic C Definition	tegies Drganizer Facts	
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