عام زايد

YEAR OF ZAYED

United Arab Emirates
Ministry of Education
Alain Educational Office

مدرسة صقر الإمارات الدولية الخاصة

EMIRATES FALCON INT'L. PRIVATE SCHOOL

MATH DEPARTMENT

GRADE 10
TERM 2
REVISION SHEET

FOR
FINAL EXAM

Lesson (4-1) a

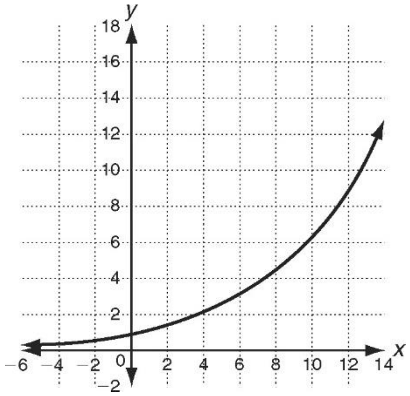
Exponential Functions, Growth, and Decay

The **base** of an exponential function indicates whether the function shows growth or decay.

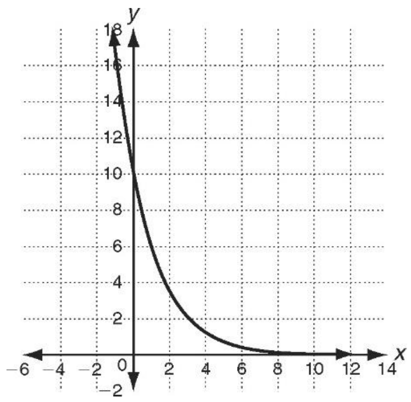
Exponential function: $f(x) = ab^x$

- a is a constant.
- b is the base. The base is a constant.
  If $0 < b < 1$, the function shows decay.
  If $b > 1$, the function shows growth.
- x is an exponent.

$f(x) = 1.2^x$
$a = 1$
$b = 1.2$
$b > 1$, so the function shows *exponential growth*.



$g(x) = 10(0.6)^x$
$a = 10$
$b = 0.6$
$0 < b < 1$, so the function shows *exponential decay*.

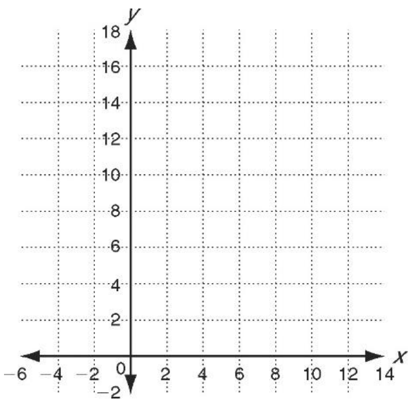


Tell whether each function shows growth or decay. Then graph.

1. $h(x) = 0.8(1.6)^x$

$a =$ ____________ $b =$ ______________

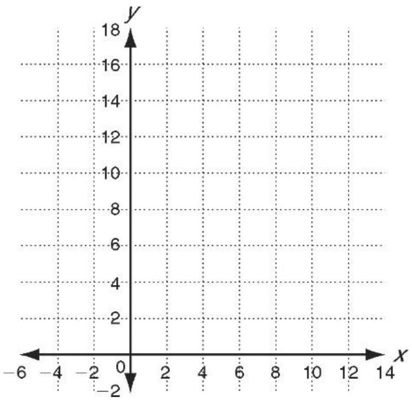
____



2. $p(x) = 12(0.7)^x$

$a =$ ____________ $b =$ ____________

____



Lesson (4-1) b

Exponential Functions, Growth, and Decay ***(continued)***

When an initial amount, *a*, increases or decreases by a constant rate, *r*, over a number of time periods, *t*, this formula shows the final amount, $A\ (t)$.

$$A\ (t) = a\ (1 + r)^t$$

$A\ (t)$, the final amount, is a function of time, *t*.

Time, *t*, is measured in years.

a is the initial amount.

The rate, *r*, usually is a percent.

An initial amount of $15,000 increases by 12% per year. In how many years will the amount reach $25,000?

Step 1 Identify values for *a* and *r*.

$a = \$15{,}000$ $\qquad r = 12\% = 0.12$

Step 2 Substitute values for *a* and *r* into the formula.

$f(t) = a\ (1 + r)^t$

$f(t) = 15{,}000\ (1 + 0.12\ )^t$

$f(t) = 15{,}000\ (1.12)^t$ *Simplify.*

Step 3 Graph the function using a graphing calculator. Modify the scales: [0, 10] and [0, 30,000].

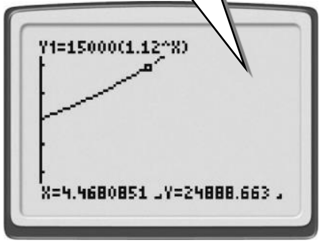
Step 4 Use the graph and the [TRACE] feature on the calculator to find $f\ (t) = 25{,}000$.

Step 5 Use the graph to approximate the value of *t* when $f(t) = 25{,}000$.

$t \approx 4.5$ when $f(t) = 25{,}000$

The amount will reach $25,000 in about 4.5 years.

Remember:
On the graph, *x* corresponds to *t* and *y* corresponds to $f(t)$.



```
Y1=15000(1.12^X)
X=4.4680851 Y=24888.663
```

Write an exponential function and graph the function to solve.

3. An initial amount of $40,000 increases by 8% per year. In how many years will the amount reach $60,000?

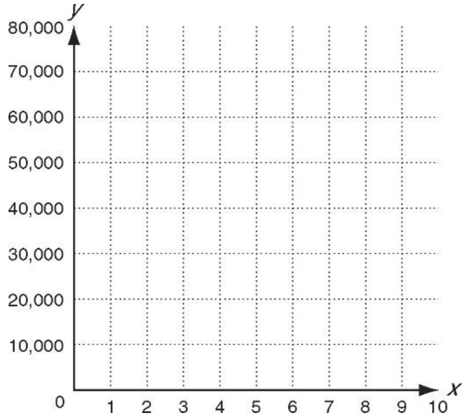
a. $a =$ ________________

b. $r =$ ________________

c. $f\ (t) =$ ________________________

d. Approximate *t* when $f\ (t) = 60{,}000$

$t \approx$ _____________



Lesson (4-2) a

Inverses of Relations and Functions

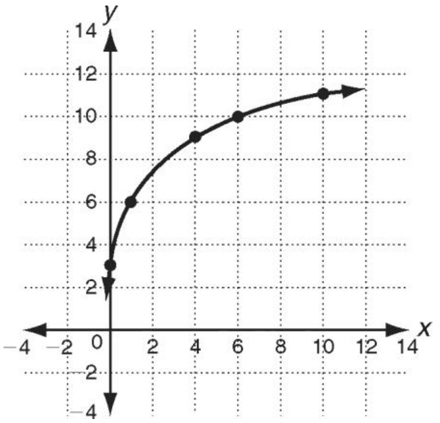
To graph an **inverse** relation, reflect each point across the line $y = x$.
Or you can switch the *x*- and *y*-values in each ordered pair of the relation to find the ordered pairs of the inverse.

Remember, a relation is a set of ordered pairs.

x	0	1	4	6	10
y	3	6	9	10	11

The domain is all possible values of *x*: $\{x \mid 0 \le x \le 10\}$.

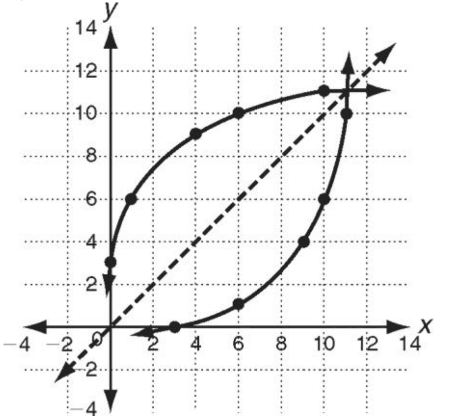
The range is all possible values of *y*: $\{y \mid 3 \le y \le 11\}$.



To write the **inverse** of the relation, switch the places of *x* and *y* in each ordered pair.

x	3	6	9	10	11
y	0	1	4	6	10

The domain of the inverse corresponds to the range of the original relation: $\{x \mid 3 \le x \le 11\}$.
The range of the inverse corresponds to the domain of the original relation:
$\{y \mid 3 \le y \le 10\}$.



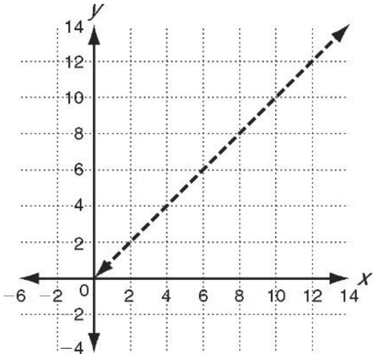
Complete the table to find the ordered pairs of the inverse. Graph the relation and its inverse. Identify the domain and range of each relation.

1. Relation

x	0	2	5	8	10
y	6	10	12	13	13

Inverse

x	6				
y	0				



Relation: Domain: ________________

Range: ________________

Inverse: Domain: ________________

Range: ________________

Lesson (4-2) b

Inverses of Relations and Functions *(continued)*

Inverse operations undo each other, like addition and subtraction, or multiplication and division.

In a similar way, **inverse functions** undo each other.

The inverse of a function $f(x)$ is denoted $f^{-1}(x)$.

Use inverse operations to write inverse functions.

Function: $f(x) = x + 8$	**Function: $f(x) = 5x$**
↑	↑
Subtraction is the opposite of addition. Use subtraction to write the inverse.	Division is the opposite of multiplication. Use division to write the inverse.
Inverse: $f^{-1}(x) = x - 8$	**Inverse: $f^{-1}(x) = \frac{x}{5}$**
Choose a value for x to check in the original function. Try $x = 1$.	Choose a value for x to check in the original function. Try $x = 2$.
$f(x) = x + 8 \rightarrow f(1) = 1 + 8 = 9$	$f(x) = 5x \rightarrow f(2) = 5(2) = 10$
Substitute 9, into $f^{-1}(x)$. The output of the inverse should be 1.	Substitute 10 into $f^{-1}(x)$. The output of the inverse should be 2.
$f^{-1}(x) = x - 8 \rightarrow f^{-1}(9) = 9 - 8 = 1$	$f^{-1}(x) = \frac{x}{5} \rightarrow f^{-1}(10) = \frac{10}{5} = 2$
Think: (1, 9) in the original function should be (9, 1) in the inverse. √	*Think:* (2, 10) in the original function should be (10, 2) in the inverse. √

Use inverse operations to write the inverse of each function.

2. $f(x) = x - 4$

____

Use $x = 5$ to check.

____

____

3. $f(x) = \frac{x}{6}$

____

Use $x = 12$ to check.

____

____

4. $f(x) = x + 3$

____

5. $f(x) = 14x$

____

Lesson (4-3) a

Logarithmic Functions

A **logarithm** is another way to work with exponents in equations.

If $b^x = a$, then $\log_b a = x$.

If b to the x power equals a,
then x is the logarithm of a in base b.

Use the definition of the logarithm to write exponential equations in logarithmic form and to write logarithmic equations in exponential form.

Exponential Form		**Logarithmic Form**
$3^4 = 81$	base, $b = 3$ exponent, $x = 4$ value, $a = 81$	$\log_3 81 = 4$

Logarithmic Form		**Exponential Form**
$\log_5 125 = 3$	base, $b = 5$ exponent, $x = 3$ value, $a = 125$	$5^3 = 125$

If no base is written for a logarithm, the base is assumed to be 10.

Example: $\log 100 = 2$ because 1 $0^2 = 100$.

Assume the base is 10.

Write each exponential equation in logarithmic form.

1. $7^2 = 49$
   $b = 7$, $x = 2$, $a = 49$
   ____

2. $6^3 = 216$
   b = ___, x = ___, a = ________
   ____

3. $2^5 = 32$
   ____
   ____

Write each logarithmic equation in exponential form.

4. $\log_9 729 = 3$
   $b = 9$, $x = 3$, $a = 729$
   ____

5. $\log_2 64 = 6$
   b =___, x = ___, a = _____
   ____

6. $\log 1000 = 3$
   ____
   ____

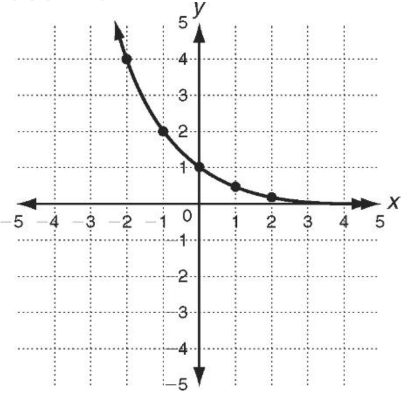
Lesson (4-3) b

Logarithmic Functions ***(continued)***

The logarithmic function is the inverse of the exponential function. Use this fact to graph the logarithmic function.

Graph *a* function and its inverse.
Graph $f(x) = 0.5^x$ using a table of values.

x	–2	–1	0	1	2
f(x)	4	2	1	0.5	0.25



Write the inverse function.

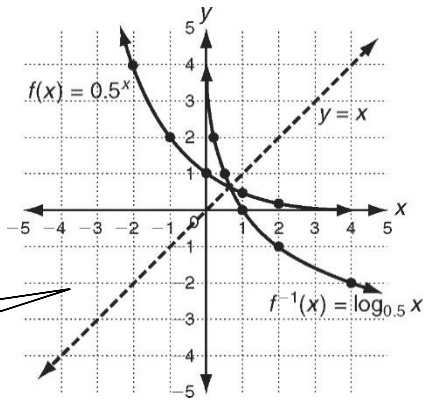
$f^{-1}(x) = \log_{0.5} x$

The base is 0.5.

x and *f* (*x*) switch places in the function and its inverse.

x	4	2	1	0.5	0.25
$f^{-1}(x)$	–2	–1	0	1	2

Remember, the graph of the inverse is the reflection of the original function across the line $y = x$.



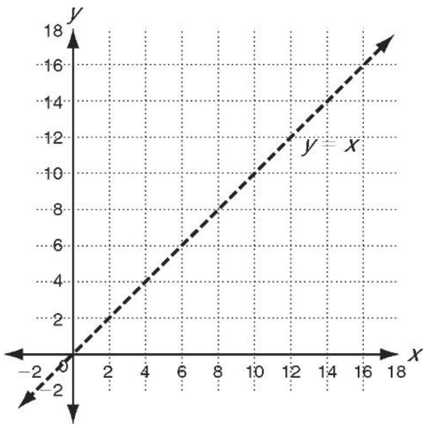
Complete the tables. Graph the functions.

7. $f(x) = 4^x$

x	–2	–1	0	1	2
f **(*x*)**	$\frac{1}{16}$	$\frac{1}{4}$			

$f^{-1}(x) = \log_4 x$

x	$\frac{1}{16}$	$\frac{1}{4}$			
$f^{-1}(x)$					



Lesson (4-4) a

Properties of Logarithms

Use properties of logarithms to simplify logarithms.

The Product Property uses addition instead of multiplication.

Product Property

The logarithm of a product can be written as the sum of the logarithm of the numbers.

$$\log_b mn = \log_b m + \log_b n$$

where m, n, and b are all positive numbers and $b \neq 1$

Simplify: $\log_8 4 + \log_8 16 = \log_8 (4 \cdot 16) = \log_8 64 = 2$

The bases must be the same for both logarithms.

Think: 8 to what power is equal to 64, or $8^? = 64$.

The Quotient Property uses subtraction instead of division.

Quotient Property

The logarithm of a quotient can be written as the logarithm of the numerator minus the logarithm of the denominator.

$$\log_b \frac{m}{n} = \log_b m - \log_b n$$

where m, n, and b are all positive numbers and $b \neq 1$

Simplify: $\log_3 243 - \log_3 9 = \log_3\left(\frac{243}{9}\right) = \log_3 27 = 3$

The bases must be the same for both logarithms.

Think: 3 to what power is equal to 27, or $3^? = 27$.

Complete the steps to simplify each expression.

1. $\log_6 54 + \log_6 4$

   $\log_6 (54 \cdot 4)$

   $\log_6 216$

   ____

2. $\log_2 128 - \log_2 8$

   $\log_2\left(\frac{128}{8}\right)$

   ____

   ____

3. $\log_9 3 + \log_9 27$

   ____

   ____

   ____

Lesson (4-4) b

Properties of Logarithms (continued)

The Power Property uses multiplication instead of exponentiation.

Power Property

The logarithm of a power can be written as the product of the exponent and the logarithm of the base.

$$\log_b a^p = p \log_b a$$

for any real number p

where a and b are positive numbers and $b \neq 1$

Simplify: $\log_4 64^5 = 5 \log_4 64 = 5(3) = 15$

"Bring down" the exponent to multiply.

Think: 4 to what power is equal to 64, or $4^? = 64$.

Logarithms and exponents undo each other when their bases are the same.

Inverse Properties	
The logarithm of b^x to the base b is equal to x. $\log_b b^x = x$ $\uparrow \quad \uparrow$ The logarithm undoes the exponent when the bases are the same. Simplify: $\log_7 7^{4x} = 4x$ The base of the log is 7 and the base of the exponent is 7.	b raised to the logarithm of x to the base b is equal to x. $b^{\log_b x} = x$ $\uparrow \quad \uparrow$ The exponent undoes the logarithm when the bases are the same. Simplify: $3^{\log_3 64} = 64$ The base of the exponent is 3 and the base of the log is 3.

Simplify each expression.

4. $\log_5 125^2$

$2 \log_5 125$

____

5. $\log_2 16^4$

$4 \log_2 16$

____

6. $\log_9 81^3$

____

____

7. $\log_6 6^{5y}$

____

8. $4^{\log_4 75}$

____

9. $2^{\log_2 3x}$

____

Lesson (4-5) a

Exponential and Logarithmic Equations and Inequalities

An **exponential equation** contains an expression that has a variable as an exponent.

$5^x = 25$ is an exponential equation.

$x = 2$, since $5\ (2) = 25$.

If $x = y$, then
$\log x = \log y$
($x > 0$ and $y > 0$).

Remember: You can take the logarithm of both sides of an exponential equation. Then use other properties of logarithms to solve.

Solve $6^{x+2} = 500$.

Step 1 Since the variable is in the exponent, take the log of both sides.

$6^{x+2} = 500$
$\log 6^{x+2} = \log 500$

Step 2 Use the Power Property of Logarithms: $\log a^p = p \log a$.

$\log 6^{x+2} = \log 500$
$(x + 2) \log 6 = \log 500$

"Bring down" the exponent to multiply.

Step 3 Isolate the variable. Divide both sides by log 6.

$(x + 2) \log 6 = \log 500$

$$x + 2 = \frac{\log 500}{\log 6}$$

Step 4 Solve for x. Subtract 2 from both sides.

$$x = \frac{\log 500}{\log 6} - 2$$

Step 5 Use a calculator to approximate x.

$x \approx 1.468$

Step 6 Use a calculator to check.

$6^{1.468+2} \approx 499.607$

Solve and check.

1. $4^{-x} = 32$
   $\log 4^{-x} = \log 32$
   $-x \log 4 = \log 32$
   ____
   ____

2. $3^{4x} = 90$
   $\log 3^{4x} = \log 90$
   $4x \log 3 = \log 90$
   ____
   ____

3. $5^{x-3} = 600$
   ____
   ____
   ____
   ____

Lesson (4-5) b

Exponential and Logarithmic Equations and Inequalities ***(continued)***

A **logarithmic equation** contains a logarithmic expression that has a variable.

$\log_5 x = 2$ is a logarithmic equation.

$x = 25$, since $5^2 = 25$.

Combine and use properties of logarithms to solve logarithmic equations.

Solve: $\log 80x - \log 4 = 1$

Step 1 Use the Quotient Property of Logarithms.

$\log 80x - \log 4 = 1$

$$\log \frac{80x}{4} = 1$$

$$\log x - \log y = \log \frac{x}{y}$$

Step 2 Simplify.

$$\log \frac{80x}{4} = 1$$

$\log 20x = 1$

Step 3 Use the definition of the logarithm:
if $b^x = a$, then $\log_b a = x$.

$\log_{10} 20x = 1$

Remember: Use 10 as the base when the base is not given.

$10^1 = 20x$

Step 4 Solve for x. Divide both sides by 20.

$10 = 20x$

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

Solve and check.

4. $\log_3 x^4 = 8$

$4 \log_3 x = 8$

$$\log_3 x = \frac{8}{4}$$

5. $\log 4 + \log (x + 2) = 2$

$\log 4\,(x + 2) = 2$

$\log_{10} (4x + 8) = 2$

$4x + 8 = 10^2$

6. $\log 75x - \log 3 = 1$

Lesson (4-6) a

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. $e \approx 2.71828\ldots$.

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

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

Simplify: $\ln e^{x+2}$

Step 1 Use the Power Property. "Bring down" the exponent to multiply.

$\ln e^{x+2}$

$(x + 2) \ln e$

$\ln e = 1$

Step 2 Simplify.

$(x + 2) \ln e$

$x + 2$

Simplify: $e^{4 \ln x}$

Step 1 Use the Power Property. Write the exponent.

$e^{4 \ln x}$

$e^{\ln x^4}$

$e^{\ln x} = x$

Step 2 Simplify.

$e^{\ln x^4}$

x^4

Simplify each expression.

1. $\ln e^{-6x}$

   $-6x \ln e$

2. $\ln e^{t-3}$

   $(t - 3) \ln e$

3. $e^{2 \ln x}$

   $e^{\ln x^2}$

4. $\ln e^{1.8}$

5. $\ln e^{x+1}$

6. $e^{7 \ln x}$

Lesson (4-6) b

The Natural Base, e ***(continued)***

The natural base, e, appears in the formula for interest compounded continuously.

$A = Pe^{rt}$

A = total amount

P = principal, or initial amount

r = annual interest rate

t = time in years

What is the total amount for an investment of $2000 invested at 3% and compounded continuously for 5 years?

Step 1 Identify the values that correspond to the variables in the formula.

P = initial investment = $2000

$r = 3\% = 0.03$

$t = 5$

Step 2 Substitute the known values into the formula.

$A = Pe^{rt}$

$A = 2000\ e^{0.03\ (5)}$

Step 3 Use a calculator to solve for A, the total amount.

$A = 2000\ e^{0.03\ (5)}$

$A \approx 2323.67$

Use the e^x key on a calculator: $2000e^{(.03*5)} = 2323.668485$

The total amount is $2323.67.

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

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

P = ________________ r = ________________ t = ________________

____

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?

5-2 Multiplying and Dividing Rational Expressions

Examples of rational expressions: $\frac{3}{x}$, $\frac{x+1}{x+2}$, and $\frac{x+3}{2x^2}$

Undefined at $x = 0$

Undefined at $x = 0$

Undefined at $x = -2$

When simplifying a **rational expression**:

- Factor the numerator and the denominator completely.
- Divide out any common factors.
- Identify any x-values for which the expression is undefined.

Simplify: $\frac{24x^6}{8x^2}$.

$x \neq 0$, because $8x^2$ is undefined at $x = 0$.

$$\frac{24x^6}{8x^2} = \frac{\cancel{8} \cdot 3}{\cancel{8}} x^{6-2} = 3x^4$$

Use the Quotient of Powers Property.

Simplify: $\frac{x^2 - 2x - 8}{x^2 + x - 2}$.

First, factor the numerator and the denominator.

$$\frac{x^2 - 2x - 8}{x^2 + x - 2} = \frac{(x-4)(x+2)}{(x+2)(x-1)} = \frac{(x-4)\cancel{(x+2)}}{\cancel{(x+2)}(x-1)} = \frac{(x-4)}{(x-1)} = \frac{x-4}{x-1}$$

$x \neq -2$ and $x \neq 1$

Divide out common factors.

Simplify.

1. $\frac{x^2 - 2x - 3}{x^2 + 6x + 5}$

$\frac{(x+1)(x-3)}{(x+1)(x+5)}$

____

$x \neq$ ______________________

2. $\frac{20x^9}{4x^3}$

____

____

$x \neq$ ______________________

3. $\frac{x^2 - 4x}{x^2 - 5x + 4}$

____

____

$x \neq$ ______________________

5-2

Multiplying and Dividing Rational Expressions *(continued)*

Multiplying rational expressions is similar to multiplying fractions.

Multiply: $\frac{15x^2y^3}{4x^3y^5}\cdot\frac{2x^4y^3}{3xy^2}$.

$$\frac{15x^2y^3}{4x^3y^5}\cdot\frac{2x^4y^3}{3xy^2}=\frac{15}{4}\cdot\frac{2}{3}\cdot\frac{x^2x^4}{x^3x}\cdot\frac{y^3y^3}{y^5y^2}$$

Group like factors.

$$=\frac{5}{2}\cdot\frac{x^6}{x^4}\cdot\frac{y^6}{y^7}$$

Simplify constants. Add exponents to multiply.

$$=\frac{5}{2}\cdot x^2\cdot\frac{1}{y}$$

Subtract exponents to divide.

$$=\frac{5x^2}{2y}$$

Simplify.

Multiplying rational expressions is similar to simplifying rational expressions.

Multiply: $\frac{x+3}{6x-6}\cdot\frac{x-1}{x^2-9}$.

$$\frac{x+3}{6x-6}\cdot\frac{x-1}{x^2-9}=\frac{x+3}{6(x-1)}\cdot\frac{x-1}{(x+3)(x-3)}$$

Completely factor all numerators and denominators.

$$=\frac{\cancel{x+3}}{6\cancel{(x-1)}}\cdot\frac{\cancel{x-1}}{\cancel{(x+3)}(x-3)}$$

Divide out common factors.

$$=\frac{1}{6(x-3)}$$

Simplify.

To divide rational expressions, multiply by the reciprocal.

$$\frac{x+7}{x-2}\cdot\frac{x^2-49}{2x-4}=\frac{x+7}{x-2}\cdot\frac{2x-4}{x^2-49}=\frac{\cancel{x+7}}{\cancel{x-2}}\cdot\frac{2(x-2)}{(x-7)(x+7)}=\frac{2}{x-7}$$

Multiply. Assume that all expressions are defined.

4. $\frac{12x^5y^2}{6x^2y^4}\cdot\frac{9x^3y}{3x^2y^3}$ ____________________

5. $\frac{2x-2}{x+4}\cdot\frac{x^2+4x}{x^2-3x+2}$ ____________________

6. $\frac{8x+16}{x^2-1}\cdot\frac{x+1}{4x+8}$ ____________________

7. $\frac{3x^3y}{5xy^2}\div\frac{9xy^3}{15y}$ ____________________

8. $\frac{4x-8}{x^2-4}\div\frac{3x}{x+2}$ ____________________

9. $\frac{x^2+2x-3}{x^2-9}\div\frac{x^2+3x-4}{x^2-2x-3}$ ____________________

Lesson (5-3) a

Adding and Subtracting Rational Expressions

Use a common denominator to add or subtract rational expressions.

Add: $\frac{6x+4}{x+5}+\frac{2x-8}{x+5}$.

Step 1 Add.

$$\frac{6x+4}{x+5}+\frac{2x-8}{x+5}=\frac{6x+4+2x-8}{x+5}$$

The denominators are the same. Add the numerators.

$$=\frac{6x+2x+4-8}{x+5}$$

Group like terms.

$$=\frac{8x-4}{x+5}$$

Combine like terms.

Step 2 Identify *x*-values for which the expression is undefined.

$x \neq -5$ because -5 makes the denominator equal 0.

Subtract: $\frac{4x-3}{2x-1}-\frac{8x+2}{2x-1}$.

Step 1 Subtract.

$$\frac{4x-3}{2x-1}-\frac{8x+2}{2x-1}=\frac{(4x-3)-(8x+2)}{2x-1}$$

The denominators are the same. Subtract the numerators.

$$=\frac{4x-3-8x-2}{2x-1}$$

Use the Distributive Property.

$$=\frac{-4x-5}{2x-1}$$

Combine like terms.

Step 2 Identify *x*-values for which the expression is undefined.

$x \neq \frac{1}{2}$ because $\frac{1}{2}$ makes the denominator equal 0.

Add or subtract.

1. $\frac{x-5}{x^2-4}+\frac{3x+2}{x^2-4}$

$\frac{(x-5)+(3x+2)}{x^2-4}$

____

$x \neq$ ________________

2. $\frac{7x-5}{x+3}-\frac{4x-1}{x+3}$

$\frac{(7x-5)-(4x-1)}{x+3}$

____

$x \neq$ ________________

3. $\frac{2x-1}{x-1}-\frac{5x+4}{x-1}$

____

____

$x \neq$ ________________

4. $\frac{4x+1}{3x+7}+\frac{9-x}{3x+7}$

____

$x \neq$ ________________

5. $\frac{8-x}{x-3}-\frac{5-x}{x-3}$

____

$x \neq$ ________________

6. $\frac{5x+2}{x^2-1}-\frac{3x-7}{x^2-1}$

____

$x \neq$ ________________

Lesson (5-3) b

Adding and Subtracting Rational Expressions *(continued)*

Use the least common denominator (LCD) to add rational expressions with different denominators. The process is the same as adding fractions with different denominators.

Add: $\dfrac{x-4}{x^2+2x-3}+\dfrac{2x}{x-1}$.

Step 1 Factor denominators completely.

$$\frac{x-4}{x^2+2x-3}+\frac{2x}{x-1}=\frac{x-4}{(x+3)(x-1)}+\frac{2x}{x-1}$$

Step 2 Find the LCD.
The LCD is the least common multiple of the denominators:
$(x+3)(x-1)$.

Step 3 Write each term of the expression using the LCD.

$$\frac{2x}{x-1}=\frac{2x}{x-1}\left(\frac{x+3}{x+3}\right)=\frac{2x^2+6x}{(x-1)(x+3)}$$

So, $\dfrac{x-4}{(x+3)(x-1)}+\dfrac{2x}{x-1}=\dfrac{x-4}{(x+3)(x-1)}+\dfrac{2x^2+6x}{(x-1)(x+3)}$

Step 4 Add the numerators and simplify.

$$\frac{x-4+2x^2+6x}{(x+3)(x-1)}=\frac{2x^2+7x-4}{(x+3)(x-1)}$$

Step 5 Identify *x*-values for which the expression is undefined.

$x \neq -3$ or 1 because both values make the denominator equal 0.

Add.

7. $\dfrac{x-1}{x^2-4}+\dfrac{3x}{x+2}$

$\dfrac{x-1}{(x+2)(x-2)}+\dfrac{3x}{x+2}$

$\dfrac{x-1}{(x+2)(x-2)}+\dfrac{3x}{x+2}\left(\dfrac{x-2}{x-2}\right)$

____

$x \neq$ ____

8. $\dfrac{4x-1}{x^2+3x+2}+\dfrac{3}{x+1}$

____

____

____

$x \neq$ ____

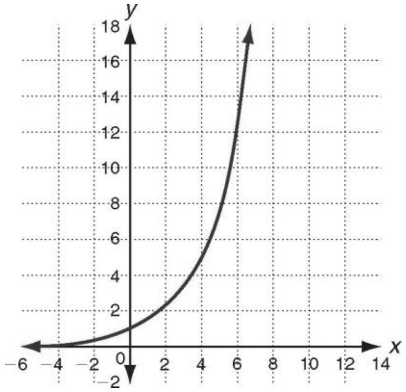
9. What is the LCD of $\dfrac{2x+1}{x^2-9}$ and $\dfrac{7}{x^2-x-6}$?

____

Answer Key Lesson (4-1)

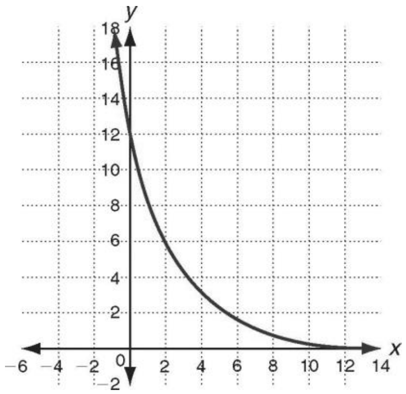
1. 0.8; 1.6

   $h(x)$ shows exponential growth.



2.12; 0.7

   $p(x)$ shows exponential decay.

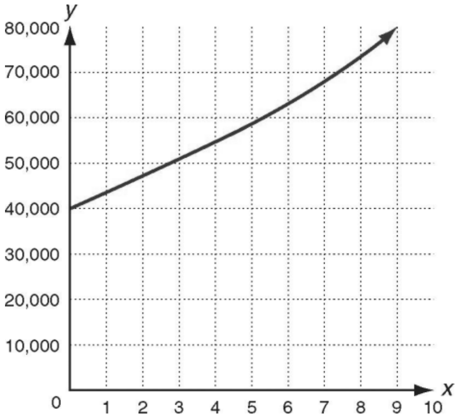


3. a. 40,000

   b. 0.08

   c. $f(t) = 40{,}000(1.08)^t$

   d. 5.25 yr



Answer Key Lesson (4-2)

1.

x	6	10	12	13	13
y	0	2	5	8	10

$\{x|0 \le x \le 10\}$

$\{y|6 \le y \le 13\}$

$\{x|6 \le x \le 13\}$

$\{y|0 \le y \le 10\}$

2. $f^{-1}(x) = x + 4$

$f(5) = 1; f^{-1}(1) = 5$

3. $f^{-1}(x) = 6x$

$f(12) = 2; f^{-1}(2) = 12$

4. $f^{-1}(x) = x - 3$

5. $f^{-1}(x) = \dfrac{x}{14}$

Answer Key Lesson (4-3)

1. $\log_7 49 = 2$
2. $b = 6, x = 3, a = 216$

   $\log_6 216 = 3$
3. $b = 2, x = 5, a = 32$

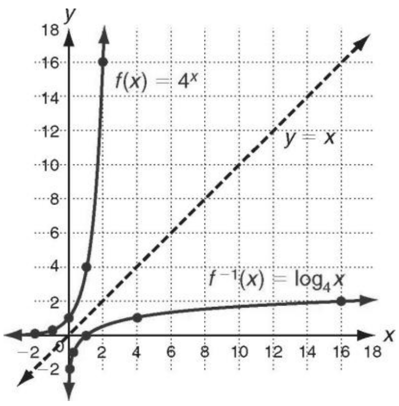
   $\log_2 32 = 5$
4. $9^3 = 729$
5. $b = 2, x = 6, a = 64$

   $2^6 = 64$
6. $b = 10, x = 3, a = 1000$

   $10^3 = 1000$
7.

x	–2	–1	0	1	2
$f(x)$	$\frac{1}{16}$	$\frac{1}{4}$	1	4	16

x	$\frac{1}{16}$	$\frac{1}{4}$	1	4	16
$f^{-1}(x)$	–2	–1	0	1	2



Answer Key Lesson (4-4)

1. 3
2. $\log_2 16$; 4
3. $\log_9 (3 \cdot 27)$; $\log_9 81$; 2
4. $2 \cdot 3 = 6$
5. $4 \cdot 4 = 16$
6. $3 \log_9 81$; $3 \cdot 2 = 6$
7. $5y$
8. 75
9. $3x$

Answer Key Lesson (4-5)

1. $x = -2.5$; $4^{-(-2.5)} = 32$
2. $x \approx 1.024$; $3^{4(1.024)} \approx 90.01$
3. $\log 5^{x-3} = \log 600$

   $(x - 3) \log 5 = \log 600$

   $x \approx 6.975$

   $5^{6.975-3} \approx 600.352$
4. $3^2 = x$

   $x = 9$
5. $4x + 8 = 100$

   $4x = 92$

   $x = 23$
6. $\log\left(\frac{75x}{3}\right) = 1$; $\log 25x = 1$; $10^1 = 25x$;

   $10 = 25x$; $x = \frac{2}{5}$

Answer Key Lesson (4-6)

1. $-6x$

2. $t-3$

3. x^2

4. $1.8 \ln e$; 1.8

5. $(x+1) \ln e$; $x+1$

6. $e^{\ln x^2}$; x^7

7. 500; 0.045; 10; $784.16

8. $1182.94

9. a. $6201.23

   b. $61.70

Answer Key Lesson (5-2)

1. $\frac{x-3}{x+5}$, -1, -5

2. $\frac{20}{4} \cdot \frac{x^9}{x^3}$; $5x^6$; 0

3. $\frac{x\cancel{(x-4)}}{\cancel{(x-4)}(x-1)}$; $\frac{x}{x-1}$; 1, 4

4. $\frac{6x^4}{y^4}$

5. $\frac{2x}{x-2}$

6. $\frac{2}{x-1}$

7. $\frac{x}{y^4}$

8. $\frac{4}{3x}$

9. $\frac{x+1}{x+4}$

Answer Key Lesson (5-3)

1. $\frac{4x-3}{x^2-4}$; -2, 2

2. $\frac{3x-4}{x+3}$; -3

3. $\frac{-3x-5}{x-1}$; 1

4. $\frac{3x+10}{3x+7}$; $-\frac{7}{3}$

5. $\frac{3}{x-3}$; 3

6. $\frac{2x+9}{x^2-1}$; ± 1

7. $\frac{x-1+\left(3x^2-6x\right)}{(x+2)(x-2)} = \frac{3x^2-5x-1}{(x+2)(x-2)}$

   $x \neq -2, 2$

8. $\frac{4x-1}{(x+2)(x+1)} + \frac{3}{x+1}\left(\frac{x+2}{x+2}\right)$

   $\frac{4x-1+3x+6}{(x+2)(x+1)}$

   $\frac{7x+5}{(x+2)(x+1)}$

   $x \neq -2, -1$

9. $(x-3)(x+3)(x+2)$