Chapter 1 Functions

Application Preview Pg. 3
Lesson 1.1 Real Numbers, Inequalities, and Lines
Notes

Inequalities
$a < b$ a is less than b
$a \leq b$ a is less than or equal to b
$a > b$ a is greater than b
$a \geq b$ a is greater than of equal to b

Practice
Which number is smaller?
1/100 or -1,000,000

Notes Cont.

Sets and Intervals

{} are read as the "set of all" and | is read as "such that."

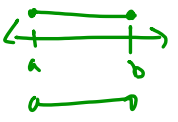
Practice
Write in set notation "the set of all x such that x is greater than or equal to -7."

Express in words $\{ x \mid x < -1 \}$.

Notes Cont.

Finite Intervals

Interval notation	Set notation	Graph Type
[a,b]	$\{ x \mid a \leq x \leq b \}$	Closed
(a,b)	$\{ x \mid a < x < b \}$	Open
[a,b)	$\{ x \mid a \leq x < b \}$	Half Open
(a,b]	$\{ x \mid a < x \leq b \}$	or Half Closed



Infinite Intervals

Interval notation	Set notation	Graph Type
$[a,\infty)$	$\{ x \mid x \geq a \}$	Closed
(a,∞)	$\{ x \mid x > a \}$	Open
$(-\infty, a]$	$\{ x \mid x \leq a \}$	Closed
$(-\infty, a)$	$\{ x \mid x < a \}$	Open

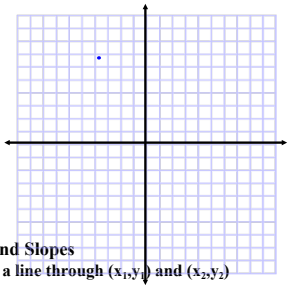
(3,4)

Assignment Pg. 14; 1-4

(3+4)5

Notes Cont.

Cartesian Plane

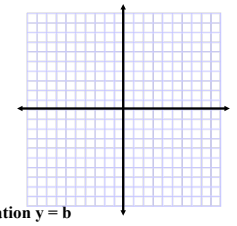


Lines and Slopes
Slope of a line through (x_1,y_1) and (x_2,y_2)

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Practice Problem 3 Pg. 9

Notes Cont.



Equations of Lines
Slope-Intercept
$y = mx + b$
Point-Slope
$y - y_1 = m(x - x_1)$
General
$ax + by = c$
Horizontal Lines will always have the equation y = b
Vertical Lines will always have the equation x = a

Practice
Find the slope-intercept form of the line through the points (2,1) and (4,7).

Find an equation for the vertical line through the point (-2,10).

Find the slope and y-intercept of the line x - y/3 = 2.

Assignment Pg. 16-21; 1-4, 5-53o, 55-75/3, 75-85o

Linear Regression Pg. 13

Chapter 1 Functions

Lesson 1.2 Exponents

Notes

Positive Integer Exponents

Properties of Exponents

$x^m * x^n = x^{m+n}$
$x^m / x^n = x^{m-n}$
$(x^m)^n = x^{m*n}$
$(xy)^n = x^n * y^n$
$(x/y)^n = x^n/y^n$

$(2x)^4 = 2^4 x^4$

Practice

Simplify

$\frac{x^5 * x}{x^2}$

$[(x^3)^2]^2$

Notes Cont.

Zero and Negative Exponents

$x^0 = 1$
$x^{-1} = 1/x$
$x^{-2} = 1/x^2$
$x^{-n} = 1/x^n$

Practice

Evaluate

2^0

2^{-4}

$\left(\frac{x}{y}\right)^{-1} = \frac{x^{-1}}{y^{-1}} = \frac{\frac{1}{x}}{\frac{1}{y}} = \frac{y}{x}$

Notes Cont.

$(x/y)^{-1} = y/x$
$(x/y)^{-n} = (y/x)^n$

Practice

Simplify

$(2/3)^{-2}$

Assignment Pg. 30; 1-16

Notes Cont.

Roots and Fractional Exponents

$\sqrt[n]{a}$ **means the principal nth root of a. Principal means positive if there are two.**

$\sqrt{4} = 2 \quad (-2)^2 = 4$
$-2 \quad (2)^2 = 4$

Fractional Exponents

$x^{1/2} = \sqrt{x}$
$x^{1/3} = \sqrt[3]{x}$
$x^{1/n} = \sqrt[n]{a}$

Practice

Evaluate:

$(-27)^{1/3}$

$(16/81)^{1/4}$

Notes Cont.

Fractional Exponents

$x^{m/n} = (\sqrt[n]{x})^m = \sqrt[n]{x^m}$

Practice

Evaluate

$16^{3/2} = \sqrt{16}^3$

$(-8)^{2/3}$

$25^{-3/2}$

$(1/4)^{-1/2}$

$\frac{1}{\sqrt{4}} = 2$

$5^{1.3}$

$5^{13/10} \sqrt[10]{5^{13}}$

$\sqrt[10]{5^{10}} \, 5^3 \quad 5\sqrt[10]{5^3}$

Notes Cont.

$(x + y)^2 = x^2 + 2xy + y^2$

Assignment Pg. 30-31; 1-16, 17-63o, 65-78, 89-108/3

Learning Curves in Airplane Production Pg. 27
Power Regression Pg. 28

Lesson 1.3 Functions: Linear and Quadratic

Notes

A function f is a rule that assigns to each number x in a set a number f(x). The set of allowable values of x is called the domain, and the set of all values f(x) for x in the domain is called the range.

Practice Problem 1 Pg. 35

Practice

For $g(z) = \sqrt{(z - 2)}$, determine:

g(27)

The domain

The range

Notes Cont.

Vertical Line Test for Functions

A curve in the Cartesian plane is a graph of a function if and only if no vertical line intersects the curve at more than one point.

Linear Fuction

A linear function is a function that can be expressed in the form $f(x) = mx + b$ with constants m and b. Its graph is a line with slope m and y-interpect b.

Practice

A trucking company will deliver furniture for a charge of $25 plus 5% of the purchase price of the furniture. Find a function D(x) that gives the delivery charge for a piece of furniture that costs x dollars.

Assignment Pg. 47-51; 1-25o

Note Cont.

Quadratic Function

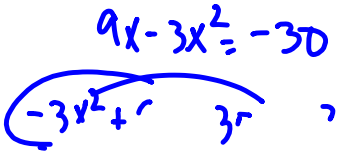
A quadratic function that can be expressed in the form $f(x) = ax^2 + bx + c$ with constants $a \neq 0$, b, and c. Its graph is called a parabola.

Vertex Formula for a Parabola

The vertex of the parabola $f(x) = ax^2 + bx + c$ has x-coordinate $x = -b/2a$

Solving Quadratic Equations

1) Factoring
2) Quadratic Formula
3) Graphing
4) Complete the Square



Practice

Solve by factoring and graphing

$9x - 3x^2 = -30$

Quadratic Formula

The solutions to $ax^2 + bx + c = 0$ are

$$x = \frac{-b + \sqrt{(b^2 - 4ac)}}{2a}$$

Assignment Pg. 47-51; 1-51o

Notes Cont.

Profit = Revenue - Cost

Assignment Pg. 47-51; 1-63 odd, 65-100/5

Lesson 1.4 Functions

Notes

Polynomial Functions

a function that can be written in the form $f(x) = a_nx^n + a_{n-1}x^{n-1} + ... + a_2x^2 + a_1x + a_0$ where n is nonnegative integer and $a_0, a_1, ..., a_n$ are real numbers, called coefficients.
The domain of a polynomial function is the set of real numbers. The degree of a polynomial is the highest power of the variable.

Practice

Solve $2x^3 - 4x^2 = 48x$

Notes Cont.

Rational Function

The quotient of two polynomials. The domain is the set of real numbers for which the denominator is not zero.

Practice

What is the domain of the rational function $f(x) = \frac{18}{(x + 2)(x - 4)}$

Notes Cont.

Exponential Functions

A function is which the independent variable appears in the exponent.
$f(x) = 2^x$.

Assignment Pg. 67-71; 1-31o, 33-52, 53-65o, 67-70, 71-97o

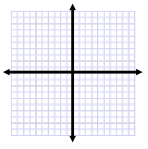
Notes Cont.

Piecewise Linear Functions

Example 3 Pg 56

Absolute Value Functions

$f(x) = |x| = \begin{cases} x \text{ if } x \geq 0 \\ -x \text{ if } x < 0 \end{cases}$



Example 5 Pg. 58

Composite Functions

The composition of f with g evaluated at x is f(g(x)).

Practice

If $f(x) = x^2 + 1$ and $g(x) = \sqrt[3]{x}$, find:

f(g(x))

g(f(x))

Assignment Pg. 64-68; 1-31o, 33-52, 53-65o, 67-70, 71-97o

Notes Cont.

Shifts of Graphs

y = f(x + a) Left by a units
y = f(x - a) Right by a units
y = f(x) + b Up by b units
y = f(x) - b Down by b units

Difference Quotient

The quantity $\frac{f(x + h) - f(x)}{h}$ is called the difference quotient.

The difference quotient gives the slope of a line that passes through the point (x,f(x)) and (x+h,f(x+h)). This quantity will become very important as our discussion comes around to derivatives.

Practice

If $f(x) = 3x^2 - 2x + 1$, find and simplify $\frac{f(x+h) - f(x)}{h}$

Assignment Pg. 64-68; 1-31o, 33-52, 53-65o, 67-70, 71-97o

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