SECTION P.1 — GRAPHS AND MODELS

WHAT YOU SHOULD LEARN

- Sketch the graph of an equation.
- Find the intercepts of a graph.
- Test a graph for symmetry.
- Find the points of intersection of two graphs.

WHY YOU SHOULD LEARN IT

Graphs can represent real-life situations.

GRAPHING AN EQUATION

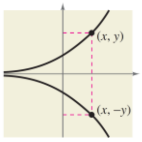
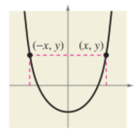
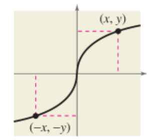
- Use a table of values to plot points
- Use basic knowledge of functions and end behavior
- Use a graphing calculator

FINDING INTERCEPTS

- *x*-intercept: Let $y = 0$
- *y*-intercept: Let $x = 0$

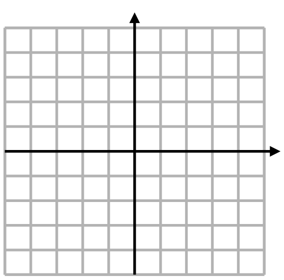
POINTS OF INTERSECTION

- Use linear combination
- Use substitution

X-AXIS SYMMETRY	Y-AXIS SYMMETRY	ORIGIN SYMMETRY
		
NEITHER	***EVEN***	***ODD***
Replace (x, y) with $(x, -y)$	Replace (x, y) with $(-x, y)$	Replace (x, y) with $(-x, -y)$

EXAMPLE 1 — Sketching Graphs, Finding Intercepts, and Testing for Symmetry

a. $y - x = 2x^2$

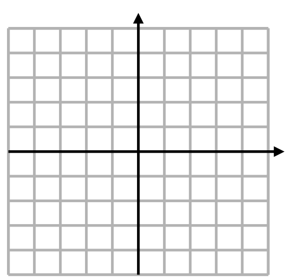


x-intercept(s): ________

y-intercept(s): ________

Symmetry: __________

b. $x = y^3$

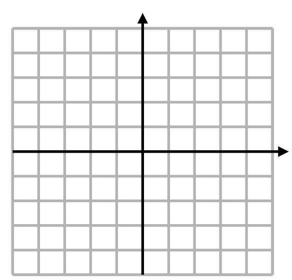


x-intercept(s): ________

y-intercept(s): ________

Symmetry: __________

c. $y = |x + 2|$



x-intercept(s): ________

y-intercept(s): ________

Symmetry: __________

EXAMPLE 2 — Finding Points of Intersection

a. $3x - 2y = -4$
$4x + 2y = -10$

b. $x = 3 - y^2$
$y = x - 1$

SECTION P.2 LINEAR MODELS AND RATES OF CHANGE

WHAT YOU SHOULD LEARN

- Find the slope of a line passing through two points.
- Write the equation of a line with a given point and slope.
- Write equations of lines that are perpendicular and parallel to a line.

WHY YOU SHOULD LEARN IT

Interpret slope as a rate in a real-life application.

SLOPE	VERTICAL & HORIZONTAL	PARALLEL & PERPENDICULAR
$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$	Vertical Line: $x = a$ Horizontal Line: $y = b$	Parallel: same slope Perp: (normal) neg reciprocal
POINT-SLOPE FORM	**SLOPE-INTERCEPT FORM**	**STANDARD FORM**
$y - y_1 = m(x - x_1)$	$y = mx + b$	$Ax + By = C$

EXAMPLE 1 Finding Slopes

a. (1, 1) (–2, 7)

b. (4, 8) (2, 8)

c. $(\frac{7}{8}, \frac{3}{4})$ $(\frac{5}{4} - \frac{1}{4})$

d. (–3, 2) (–3, 6)

EXAMPLE 2 Writing Equations of Lines

a. Point: (3, 5)
Point: (–1, 13)

Pt-Slope: ____________________

Slope-Int: ____________________

Standard: ____________________

b. Point: (4, –7)
Parallel to: $y = \frac{2}{3}x + 5$

Pt-Slope: ____________________

Slope-Int: ____________________

Standard: ____________________

c. Point: (–2, 8)
Perpendicular to: $y = \frac{2}{7}x + 2$

Pt-Slope: ____________________

Slope-Int: ____________________

Standard: ____________________

EXAMPLE 3 Rates of Change

Hot water is dripping through a coffeemaker, filling a large cup with coffee. The amount of coffee in the cup at time t, $0 \le t \le 6$, is given by a function C, where t is measured in minutes. Selected values of $C(t)$, measured in ounces, are given in the table below.

t (minutes)	0	1	2	3	4	5	6
$C(t)$ (ounces)	0	5.3	8.8	11.2	12.8	13.8	14.5

Find the rate of change at t = 3.5 minutes.

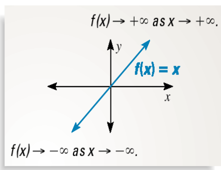
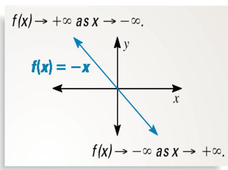
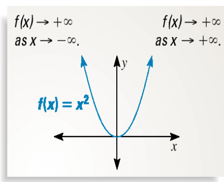
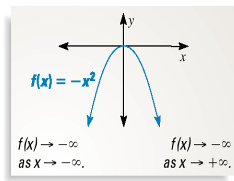
SECTION P.3 FUNCTIONS AND THEIR GRAPHS

WHAT YOU SHOULD LEARN

- Use function notation to represent and evaluate a function.
- Find the domain and range of a function.
- Identify different graphs and transformations.
- Recognize combinations of functions.

WHY YOU SHOULD LEARN IT

Recognizing functions lets you sketch quick graphs.

LEADING COEFFICIENT TEST			
ODD POSITIVE	**ODD NEGATIVE**	**EVEN POSITIVE**	**EVEN NEGATIVE**
			

LINEAR	QUADRATIC	CUBIC	ABS VALUE	SQUARE ROOT	CUBE ROOT
$f(x) = mx + b$	$f(x) = x^2$	$f(x) = x^3$	$f(x) = \|x\|$	$f(x) = \sqrt{x}$	$f(x) = \sqrt[3]{x}$
RATIONAL	**SINE**	**COSINE**	**TANGENT**	**SHIFT**	**REFLECT**
$f(x) = \frac{1}{x}$	$f(x) = \sin x$	$f(x) = \cos x$	$f(x) = \tan x$	Up: $f(x) + c$ Down: $f(x) - c$ Right: $f(x - c)$ Left: $f(x + c)$	x-axis: $-f(x)$ y-axis: $f(-x)$ Origin: $-f(-x)$

VOCABULARY

- Function – every input has exactly one output (vertical line test)
- Interval notation – [include] and (does not include)

Compositions

$f \circ g = f(g(x))$

$g \circ f = g(f(x))$

EXAMPLE 1 Evaluating a Function

a. $g(x) = x^2(x - 4)$

$g(4) =$ _________

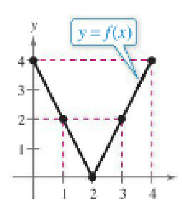
$g(2) =$ _________

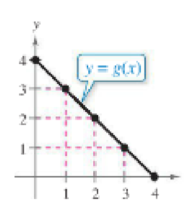
b. $f(x) = \begin{cases} x^2 + 2, & x \le 1 \\ 2x^2 + 2, & x > 1 \end{cases}$

$f(-2) =$ _________

$f(1) =$ _________

c.





______ **a.** $(f + g)(1)$

______ **b.** $(fg)(3)$

______ **c.** $(f \circ g)(3)$

______ **d.** $(g \circ f)(0)$

d. $f(x) = \sin x$

$f(\pi) =$ _________

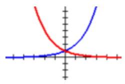
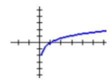
$f(\frac{2\pi}{3}) =$ _________

e. $h(x) = \cos x$

$h(\frac{3\pi}{4}) =$ _________

$h(\frac{3\pi}{4}) =$ _________

SECTION P.5 — EXPONENTIAL & LOGARITHMIC FUNCTIONS

	 **EXPONENTIAL** $f(x) = a^x$ *or* a^{-x}	 **NATURAL LOG** $f(x) = \ln x$
Domain	$(-\infty, \infty)$	$(0, \infty)$
Range	$(0, \infty)$	$(-\infty, \infty)$
y-intercept	$(0, 1)$	$(1, 0)$
Function	One-to-one	One-to-one

WHAT YOU SHOULD LEARN

- Graph exponential and natural logarithmic functions.
- Use properties of exponential and natural logarithm functions.
- Solve exponential and logarithmic equations.

WHY YOU SHOULD LEARN IT

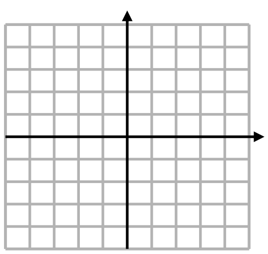
Exponential & logarithmic functions are useful in real-life applications.

EXAMPLE 1 Graphing Exponential and Logarithmic Functions

GROWTH	$a > 1$
DECAY	$0 < a < 1$ or $y = a^{-x}$

a. $y = 2^{x+3}$

Growth *or* Decay



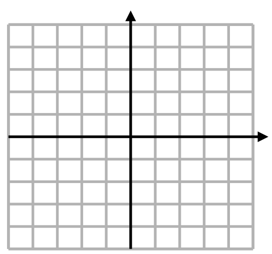
Domain:

Range:

Asymptote:

b. $y = \left(\frac{1}{2}\right)^{x+2} + 1$

Growth *or* Decay

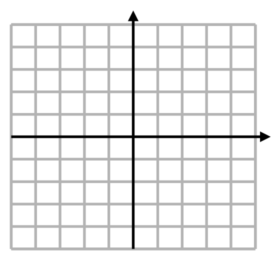


Domain:

Range:

Asymptote:

c. $y = e^x$

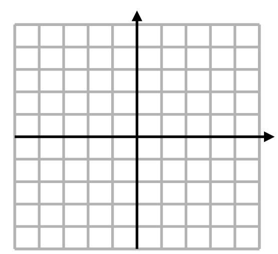


Domain:

Range:

Asymptote:

d. $y = \ln x$



Domain:

Range:

Asymptote:

PROPERTIES OF LOGARITHMS

1. $\ln xy = \ln x + \ln y$
2. $\ln \frac{x}{y} = \ln x - \ln y$
3. $\ln x^z = z \ln x$

EXAMPLE 2 Expanding Logarithmic Expressions

a. $\ln \sqrt{x^5}$ **b.** $\ln(xyz)$ **c.** $\ln \dfrac{y(z-1)^2}{x}$

EXAMPLE 3 Condensing Logarithmic Expressions

a. $\ln y + \ln x^2$ **b.** $3\ln x + 2\ln y - 4\ln z$ **c.** $\ln x + \ln y + 7\ln z$ **d.** $\frac{1}{2}\ln(3x+2)$

EXAMPLE 4 Solving Exponential and Logarithmic Equations

a. $5^x = 18$ **b.** $\log_4(x+3) = 2$ **c.** $e^{x+1} = 7$ **d.** $\ln(2x-3) + 4 = 9$