Contracts

Name	Domain	Range	example
••	•	↑	
:	:	↑	
••	•	↑	
••		↑	
•	•	^	
••	•	^	
••	:	↑	
••		↑	
••	•	^	
•	•	↑	
••		↑	
••	:	↑	
;	•	^	
••	•	↑	
•		+	
••	:	↑	
•	•	↑	

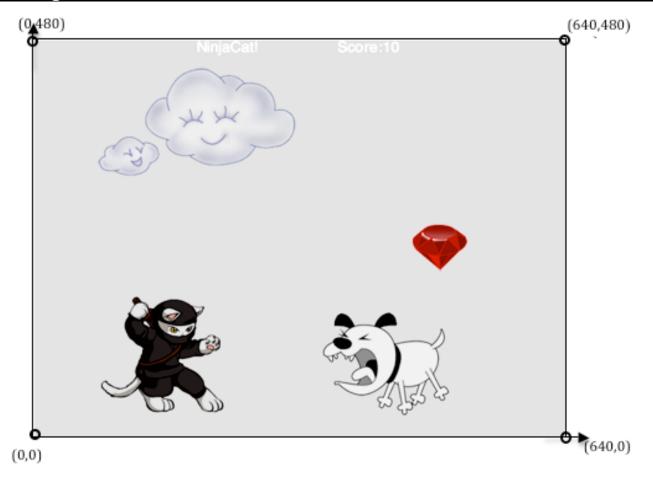
Contracts

example																	
Range	1	1	1	1	↑	↑	↑	↑	↑	↑	1	↑	↑	↑	↑	↑	1
Domain		••		•	•	•	•	:	•	•		:	•	•	•	•	<u></u>
Name	••	••	••	••	••	••	••	••	••	••	••	•	••	••	••	:	••

Reverse-Engineering: How does NinjaCat work?

Thing in the game	What changes about it?	More specifically
cloud	position	x-coordinate

Finding Coordinates



The coordinates for the PLAYER (NinjaCat) are:	(,)	
	X-C	oordinate y	y-coordinate	
The coordinates for the DANGER (Dog) are:	(,)	
The coordinates for the TARGET (Ruby) are:	(,)	

Our Videogame

Created by (write your names):
Background
Our game takes place in:(space? the desert? a mall?)
The Player
The player is a
The player moves only up and down.
The Target
Your player GAINS points when they hit the target.
The Target is a
The Target moves only to the left and right.
The Danger Your player LOSES points when they hit the danger.
The Danger is a
The Danger moves only to the left and right.

Circle of Evaluation Practice Time: 5 minutes Don't forget to use the computer's symbols for things like multiply and divide!

Math	Circle of Evaluation	Racket Code
5 x 10		
8 + (5 x 10)		
(8 + 2) - (5 x 10)		
<u>5 x 10</u>		
<u>5 x 10</u> 8 - 2		

(draw Circles of Evaluation here if you need extra scratch paper)

	Circles Co	mpetition	Time: 5 minutes
	Math	Circle of Evaluation	Racket Code
Round 1	(3 * 7) - (1 + 2)		
Round 2	3 - (1 + 2)		
Round 3	3 - (1 + (5 * 6))		
Round 4	(1 + (5 * 6)) - 3		

Fast Functions						
;:		>				
name	domain	range				
(EXAMPLE ())			
(EXAMPLE ())			
(define ())			
;	<u>:</u>	>				
name	domain	range				
(EXAMPLE ())			
(EXAMPLE ())			
(define ())			
;	;	>				
name	domain	range				
(EXAMPLE ())			
(EXAMPLE ())			
(define ())			
;	<u>:</u>	>				
name	domain	range				
(EXAMPLE ())			
(EXAMPLE ())			
(define ())			

Fast Functions						
;:		>				
name	domain	range				
(EXAMPLE ())			
(EXAMPLE ())			
(define ())			
;	<u>:</u>	>				
name	domain	range				
(EXAMPLE ())			
(EXAMPLE ())			
(define ())			
;	;	>				
name	domain	range				
(EXAMPLE ())			
(EXAMPLE ())			
(define ())			
;	<u>:</u>	>				
name	domain	range				
(EXAMPLE ())			
(EXAMPLE ())			
(define ())			

	•	•	-	
 · · · · · · · · · · · · · · · · · · ·	-	-	-	

DESIGN RECIPE

Word Problem: rocket-height

A rocket blasts off, traveling at 7 meters per second. Write a function called "rocket-height" that takes in the number of seconds that have passed since the rocket took off, and which produces the height of the rocket at that time.

I. Contract+Purpose	Statement	
Every contract has three pa	rts:	
•		->
name	Domain	Range
•		
,	What does the function do?	
	mad ases the function as:	
II. Give Examples	example of your function in action, using E	EYAMDI E
on the computer, write an	example of your function in action, using t	_AAMFLL.
/ U V N M D T U /		1
(EXAMPLE (the user types	/
	3,	
	which should be some)
	which should become	
(EXAMPLE ()
(the user types	/
		,
	which should become)
III. Definition	giving variable names to all your input	tyaluos
wille the deliminon	, giving variable names to all your input	values.
/ 1 C' /		,
(define (me variable names)
TUILCUOITIId	ne variable names	
		1
	the computer does this	<i>,</i>

Word Problem: red-square

Use the Design Recipe to write a function <u>red-square</u>, which takes in a number (the size of the square) and outputs a solid red rectangle whose length and width are the same size.

I. Contract+Purpose S	tatement	
Every contract has three par		
		->
, •	Domain	Range
		5-
;		
	What does the function do?	
II. Give Examples		
On the computer, write an e	example of your function in action, using E	XAMPLE
(EXAMPLE ()
(=>=====	the user says	/
		\
	Racket replies)
	<u> </u>	
(EXAMPLE (\
(LAAMPLL (the user says)
	Racket turns that into)
	Nacket turns that into	
III. Definition		
Write the definition,	giving variable names to all your input	values.
(define ()
function nam	ne variable names	/
)
	the computer does this	/

Word Problem: yard-area

Use the Design Recipe to write a function <u>yard-area</u>, which takes in the width and length of a yard, and returns the area of the yard.

(Don't forget: area = length * width!)

I. Contrac	t+Purpose Statement	•		
Every contract h				
•	•		_	
name	:	 Domain	> Range	
name		Domain	Nulige	
•				
	W	hat does the function do?		
II. Give Exc	amples			
On the compute	r, write an example of	your function in action, using EXAMP	LE.	
(EVAMDLE (\	
(EXAMPLE (Use the fu	nction here)	
_)	
	fir	nd another way to get the same result here		
(EXAMPLE ()	
	Use the fu	inction here		
)	
_	fir	nd another way to get the same result here	/	
III Dofinitio				
III. Definitio Write the		ariable names to all your input value	2 S.	
,,,,,,			70.	
(define (_)	
(======================================	function name	variable names	<u> </u>	
)
-	and the compute	er does this		—/

Word Problem: update-danger

Use the Design Recipe to write a function <u>update-danger</u>, which takes in the danger's x-coordinate and produces the next x-coordinate, which is 50 pixels to the left.

I. Contrac	ct+Purpose Statement			
Every contract	has three parts:			
•	•		->	
name	•	Domain	Ra	inge
_				
;	What doe	es the function do?		
	What doe	s the function do:		
	amples er, write an example of your	function in action luci	ng EVAMDI E	
On the comput				
(EXAMPLE	<u> </u>)	
	Use the function I	here		
_)
_	find anoth	her way to get the same re	sult here	
(EXAMPLE	<u> </u>)	
	Use the function I	here		
)
-	find anoth	her way to get the same re	sult here	
III. Definitio	on			
	e definition, giving variable	names to all your in	put values.	
(define (_)	
	function name	variable names	i	
	and the second of the second	thic)
	and the computer does	UIIS		

Word Problem: update-target

Write a function <u>update-target</u>, which takes in the target's x-coordinate and produces the next x-coordinate, which is 50 pixels to the right.

I. Contrac	ct+Purpose Statement		
	has three parts:		
•	•	->	
name	•Domai		Range
;	What does the function		
	What does the function	uo:	
II. Give Ex	amples	ection using EVAMPLE	
On the compute	er, write an example of your function in a		
(EXAMPLE (Use the function here)	
	Use the function here		
_)
_	find another way to get	the same result here	,
(EXAMPLE (,)	
	Use the function here		
_)
	find another way to get	the same result here	,
III. Definitio	on		
Write th	e definition, giving variable names to	all your input values.	
(`	
(define (_	function name val	riable names	
	runction name val	iante liailles	
			1
	and the computer does this)

Sam is in a 640 x 480 yard. How far he can go to the left and right before he's out of sight?

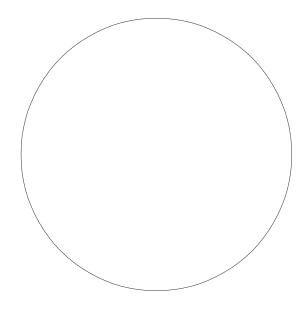
1. A piece of Sam is still visible on the left as long as...

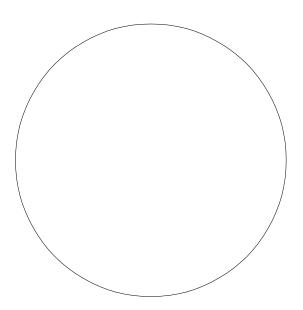
$$(> x -50)$$

2. A piece of Sam is still visible on the right as long as...



3. Draw the Circle of Evaluation for these two expressions in the circles below:





Word Problem: safe-left?

Use the Design Recipe to write a function <code>safe-left?</code>, which takes in an x-coordinate and checks to see if it is greater than -50.

. Contract+Purpos	e Statement			
very contract has thre	e parts:			
:			->	
name		Domain	Range	
	What de	oes the function do?		
Cive Everneles				
. Give Examples On the computer, write	an example of y	your function in action, us	sing EXAMPLE.	
EXAMPLE (Use the function	n here)	
			,	
	find and	other way to get the same result) here	
		other may to get the same result	Tiere	
EXAMPLE ()	
L//A//// LL (Use the function	n here	/	
			,	
	find and	other way to get the same result	here	
II. Definition				
	n, giving variab	ole names to all your inpu	t values.	
define ()	
function	name	variable names		
				,

...and the computer does this

Word Problem: safe-right?

Use the Design Recipe to write a function <u>safe-right?</u>, which takes in an x-coordinate and checks to see if it is less than 690.

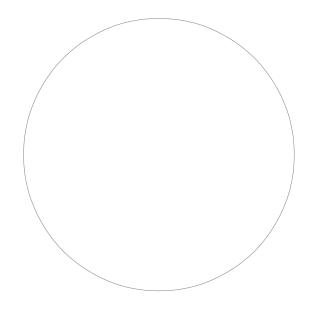
	act+Purpose Statemer	nt		
	t has three parts:			
•	•		_	
,	·	 Domain	->	
name		Domain	Range	
:				
,		What does the function do?		
u Circul				
	xamples	of your function in action, using EXAM	ADI F	
on the compe	itel, write all example e	or your runction in action, using EXAM	W LL.	
(EXAMPLE	()	
	Use the f	function here		
			`	
		find another way to get the same result here)	
		and another way to get the same result here		
(EXAMPLE	()	
	Use the f	function here		
			,	
	f	find another way to get the same result here)	
III. Defini				
write	rne definition, giving v	ariable names to all your input valu	ues.	
(dofina	,		1	
(define	function name)	
	TUNCTION NAME	variable names		
)

...and the computer does this

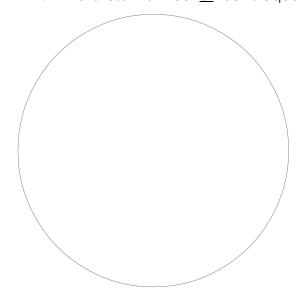
and / or

Write the Circles of Evaluation for these statements, and then convert them to Racket

1. Two is less than five, <u>and</u> zero is equal to six.



2. Two is less than four <u>or</u> four is equal to six.



Word Problem: onscreen?

Use the Design Recipe to write a function <u>onscreen?</u>, which takes in an x-coordinate and checks to see if Sam is safe on the left <u>and</u> safe on the right.

I. Contro	act+Purpose Statement	
	t has three parts:	
•	•	
name	•	> Range
name	Domain	Kange
•		
,	What does the function do?	
U. Chan F		
On the compu	xamples Iter, write an example of your function in action, us	ing FXΔMPI F
on the compa		
(EXAMPLE	Use the function here)
	Use the function here	
		`
	find another way to get the same re	
	Tind dilother way to get the sume it	23dic nere
(EXAMPLE	()
	Use the function here	
		\
	find another way to get the same re	esult here
III. Definit		
write i	the definition, giving variable names to all your in	nput values.
(dofina (,	1
(define (function name variable name	
	function name variable name	3
)

...and the computer does this

Word Problem: cost

Luigi's Pizza has hired you as a programmer. They offer "pepperoni" (\$10.50), "cheese" (\$9.00), "chicken" (\$11.25) and "broccoli" (\$10.25). Write a function called cost which takes in the name of a topping and outputs the cost of a pizza with that topping.

I. Contract+Purpose Statem	ent	
, •	Domain	
II. Give Examples		
On the computer, write an exam	iple of your function for <u>e</u>	ach topping, using EXAMPLE.
	"pepperoni"))
Use the function	n here	What should the function produce?
(EXAMPLE ()	What should the function produce?
(EXAMPLE ())
Use the function	n here	What should the function produce?
(EXAMPLE (What should the function produce?
III. Definition		
(define (1
function name	variable r	names
	_	

Word Problem: update-player

Write a function called <u>update-player</u>, which takes in the player's y-coordinate and the name of the key pressed, and returns the new y-coordinate.

I. Contra	ıct+Purpose Statemer	nt		
•	:			->
name	·		Domain	Range
	xamples examples we've star	ted for you	u, and make tv	wo more
(EXAMPLE	(<u>update-player</u> Use the function t		<u>"up"</u>) _	What should the function produce?
(EXAMPLE	(<u>update-player</u> Use the function t		"down") _	What should the function produce?
(EXAMPLE	Use the function h	nere)	What should the function produce?
(EXAMPLE	Use the function h	nere)	What should the function produce?
III. Definiti	on			
(define	function name		variable no	ames

Write a function called <u>line-length</u>, which takes in two numbers and returns the difference between them. It should always subtract the smaller number from the bigger one.

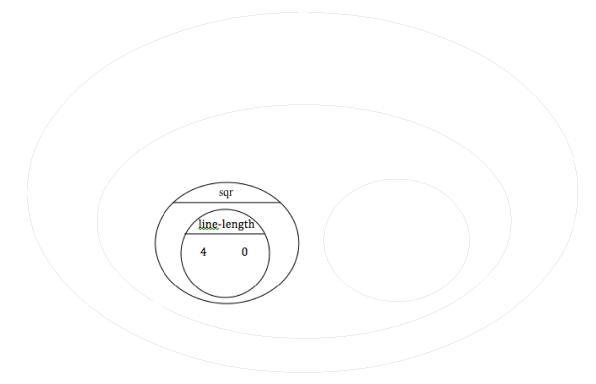
	act+Purpose State at has three parts:	ement					
name	Examples			Domain	->	Range	
(EXAMPLE	(line-length Use the func	10 tion here	5)	<u>(-</u> 10 What should the fu)
III. Defini		tion here			(- 8 What should the fu)
(define	the definition, givi			•)		
)							

The Distance Formula (an example)

The distance between the points (0, 0) and (4, 3) is given by:

$$\sqrt{(line-length \ 4\ 0)^2 + (line-length \ 3\ 0)^2}$$

Convert the formula above into a Circle of Evaluation. (We've already gotten you started!)



Convert the Circle of Evaluation to code, then label the numbers with (x1,y1) & (y1,y2):

Write a function distan	e, which takes	FOUR inp	outs:
-------------------------	----------------	----------	-------

- □ px: The x-coordinate of the player
- py: The y-coordinate of the player
- □ cx: The x-coordinate of another game character
- □ cy: The y-coordinate of another game character

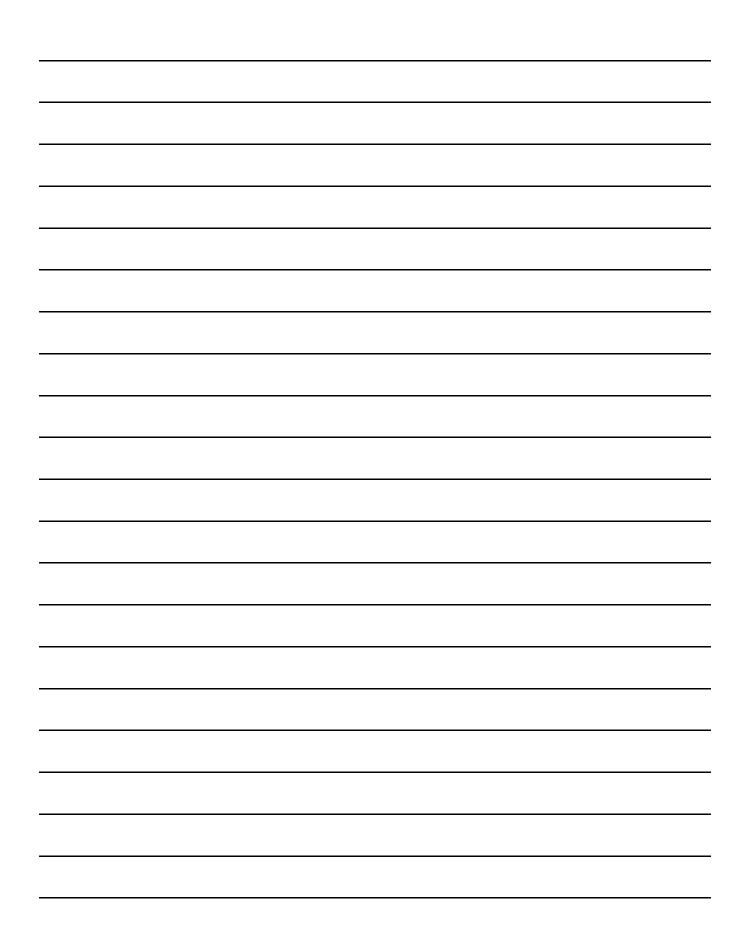
It should return the distance between the two, using the Distance formula. (HINT: look at what you did on page 27!)

I. Contract+Pur	pose Statement			
•			->	
name	_ •	Domain	Range	
•				
,	What o	does the function do?		
II. Give Example	es			
(EXAMPLE (on here)	
	Use the function	on here		
				,
	find ar	nother way to get the same re	esult here	
(EXAMPLE ()	
	Use the function	on here	,	
				,
	find ar	nother way to get the same re	esult here	/
III. Definition				
(define ()	
	tion name	variable names	/	
				1
				<i>!</i>

Write a function collide?,which takes FOUR inputs:
px: The x-coordinate of the player

Contract+Purpose Sta	lement	->
name	Domain	Range
	What does the function do?	
Give Examples		
EXAMPLE (se the function here)
	find another way to get the same result h) ere
XAMPLE (se the function here)
)
	find another way to get the same result h	ere
. Definition	find another way to get the same result h	ere
define (variable names)

Catchy Intro:
lame, Age, Grade:
Same Title:
ack Story:
Characters:
xplain a piece of your code:



Presentation Feedback

For each question, circle the answer that fits best.

Was the introduction catchy? No way! A little. Definitely! Did they talk about their characters? No way! A little. Definitely! Did they explain the code well? No way! A little. Definitely! Did they speak slowly enough? Definitely! No way! A little. Did they speak loudly enough? No way! A little. Definitely! Were they standing confidently? No way! A little. Definitely! Did they make eye contact? No way! A little. Definitely!

Presentation Feedback

For each question, circle the answer that fits best.

Was the introduction catchy? No way! A little. Definitely!

Did they talk about their characters? No way! A little. Definitely!

Did they explain the code well? No way! A little. Definitely!

Did they speak slowly enough? No way! A little. Definitely!

Did they speak loudly enough? No way! A little. Definitely!

Were they standing confidently? No way! A little. Definitely!

Did they make eye contact? No way! A little. Definitely!

Word Problem: red-shape

Write a function called <u>red-shape</u>, which takes in the name of a shape ("circle", "triangle", "star" or "rectangle"), and draws that shape. All shapes should be solid and red, and can be whatever size you choose

I. Contract+Purpose Staten	hent	
name	Domain	-> Range
,	What does the function do	0%
II. Give Examples Write some examples of red-shape	e below. The first one has a	lready been done for you.
(EXAMPLE <u>(red-shape</u> Use the function		(circle 50 "solid" "red") What should the function produce?
(EXAMPLE (on here	What should the function produce?
(EXAMPLE () on here	What should the function produce?
(EXAMPLE () on here	What should the function produce?
III. Definition		
(define (variable r	names
<u>(cond</u>		
-	(cir	cle 50 "solid" "red")

Translating into Algebra

Value Definitions

Racket Code	Algebra
(define x 10)	x = 10
(define y (* x 2))	y = x*2
(define z (+ x y))	
(define age 14)	
(define months (* age 12))	
(define days (* months 30))	
(define hours (* days 24))	
(define minutes (* hours 60))	

Function Definitions

Racket Code	Algebra
<pre>(define (area length width) (* length width))</pre>	area(length, width) = length * width
(define (circle-area radius) (* pi (sqr radius)))	
(define (distance x1 y1 x2 y2) (sqrt (+ (sqr (- x1 x2))	

A rocket is flying from Earth to Mars at 80 miles per second. Write a function that describes the <u>distance</u> D that the rocket has traveled, as a function of <u>time</u> t.

<u>D</u> :		->
name	Domain	Range
	What does the function do?	
Give Examples		
an example of your fur	nction for <u>some sample inputs</u>	
D(1) =		
function here	What should the function produce?	
D(2)=		
function here	What should the function produce?	
D() =		
function here	What should the function produce?	
=		
function here	What should the function produce?	
Definition		
	able names to all your input values.	

A rocket is traveling from Earth to Mars at 80 miles per second. Write a function that describes the *time* the rocket has been traveling, as a function of *distance*.

·		>
name	Domain	Range
	What does the function do?	
. Give Examples Write an example of your function	n for some sample inputs	
=		
lse the function here	What should the function produce?	
=		
lse the function here	What should the function produce?	
=		
lse the function here	What should the function produce?	
=		
lse the function here	What should the function produce?	
II. Definition Vrite the Formula, giving variable		

A rocket leaves Earth, headed for Mars at 80 miles per second. **At the exact same time**, an asteroid leaves Mars traveling towards Earth, moving at 70 miles per second. If the distance from the Earth to Mars is 50,000,000 miles, how long will it take for them to meet?

·· _	:	>
name	Domain	Range
;	What does the function do?	
II. Give Examples		
write an example of your	function for <u>some sample inputs</u>	
=		
Use the function here	What should the function produce?	
 Use the function here	What should the function produce?	
=		
Use the function here	What should the function produce?	
=		
= Use the function here	What should the function produce?	
Use the function here	What should the function produce?	
=		
Use the function here	What should the function produce? variable names to all your input values.	
Use the function here		

•	-	>
name	Domain	Range
	What does the function do?	
Give Examples rite an example of your	function for <u>some sample inputs</u>	
=		
a tha function hara		
e the function here =	What should the function produce?	
	What should the function produce? What should the function produce?	
= e the function here =	What should the function produce?	
= e the function here		
= the function here = the function here	What should the function produce?	