Contracts

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

Contracts

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

Reverse-Engineering: How does NinjaCat work?

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



The coordinates for the PLAYER (NinjaCat) are	e:	(,)	
		x-coordinate	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.

Don't forget to use the computer's symbols for things like multiply and divide!

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

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

	Circles Triathalon		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 ()	
(define ())	
;	:	>	
name	domain	range	
(EXAMPLE ((EXAMPLE ((define ())	
·	:	>	
;name	.• domain	> range	
;			
(EXAMPLE (
(EXAMPLE (range)	

Fast Functions!



	_:	
name	domain	range
(EXAMPLE ())
(EXAMPLE ())
(define ())
	_:	
name	domain	range
_(EXAMPLE ())
(EXAMPLE ())
(define ())
;	<u>;</u>	
(EXAMPLE ())
(EXAMPLE ())
(define ())
;	<u>:</u>	
(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.

•		->
name	Domain	Range
nane	Domain	Nange
	Vhat does the function do?	
Give Examples		
	f your function in action, using EX	(AMPLE.
XAMPLE (the user t		١
the user t	types	/
		,
	which should become)
XAMPLE (the user t	types)
the user i	types	
		`
	which should become)
Definition		
	ariable names to all your input v	alues.
lefine (_{function name}	variable names)

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. Contrac	t+Purpose Statement			
Every contract h				
•	•		->	
Name	:	 Domain	/ Range	
Name		Domain	Nange	
•				
•	What	does the function do?		
II. Give Exc	amples			
On the compute	r, write an example of yo	our function in action, using EXA	AMPLE	
(EVAMBLE (`	
(EXAMPLE (_	the user says.)	
	the user says.	•••		
)	
		Racket replies	,	
(EXAMPLE (_)	
(======================================	the user says.	···	/	
_		Racket turns that into)	
		Racket turns that into		
III. Definition				
Write the	e definition, giving vario	able names to all your input vo	alues.	
(dofina (1	
(define (_	function name	variable names)	
	runction name	variable fidilies		
				`
)
	and the computer d	oes tnis		

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. Contra	ct+Purpose Statement	
Every contract	has three parts:	
•	•	->
name	•	/ Range
name	Jonan	range
;		
	What does the function do?	
II. Give Ex	camples .	
	er, write an example of your function in action, using EX	AMPLE.
(EXAMPLE	()
(LXAMI LL	Use the function here)
	Control and the control to the the control to the)
	find another way to get the same result he	ere
(EXAMPLE	()
	Use the function here	
)
	find another way to get the same result he	ere
III. Definitio	on	
	ne definition, giving variable names to all your input v	alues.
(define (_)
	function name variable names	
)
	and the computer 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. Contra	ct+Purpose Stater	ment		
	has three parts:			
•	•		->	
name		Domain	Range	
•				
,		What does the function do?		_
U Chia F	communication and the second s			
	camples er, write an examp	ole of your function in action, using EXAMF	PLE.	
			`	
(EXAMPLE	(the function here)	
		find another way to get the same result here)	
		This another way to get the same result here		
(EXAMPLE	(,	
	Use ·	the function here	/	
			,	
		find another way to get the same result here)	
III Definiti		* *		
III. Definiti Write th		g variable names to all your input valu	es.	
		, ,		
(define ()	
	function name	variable names		
		mouton do sa this)
	and the co	mputer does this		

Design Recipe: update-target

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			
Every contract	has three parts:			
•	• 		->	
name	·	Domain	Range	
•				
,		hat does the function do?		
II. Give Ex	camples er, write an example of	your function in action, using EXA	AMPLE.	
(EXAMPLE (Use the fu	nction here)	
	000 4.10 14			
-	fir	nd another way to get the same result he)	
		a diodier way to get the same result her		
(EXAMPLE (()	
	Use the fu	nction here	/	
			,	
-	fir	nd another way to get the same result he	<i>)</i> re	
III. Definitio	on			
		riable names to all your input vo	alues.	
(d - £: (,	
(define (_	function name	variable names)	
	runction name	variable names		
			,	
			j	1

.....and the computer does this

Protecting Sam

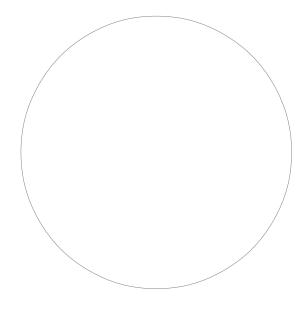
Sam is in a 640 x 480 yard. How far he can go to the left and right before he's out of sight?

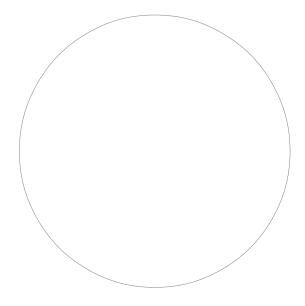
1. A piece of Sam is still visible on the left as long as...

(> 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.

		>
name	Domain	Range
	What does the function do?	
Give Examples		
n the computer, write an	example of your function in action, us	ing EXAMPLE.
EXAMPLE ()
	Use the function here	
)
	find another way to get the same result	nere
EXAMPLE (Use the function here)
	find another way to get the same result) nere
D (1)	ancono. May to got an oame route	
Definition Write the definition.	giving variable names to all your input	values.
, , , , , , , , , , , , , , , , , , , ,		
define (ne variable names)

...and the computer does this

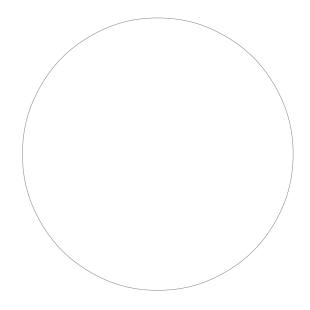
Word Problem: safe-right?

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.

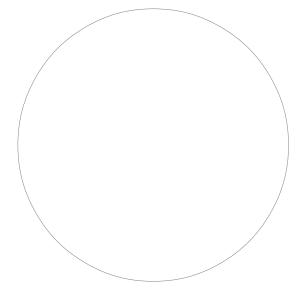
name	Domain	Range
	What does the function do?	
Give Examples		
the computer, write an exa	mple of your function in action, using E	XAMPLE.
)
Ţ	Jse the function here	,
)
	find another way to get the same result h	nere
XAMPLE ()
U	Jse the function here	,
		,
	find another way to get the same result h	ere
Definition		
	ving variable names to all your input	values.
, , , , , , , , , , , , , , , , , , , ,	and a second of the second of	
define ()

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.

name	Domain	Range
		Kange
	What does the function do?	
Give Examples		
the computer, write an ex	xample of your function in action, using	g EXAMPLE.
EXAMPLE ()
· ·	Use the function here	·
)
	find another way to get the same resu	/ ult here
EXAMPLE ()
(Use the function here	
		1
	find another way to get the same resu	/ ult here
. Definition		
	giving variable names to all your inp	out values.
	7 1	
)

...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 Sto	atement	
name •	Domain	-> Range
II. Cive Evennentee		
II. Give Examples On the computer, write an e	example of your function for	each topping, using EXAMPLE.
	"pepperoni")	1
	unction here	What should the function produce?
(EXAMPLE ())
Use the f	unction here	What should the function produce?
(EXAMPLE (unction here	What should the function produce?
(EXAMPLE (unction here	What should the function produce?
III. Definition		
(define ()
function nam		e 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. Contract+P	urpose Statement			
,	_:		Domain	> Range
II. Give Example Finish the two examples	ples mples we've started f	or you	, and make tw	vo more
(EXAMPLE (up	date-player Use the function here	128	<u>"up"</u>) _	What should the function produce?
(EXAMPLE (<u>up</u>	date-player Use the function here	451	"down") _	What should the function produce?
(EXAMPLE (Use the function here)	What should the function produce?
(EXAMPLE (Use the function here)	What should the function produce?
III. Definition				
(define (nction name		variable na	mes

)

Lesson 8

Word Problem: line-length

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.

name	•			Domain	>	Range	
II. Give	Examples						
(EXAMPLE	(line-length Use the funct	10 tion here	5)	(- 10 What should the fu		
(EXAMPLE	(line-length Use the funct	2 tion here	8)	(- 8 What should the fu	2) unction produce?	
III. Defini Write	<mark>ition</mark> the definition, givi	ng varial	ole nam	es to all you	ur input values.		
(define	()		
(0.01110	function name			variable na	ames		
							_
							-
							-
							-
							-

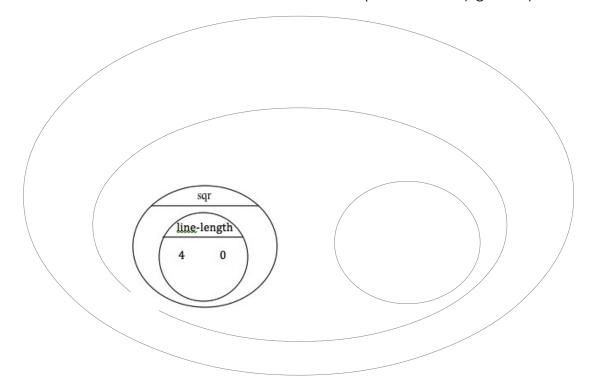
...and the computer does this

The Distance Formula, with Numbers

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 into Racket code:

Word Problem: distance

Write a function distance, which takes FOUR inputs:

□ px: The x-coordinate of the player

(define (

function name

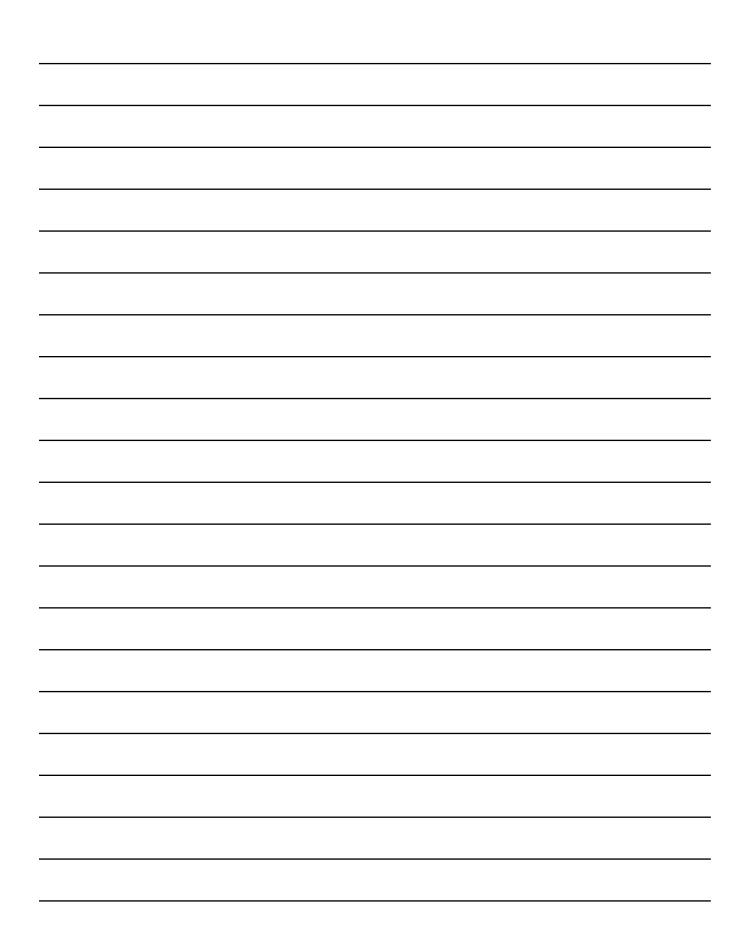
_ 	cx: Th	e y-coordinate of the player e x-coordinate of another game character e y-coordinate of another game character	
	lid on p	rn the distance between the two, using the Distance formage 27!)	nula. (HINT: look at what
;			>
	name	Domain	Range
;		What does the function do?	
(EXA	MPLE	Use the function here)
		find another way to get the same result here	
(EXA	MPLE	Use the function here)
		find another way to get the same result here	

variable names

Word Problem: collide?

□ px: The □ py: The □ cx: The □ cy: The It shou	e x-coordinate of the per y-coordinate of the per y-coordinate of another y-coordinate of another true if the contacts of the other characters.	player ner game character ner game character coordinates of the player are within 50 racter. Otherwise, false.	pixels of the	
i. Conirc	ıct+Purpose Stateme	Ш		
name	:	Domain	-> Range	
;		What does the function do?		
II. Give E	xamples			
(EXAMPLE	(Use the	function here)	
		find another way to get the same result here)	
(EXAMPLE	(Use the	function here)	
III. Definit		find another way to get the same result here)	
III. Definit	ION			
(define (function name	variable names)	\
·				<i>!</i>

Catchy Intro:
lame, Age, Grade:
Game Title:
Back 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? 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!

Presentation Feedback

For each question, circle the answer that fits best	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

Write some examples of red-shape below. The first one has already been done for you. (EXAMPLE (red-shape "circle") (circle 50 "solid" "red") What should the function produce? (EXAMPLE () What should the function produce?	I. Contr	act+Purpose Statement		
Write some examples of red-shape below. The first one has already been done for you. (EXAMPLE (red-shape "circle") (circle 50 "solid" "red") What should the function produce? (EXAMPLE (•	•		->
Write some examples of red-shape below. The first one has already been done for you. (EXAMPLE (red-shape "circle") (circle 50 "solid" "red") (what should the function produce? (EXAMPLE () (by the function here) (cond (cond by the function here) (cond (circle 50 "solid" "red") (circ	name	•	Domain	
Write some examples of red-shape below. The first one has already been done for you. (EXAMPLE (red-shape "circle") (circle 50 "solid" "red") (what should the function produce? (EXAMPLE () (by the function here) (cond (cond (circle 50 "solid" "red") (by the function produce? (circle 50 "solid" "red") (circle	II. Give I	Examples		
Use the function here What should the function produce? (EXAMPLE (Write some ex	xamples of red-shape below. The fi	rst one has alr	eady been done for you.
(EXAMPLE ((EXAMPLE)	
Use the function here What should the function produce? (EXAMPLE () Use the function here What should the function produce? Variable names (cond	(EXAMPLE	(Use the function here)	
Use the function here What should the function produce? What should the function produce? What should the function produce? Variable names (cond	(EXAMPLE	Use the function here)	What should the function produce?
(define () function name variable names (cond	(EXAMPLE	(Use the function here)	What should the function produce?
function name variable names (cond	III. Defini	tion		
function name variable names (cond	(define (()
(circle 50 "solid" "red")	`	function name	variable na	ames ,
			(circ	cle 50 "solid" "red")

Translating into Algebra...

Values: Translate the Racket Code into Algebra						
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))						
Functions: Translate the Backet Code into Algebra						

Functions: Translate the Racket Code into Algebra					
<pre>(define (double x) (* x 2))</pre>	double(x) = x*2				
<pre>(define (area length width) (* length width))</pre>	area(length, width) = length * width				
<pre>(define (circle-area radius) (* pi (sq radius)))</pre>					
(define (distance x1 y1 x2 y2) (sqrt (+ (sq (- x1 x2)) (sq (- y1 y2))))					

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

l. Every	Contract+P				
;	D name	:	Domain	-> Range	
II. Write	Give Exam an example o		tion for <u>some sample inputs</u>		
Use the	D(1) function here	=_	What should the function produce?		
Use the	D(2)= function here		What should the function produce?		
Use the	D() function here	=,	What should the function produce?		
Use the	function here	=	What should the function produce?		
III.	Definition Write the fo	rmula, givi	ng variable names to all your input vo	alues.	
D() =				

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*.

I. Contract+Pur		nent	
Every contract has t	hree parts:		
;	:		->
name		Domain	Range
II. Give Example	es		
Write an example of	your function	on 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?	
III. Definition			
Write the Forn	nula, giving	variable names to all your input	values.

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
I. Give Examples		
Write an example of your fur	ction for <u>some sample inputs</u>	
=		
Jse the function here	What should the function produce?	
=		
Jse the function here	What should the function produce?	
=		
Use the function here	What should the function produce?	
=		
Jse the function here	What should the function produce?	
II. Definition		
	iving variable names to all your input valu	00

I. Contract+Purpose Statement Every contract has three parts:					
•	:	Domain	> Range		
II. Give Examp Write an example of		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?			
III. Definition					
Write the Fol	rmuia, giving v =	variable names to all your input	values.		