Contracts

••	Domain :	Range →	example
		Λ Λ	
••		↑	
••		^	
••		↑	
•		↑	
••		↑	
••		^	
••		↑	
•		↑	
•		↑	
•		^	
••		↑	
••		↑	
••		^	
••		↑	

Contracts

Name	Domain	Range	example
	••	1	
		^	
	:	↑	
	:	^	
	:	^	
	:	↑	
	:	^	
	:	↑	
	:	^	
	:	↑	
	:		
	:	↑	
	:	^	
	:	↑	
	:	↑	
	:	↑	
	•	^	

Reverse-Engineering: How does NinjaCat work?

Thing in the game	What changes about it?	More specifically
Thing in the game Cloud	What changes about it? POSITION	More specifically X-COORdinate



The coordinates for the PLAYER (NinjaCat) are:	<i>x-coor</i>	y rdinate y-coo) rdinate	
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> 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!



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

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
		3
	What does the function do?	
. Give Examples		
n the computer, write an exan	nple of your function in action, using EXA	MPLE.
EXAMPLE (e user types)
the	e user types	
	which should become)
EXAMPLE ()
the	e user types	
	which should become)
I. Definition		
	ing variable names to all your input value	es.
dofina (•
define (variable names)

Word Problem: red-square

Use the Design Recipe to write a function $\underline{red-square}$, which takes in a number (the size of the square) and outputs a solid red rectangle whose length and width are the same size.

;:_		
Name	Domain	Range
•		
, —	What does the function do?	
II. Give Examples		EVANDI E
•	example of your function in action, usin	
(EXAMPLE (the user says)
	the user says	
)
	Racket replies	
(EXAMPLE ()
(270-0711 22 (the user says	
		,
	Racket turns that into	/
III. Definition		
Write the definition,	, giving variable names to all your input	t values.
(dofina (1
(define (me variable names	<i></i>
function na	ne variable names	

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			
	has three parts:			
:	•		->	
name		Domain	Range	
•				
,	What d	loes the function do?		
II. Give Ex	amples			
	amples er, write an example of you	r function in action, using	EXAMPLE.	
/EVAMBLE			,	
(EXAMPLE	Use the functio	on here)	
-	find an	other way to get the same resul	t here	
	Tilla air		t nere	
/EVAMBLE	1		`	
(EXAMPLE	Use the functio	on here)	
-	find an	other way to get the same resul)	
		other way to get the sume result	CHEFC	
III. Definiti	on le definition, giving variable	e names to all your input y	values	
Wile ti		•	ratues.	
(define (_	for this case)	
` ` `	function name	variable names	,	
)
	and the computer doe	es 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.

name		>
	Domain	Range
	What does the function do?	
Give Examples		
he computer, write an examp	le of your function in action, using EX	AMPLE.
XAMPLE ()
Use t	the function here	
)
	find another way to get the same result he	re
XAMPLE (the function here)
Use t	the function here	
)
	find another way to get the same result he	re
Definition		
	g variable names to all your input valu	ies.
	, ,	es.

.....and the computer does this

Design Recipe: update-target

Word Problem: update-target

Write a function $\underline{update-target}$, which takes in the target's x-coordinate and produces the next x-coordinate, which is 50 pixels to the right.

name Wha Give Examples the computer, write an example of y	Domain t does the function do?	Range
What Give Examples	t does the function do?	
What Give Examples	t does the function do?	
	our function in action, using EX	XAMPLE.
EXAMPLE ()
Use the func	tion here	
)
find	another way to get the same result h	/ ere
EXAMPLE ()
Use the func	tion here	·
)
find	another way to get the same result h	ere ,
. Definition		
Write the definition, giving varia	ble names to all your input val	ues.
define (•
define (variable names)

.....and the computer does this

Protecting Sam

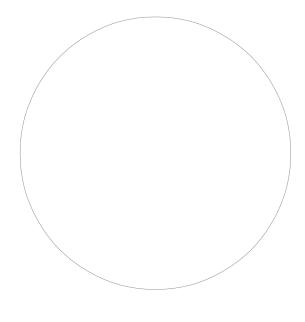
Sam is in a 640 x 480 yard. How far he can go to the left and right before he's out of sight?

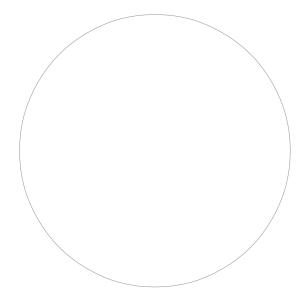
1. A piece of Sam is still visible on the left as long as...

(> 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 safe-left?, which takes in the target's x-coordinate and checks to see if it is greater than -50.

	:		>
name		Domain	Range
		t does the function do?	
Give Example	es		
•		our function in action, using EX	
EXAMPLE (tion here)
	Use the funct	tion here	
)
	find a	another way to get the same result he	re
EXAMPLE (Use the funct	ting hour)
	ose the funct	tion here	
)
	find a	another way to get the same result he	ere
. Definition			
Write the def	inition, giving varial	ble names to all your input valu	ies.
write the der			
	action name)

...and the computer does this

Word Problem: safe-right?

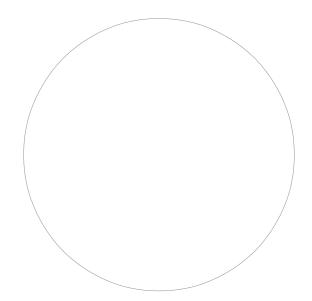
Use the Design Recipe to write a function $\underline{safe-right?}$, which takes in the target's x-coordinate and checks to see if it is less than 690.

•		>
name	Domain	Range
	What does the function do?	
Give Examples	n example of your function in action, using	EVAMDI E
•		
EXAMPLE (Use the function here)
	ose the function here	
)
	find another way to get the same result	: nere
EXAMPLE ()
LL (Use the function here	/
		,
	find another way to get the same result	<i>)</i> t here
Definition		
. Definition Write the definitio	n, giving variable names to all your input v	alues.
define ()
derine (

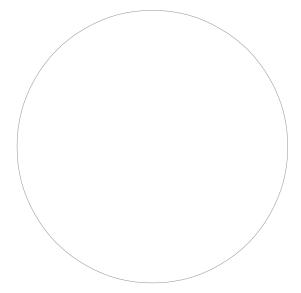
...and the computer does this

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 $\underline{onscreen?}$, which takes in the target's x-coordinate and checks to see if Sam is protected on the left \underline{and} protected on the right.

•		>
name	Domain	Range
	What does the function do?	
Give Examples	n example of your function in action, using	EVAMDI E
•		
EXAMPLE (Use the function here)
	ose the function here	
)
	find another way to get the same result	: nere
EXAMPLE ()
LL (Use the function here	/
		,
	find another way to get the same result	<i>)</i> t here
Definition		
. Definition Write the definitio	n, giving variable names to all your input v	alues.
define ()
derine (

...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.

. Contr	act+Purpose Statement		
name	·:	Domain	-> Range
	Examples uter, write an example of your functi	on for <u>each</u>	topping, using EXAMPLE.
EXAMPLE	(cost "pepperoni Use the function here	<u>"</u>)	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?
(EXAMPLE	Use the function here)	What should the function produce?
II. Defini	ition		
(define	function name	variable n	ames)
)			

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. Contr	act+Purpose Statement			
Finish the two examples we've started for you, and make two more (EXAMPLE (update-player 128 "up") Use the function here What should the function produce? (EXAMPLE (update-player 451 "down") Use the function here What should the function produce? (EXAMPLE (name	·	Domain		
Use the function here What should the function produce? (EXAMPLE (update-player 451 "down") Use the function here What should the function produce? (EXAMPLE (you, and make two	more	
Use the function here 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? What should the function produce? What should the function produce?	(EXAMPLE		28 "up") _	What should the function produce?)
Use the function here What should the function produce? (EXAMPLE () Use the function here What should the function produce? What should the function produce? (define ()	(EXAMPLE	(<u>update-player</u> 4) Use the function here	51 "down") _	What should the function produce?	
Use the function here What should the function produce? . Definition (define ())	(EXAMPLE	(Use the function here)	What should the function produce?)
(define ()	(EXAMPLE	(Use the function here) _	What should the function produce?)
		(variable r	names)	
	_				

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.

L. Contract Every contract	act+Purpose Stater ct has three parts:	ment					
,	:			Domain	> _	Range	
II. Give E	Examples						
(EXAMPLE	(line-length Use the funct	10 tion here	5)	(- 10 What should the	5) function produce?)
(EXAMPLE	(line-length Use the func	2 tion here	8)		2) function produce?)
III. Defini	i tion the definition, givi	ng variabl	e names	to all vour i	nput values.		
				-	•	١	
(define	function name		variable names		ames)	
							_
							_
							_
							_
)							

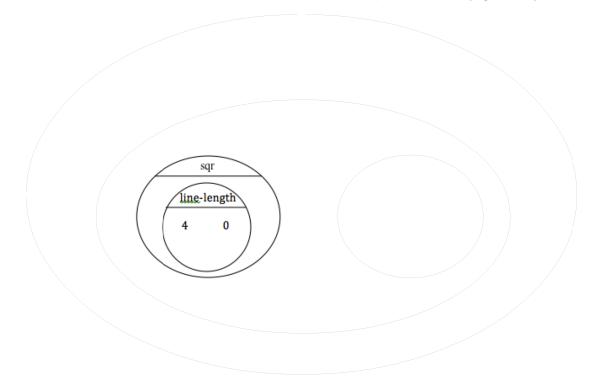
...and the computer does this

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 <u>distance</u>, which takes FOUR inputs:

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

 \Box px: The x-coordinate of the player

Contract+Purpose State	ment	
• name	Domain	> Range
	What does the function do?	
Give Examples		
PLE (us	e the function here)
	find another way to get the same resu	ılt here
PLE (e the function here)
US	e the function here	
	find another way to get the same resu	ılt here
Definition Ne ()
function name	variable names	,

DESIGN RECIPE

Word Problem: collide?

Write a function collide?, which takes FOUR inputs:

px: The x-coordinate of the player
 py: The y-coordinate of the player

Contract+Purpose Stateme	ent	
name •	Domain	> Range
	What does the function do?	
Give Examples		
AMPLE (ne function here)
Use ti	ie function here	
)
	find another way to get the same result	here
AMPLE (ne function here)
ose ti	ie function here	
)
	find another way to get the same result	here

Catchy Intro:		
Name, Age, Grade:		
Game Title:		
Back Story:		
Characters:		
Explain a piece of your code:		

_

Presentation Feedback For each question, circle the answer that fits best. Definitely! No way! A little. Was the introduction catchy? Definitely! Did they talk about their characters? No way! A little. Did they explain the code well? No way! Definitely! A little. 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!

Drosontation Foodback			
Presentation Feedback For each question, circle the answer the	at 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. Contrac	t+Purpose Statement		
•	:		->
name	v	Domain	Range
II. Give Ex Write some exa	amples Imples of red-shape below. The fi	rst one has alr	ready been done for you.
(EXAMPLE <u>(</u>	red-shape "circle" Use the function here)	(circle 50 "solid" "red") 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?
(EXAMPLE (Use the function here)	What should the function produce?
III. Definiti	on		
(define (_	function name	variable na	ames
(cond			
		(ci	rcle 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	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))		

Word Problem

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

l.	Contract+P	urpose State	ment		
Every	contract has	three parts:			
:	D	•		->	
, —	name		Domain	Range	
				-	
II.	Give Examp				
Write	e an example c	of your function	on for <u>some sample inputs</u>		
	D(4)				
	<u>D(1)</u>	=			
Use th	e function here		What should the function produce?		
	D(2)				
	<u>D(Z)=</u>				
Use tr	ne function here		What should the function produce?		
	D()	_			
llaa th	U()		What should the fination was due?		
use ti	e function here		What should the function produce?		
		=			
llse th	ne function here	<u> </u>	What should the function produce?		
030 (1	ic ranction here		What should the function produce.		
III.	Definition				
	Write the fo	rmula, giving	variable names to all your input values.		
		. 5	•		
D() –				
~ (, –				

Word Problem

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
. Give Examples		
/rite an example of your f	unction for <u>some sample inputs</u>	
=		
se the function here	What should the function produce?	
=		
se the function here	What should the function produce?	
=		
se the function here	What should the function produce?	
=		
lse the function here	What should the function produce?	
II. Definition Write the Formula,	giving variable names to all your input values.	
_		

Word Problem

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
II. Give Examples		
Write an example of your fu	unction 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		
	giving variable names to all your input values.	

Word Problem

	:		->
name		Domain	Range
. Give Examp	les		
/rite an example o	f your funct	ion for <u>some sample inputs</u>	
	=		
Ise the function here		What should the function produce?	
	_		
lse the function here	=	What should the function produce?	
	=		
		What should the function produce?	
Ise the function here			
se the function here	_		
lse the function here	=	What should the function produce?	