Contracts

Name	Domain	Range	example
••	•	↑	
•	•	↑	
;	•	↑	
••	:	↑	
••	•	↑	
•	•	↑	
••	•	↑	
•	:	↑	
••	•	^	
••		↑	
••	:	↑	
••	:	↑	
.,		↑	
••		↑	
••		↑	
••	:	↑	
••		↑	

Contracts

Name	Domain	Range	example
••	:	→	
••	:	+	
•	:	→	
•	:	→	
••	:	→	
••	:	→	
•	:	→	
•6	•	→	
;	:	↑	
•	:	→	
•	:	→	
•6	•	→	
••	:	↑	
••	••	↑	

Reverse-Engineering: How does NinjaCat work?

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

Game Parts - NinjaCat! (0,480) NinjaCat! Score:10

6 (640,0)

The coordinates for the PLAYER (NinjaCat) ar	e:	()
		x-coordinate	y-coordinate
The coordinates for the DANGER (Dog) are:	(ı)
The coordinates for the TARGET (Ruby) are:	(ı)

(0,0)

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 Tria		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			

Fast Functions!

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

Fast Functions!

		->		
name				_
(EXAMPLE ())
(EXAMPLE ())
(define ())
·	:	>		
name	domain		range	
(EXAMPLE ())
(EXAMPLE ())
(define ())
·	;	>		
;name	:domain	->	range	
,	domain		range)
name (EXAMPLE (domain)		range)
name (EXAMPLE (domain)		-))
name (EXAMPLE (domain)		-))
name (EXAMPLE (domain)))		-)))
name (EXAMPLE ((EXAMPLE ((define ()	domain)))
name (EXAMPLE ((EXAMPLE ((define (;	domain))))))))

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.

Contract+Purpose			
ry contract has three p	arts:		
			->
name		Domain	Range
		does the function do?	
Cive Evernles			
Give Examples the computer, write ar	n example of yo	our function in action, using EXAN	MPLE.
•	. ,	•	
EXAMPLE ()
\	the user types		·
)
		which should become	<i>/</i>
EXAMPLE ()
	the user types)	
)
		which should become	
. Definition			
Write the definitio	n, giving varia	ble names to all your input valu	Jes.
· · · · · · · · · · · · · · · · · · ·)
function n	ame	variable names	
ar	d the computer do	pes this	

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.

	t+Purpose Statement			
Every contract h	as three parts:			
•			->	
Name	•	 Domain	Range	
		2 sma	age	
· /				
	Wha	at does the function do?		
II. Give Exa	amples			
On the compute	r, write an example of	your function in action, using EXA	MPLE	
(EXAMPLE (_)	
(270 001 22 (_	the user say	/S	/	
			,	
_		Racket replies)	
		daket replies		
/EVANDLE /			\	
(EXAMPLE (_	the user say	/S)	
_)	
		Racket turns that into		
III. Definition				
Write the	e definition, giving var	iable names to all your input va	ılues.	
(define (_)	
(define (_	function name	variable names	/	
		. 2. 144.10		
				١
	and the computer	does this		J

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				
	:	 Domain	>	
name		Domain	Range	
•				
,	What d	oes the function do?		
II Givo Ev	amples			
II. Give Exa On the compute		ır function in action, using E	XAMPLE.	
•		_		
(EXAMPLE (n here)	
	Use the functio	n here		
)	
_	find an	other way to get the same result h	nere	
(EXAMPLE ()	
(LXAIVII LL (Use the functio	n here	/	
_)	
	find and	other way to get the same result h	iere	
III. Definitio	n			
Write the	e definition, giving variab	ole names to all your input	values.	
/			`	
(define (_)	
	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.

I. Contrac	ct+Purpose Statement			
Every contract	has three parts:			
•				
/name	:	Domain	-> Range	_
nume		Domain	Kunge	
				_
	Wh	nat does the function do?		
II. Give Ex	amples			
On the compute	er, write an example of	your function in action, using EXAM	PLE.	
(EXAMPLE (,		1	
(LAAIVIPLL (Use the fur	nction here	/	
-	<i>c</i> :	d)	
	TIN	d another way to get the same result here		
(EXAMPLE (Llea the fun	action have)	
	Use the rui	nction here		
_)	
	fin	d another way to get the same result here	·	
III. Definitio	on			
		riable names to all your input valu	ies.	
() ()				
(define (_)	
	function name	variable names		
)
	and the computer	r does this		

Design Recipe: update-target

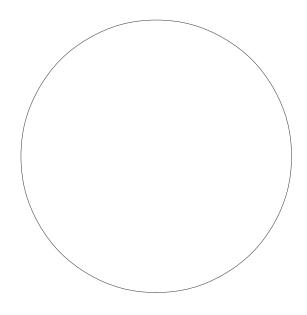
Word Problem: update-target

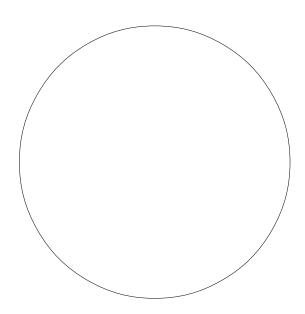
Write a function <u>update-target</u>, which takes in the target's x-coordinate and produces the next x-coordinate, which is 50 pixels to the right.

I. Contra	ct+Purpose Statemen			
	has three parts:			
•	•		->	
name	:	Domain	/ Range	-
			3	
· /				
	W	hat does the function do?		
II. Give Ex	camples			
On the comput	er, write an example o	f your function in action, using EXAN	MPLE.	
(EXAMPLE	()	
(L/// IVII LL	Use the fu	unction here	/	
			,	
		nd another way to get the same result here)	
		and another way to get the same result here		
/EVANDLE	/		,	
(EXAMPLE	Use the fu	unction here)	
)	
	fi	nd another way to get the same result here		
III. Definiti				
Write th	ne definition, giving va	ariable names to all your input val	ues.	
(define (1	
(define (_	function name	variable names	/	
	Tanotton name	variable names		
				١
	and the compute	er does this		<i>)</i>
	a.ia tiio ooiiipatt			

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...
- (> -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 an x-coordinate and checks to see if it is greater than -50.

Every contract has three parts:	
3	
;:>>	
name Domain Range	
What does the function do?	
II. Give Examples	
On the computer, write an example of your function in action, using EXAMPLE.	
(EXAMPLE ()	
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	
Tind dilottich way to get the sume result here	
III. Definition	
Write the definition, giving variable names to all your input values.	
(dofino (
(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.

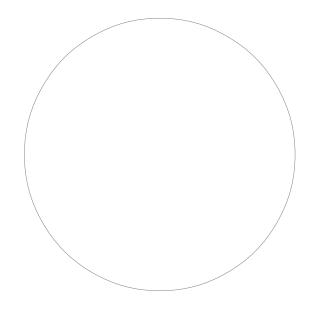
I. Contract+Purpose Stater	ment	
Every contract has three parts:		
name •	Domain	> Range
name	Bomain	nange
	What does the function do?	
II. Give Examples		
On the computer, write an examp	ple of your function in action, using E	XAMPLE.
(EVANDLE (`
(EXAMPLE (the function here)
930	The fall of the fa	
)
	find another way to get the same result he	ere
(EXAMPLE (the function here)
Use	the function here	
)
	find another way to get the same result he	/ ere
III Definition		
III. Definition Write the definition givin	ng variable names to all your input v	values
_		valdos.
(define ()
function name	variable names	
)

...and the computer does this

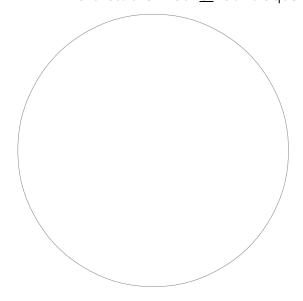
and / or

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.

name	:	Domain	> Range	
		does the function do?		
Give Examples	S		VANDLE.	
n the computer, write	e an example of yo	our function in action, using E	XAMPLE.	
EXAMPLE (Use the funct	ion horo)	
	ose the funct	ion nere		
	find	another way to get the same result h)	
	Tillu a	inother way to get the same result in	ere	
EXAMPLE ()	
	Use the funct	ion here	/	
)	
	find a	another way to get the same result h	ere	
I. Definition				
	ition, giving varia	able names to all your input	values.	
			1	
define (

...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.

 Contract+Purpose Stateme 	nt	
name	Domain	> Range
I. Give Examples On the computer, write an examp	ole of your function for <u>e</u>	ach topping, using EXAMPLE.
(EXAMPLE (<u>cost</u> "	pepperoni")	What should the function produce?
(EXAMPLE ()) here) What should the function produce?
(EXAMPLE ())) What should the function produce?
(EXAMPLE (Use the function))	What should the function produce?
III. Definition		
(define (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	ct+Purpose Statement			
name	::		omain	-> Range
	xamples examples we've started t	for you, an	d make two	o more
(EXAMPLE	(<u>update-player</u> Use the function here	128	<u>"up"</u>)	What should the function produce?
(EXAMPLE	(update-player Use the function here	451 "d	<u>own"</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?
III. Definiti	on			
(define (function name		variable nan	nes

)

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	5) unction produce?	
(EXAMPLE	(line-length Use the funct		8)	(- 8 What should the fu	2) unction produce?	
III. Defini Write	ition the definition, givi	ng varial	ble nam	os to all voi	ır innut values		
				ies io ali voi	ai ii ibuut vaiucs.		
)		
(define				variable na)		
	()		
	()		
	()		
	()		
	()		

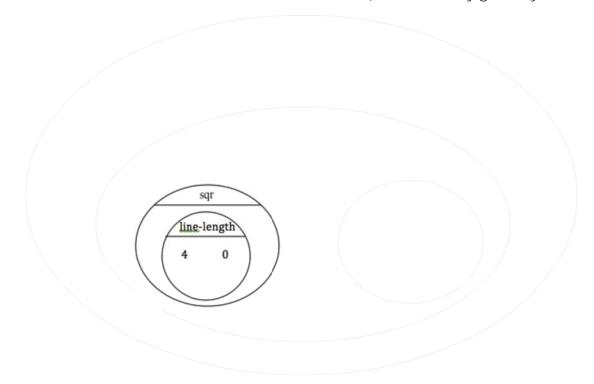
...and the computer does this

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
- 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!)

• /	:		>	_
name		Domain	Range	
				_
	What do	oes the function do?		
II. Give Example	es			
(EXAMPLE (Lise the function	n here)	
	Use the fulletion	THEIC		
				,
	find and	other way to get the same result he	ere	/
(EXAMPLE ()	
(=-:::::::::== (Use the function			
	 find and	other way to get the same result he	 ere)
III. Definition				
			`	
	tion name	variable names)	

Word Problem: Collide?

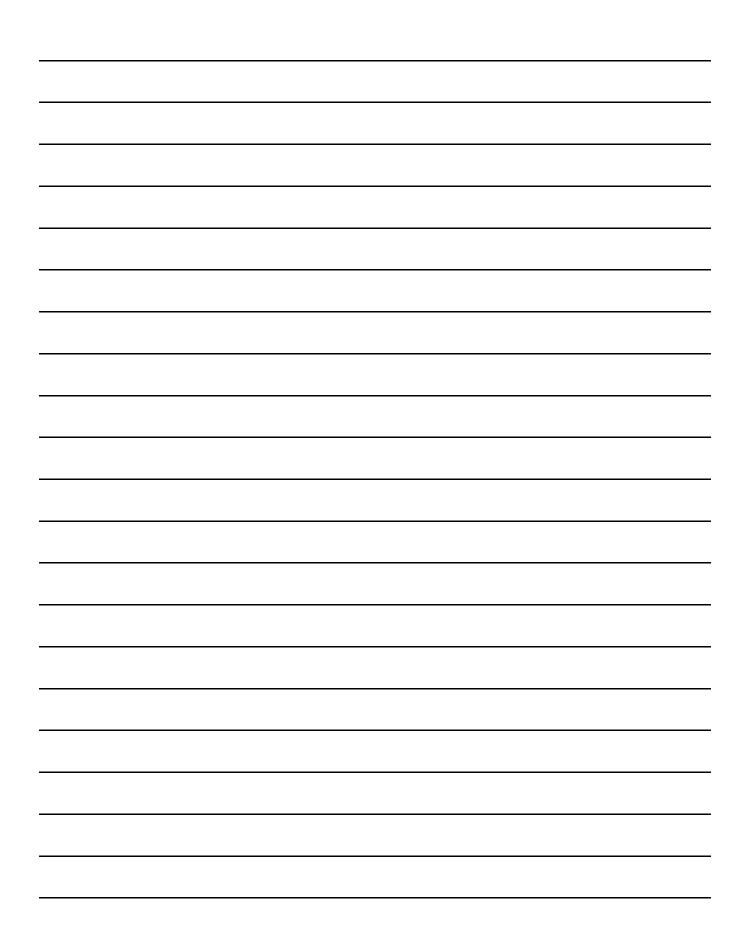
Write a function collide?, which takes FOUR inputs:

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

□ px: The x-coordinate of the player

It shou	e y-coordinate of another game character Id return true if the coordinates of the player are with Inates of the other character. Otherwise, false.	in 50 pixels of the	
I. Contra	act+Purpose Statement		
•	::	>	
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 h	nere)	
(EXAMPLE	Use the function here)	
	find another way to get the same result h) nere	
III. Definit	ion		
(define (function name 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.

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

Drocon	tation		haal
Presen	tation	reed	Daci

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. Contr	act+Purpose Statement		
name	:	Domain	> Range
	Examples		
Write some e	xamples of red-shape below. The fi	rst one has al	ready been done for you.
(EXAMPLE	(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. Defini	tion		
(define	<u> </u>)
(con	function name	variable n	ames
		(ciro	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	ne Racket Code into Algebra	
<pre>(define (double x) (* x 2))</pre>	double(x) = x*2	
(define (area length width) (* length width))	area(length, width) = length * width	
(define (circle-area radius)		

(* pi (sq radius)))

(sq (- y1 y2))))

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.

I. Contract+Pu Every contract has	rpose Stateme three parts:	ent		
; <u>D</u> name	:	Domain	> Range	
II. Give Examp Write an example of		n for <u>some sample inputs</u>		
D(1) Use the function here	=	What should the function produce?		
D(2)= Use the function here		What should the function produce?		
D()	=			
Use the function here	=	What should the function produce?		
Use the function here III. Definition		What should the function produce?		
	giving variable	e names to all your input values.		
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+Purpo	se Statement	
Every contract has thre	ee parts:	
		->
name	Domain	Range
II. Give Examples		
•	our function for some sample inputs	
, -	• •	
=		
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?	
USC THE TUNCTION THEIR	what should the function produce:	
=		
Use the function here	What should the function produce?	
III Dagarii a		
III. Definition		
write the Formula, givir	ng 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?

 Contract+Purpose Sta 	itement	
Every contract has three pa	rts:	
		·>
·		
name	Domain	Range
II. Give Examples		
Write an example of your fur	nction 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 Formula, giving vai	riable names to all your input values.	
=		

I. Contract+Purpose State	ment	
Every contract has three parts:		
·		>
name	Domain	Range
II. Give Examples		
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 Da Gualdian		
III. Definition		
write the Formula, giving varial	ble names to all your input values.	
=		