Contracts

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

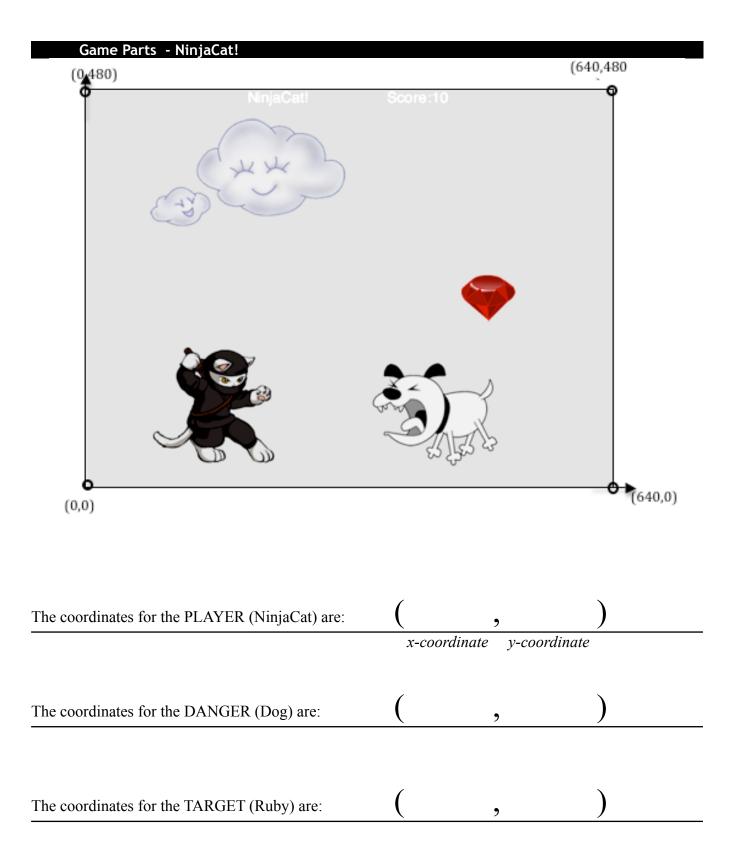
Contracts

Name	Domain	Range	example
••		^	
•		¥	
•		¥	
••		↑	
••		◆	
••		≁	
••			
•		¥	
•		≯	
••		≁	
••		¥	
••		^	
••		≁	
••		≁	
••		≁	
••		↑	
		1	

Lesson 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? <i>position</i>	More specifically <i>X-COORDINATE</i>



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 · (E · 10)		
8 + (5 x 10)		
(8 + 2) - (5 x 10)		
$(0+2) - (J \times 10)$		
<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		

Lesson 3

Fast Functions! Fill out two examples for each function, then try to write the contract, examples and definition by yourself.

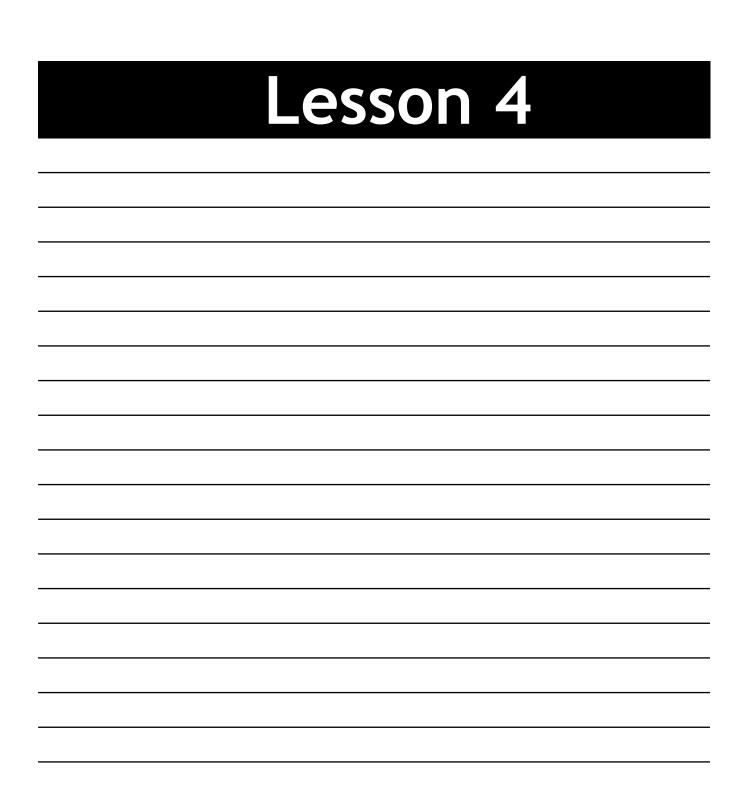


;	_:	>
name	domain	range
(EXAMPLE ())
(EXAMPLE ())
(define ())
;	_:	>
name	domain	range
(EXAMPLE ())
(EXAMPLE ())
(define ())
• •	••	>
(EXAMPLE ())
(EXAMPLE ())
(define ())
;	•	>
(EXAMPLE ())
(EXAMPLE ())
(define ())

Fast Functions! Fill out two examples for each function, then try to write the contract, examples, and definition by yourself.



;	_:	>
name	domain	range
(EXAMPLE ())
(EXAMPLE ())
(define ())
;	_:	>
name	domain	range
(EXAMPLE ())
(EXAMPLE ())
(define ())
;	•	->
(EXAMPLE ())
(EXAMPLE ())
(define ())
;	:	>
(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
•		
)	What does the function do?	
II. Give Examples		
On the computer, write an exa	mple of your function in action, using EXA	MPLE.
(EXAMPLE ()
tl	he user types	,
)
	which should become	······································
)
ti	he user types	
)
	which should become	
III. Definition		
Write the definition, give	ving variable names to all your input value	es.
(define ()
		/

.....and the computer does this

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.

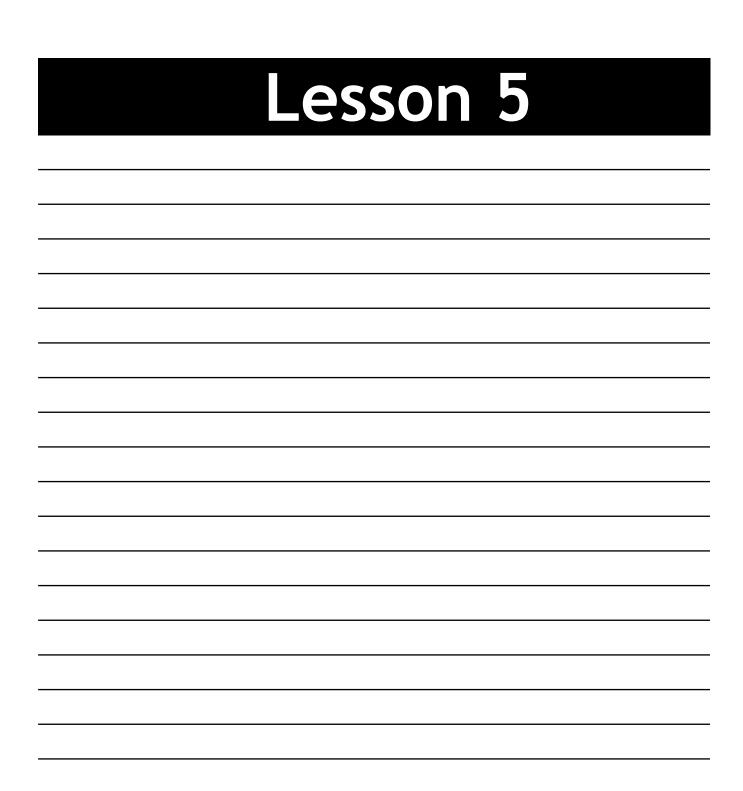
•		->
• Name	Domain	Z Range
	What does the function do?	
Give Examples		
	example of your function in action, using	EXAMPLE
EXAMPLE (the user says)
,	the user says	,
)
	Racket replies	/
EXAMPLE ()
,	the user says	,
)
	Racket turns that into)
. Definition		
	, giving variable names to all your input v	values.
define ()
	ame 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 !)

	t+Purpose Statement		
Every contract	has three parts:		
•	•		->
name	•	Domain	Range
;			
	WI	hat does the function do?	
II. Give Ex			
On the comput	er, write an example of	your function in action, using EXA	MPLE.
(EXAMPLE	()
	Use the fu	nction here	
)
-	fir	nd another way to get the same result her	/ re
(EXAMPLE	()
(Use the fu	nction here	/
)
-	fir	nd another way to get the same result her) re
			-
III. Definiti Write th		iable names to all your input value	<u>عر</u>
(define (_)
	function name	variable names	
)
	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 xcoordinate and produces the next x-coordinate, which is 50 pixels to the left.

	+Purpose Statement		
Every contract h	has three parts:		
•	•		>
name		Domain	Range
•			
,		t does the function do?	
ll. Give Exa			
On the compute	r, write an example of y	our function in action, using	EXAMPLE.
(EXAMPLE ()
	Use the func	tion here	,
)
_	find	another way to get the same result	t here
(EXAMPLE ()
	Use the func	tion here	
)
_	find	another way to get the same result	t here
III. Definitio	on		
		ble names to all your input v	alues.
(dofina (
(define (_	function name	variable names)
	ranceion name	variable names	
	and the computer of	loes 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 Domain Range				Range	
I. Give Examples On the computer, write an example of your function in action, using EXAMPLE. (EXAMPLE (
I. Give Examples On the computer, write an example of your function in action, using EXAMPLE. (EXAMPLE (
Con the computer, write an example of your function in action, using EXAMPLE. (What	does the function do?		
EXAMPLE () Use the function here) find another way to get the same result here (EXAMPLE () Use the function here (J. Definition Write the definition, giving variable names to all your input values. (define ())					
	•				
(EXAMPLE () Use the function here) Ind another way to get the same result here find another way to get the same result here find another way to get the same result here (define ()	EXAMPLE ()	
(EXAMPLE () Use the function here) find another way to get the same result here (In Definition Write the definition, giving variable names to all your input values. (define ()		Use the funct	tion here	,	
EXAMPLE () Use the function here Use the function here find another way to get the same result her					
EXAMPLE () Use the function here find another way to get the same result here I. Definition Write the definition, giving variable names to all your input values. (define ()))	
Use the function here Use the function here find another way to get the same result here I. Definition Write the definition, giving variable names to all your input values. (define ()		find a	another way to get the same result h	ere	
Use the function here Use the function here find another way to get the same result here I. Definition Write the definition, giving variable names to all your input values. (define ()					
Use the function here Use the function here find another way to get the same result here II. Definition Write the definition, giving variable names to all your input values. (define ()					
Use the function here Use the function here find another way to get the same result here I. Definition Write the definition, giving variable names to all your input values. (define ()	EXAMPLE ()	
II. Definition Write the definition, giving variable names to all your input values. (define ()	\			,	
II. Definition Write the definition, giving variable names to all your input values. (define ()					
II. Definition Write the definition, giving variable names to all your input values. (define ())	
II. Definition Write the definition, giving variable names to all your input values. (define ()		find ;	another way to get the same result h	/	
Write the definition, giving variable names to all your input values.			, ,		
(define ()		nition, giving varial	ole names to all your input val	ues.	
				`	
)	
	(define ()	

Lesson 6

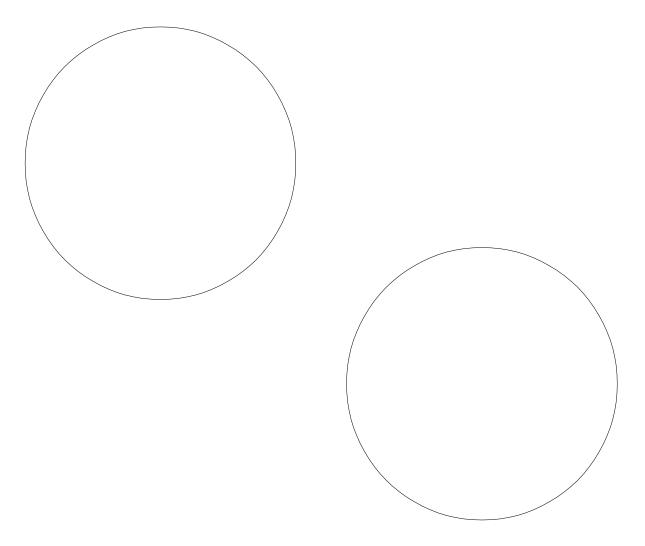
Protecting Sam

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...

<u>(> x -50)</u>

- 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.

very contract has three	ose Statement			
ery contract has the				
	•		>	
name		Domain	Range	
	What	does the function do?		
Give Examples		our function in action, using E		
in the computer, write	e an example of yo			
EXAMPLE ()	
	Use the funct	tion here		
)	
	find a	another way to get the same result	here	
EXAMPLE ()	
	Use the funct	tion here	/	
			,	
	find :	another way to get the same result)	
		another way to get the same result	nere	
Definition				
write the defin	ition, giving variat	ble names to all your input va	ilues.	
define ()	
	ion name	variable names	/	

...and the computer does this

Word Problem: safe-right?

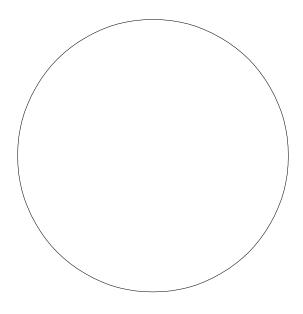
Use the Design Recipe to write a function <u>safe-right?</u>, which takes in the target's x-coordinate and checks to see if it is less than 690.

name			
		Domain	Range
	What door th	he function do?	
Give Examp n the computer, w	les rrite an example of your fur	nction in action, using E	XAMPLE.
EXAMPLE ()
(Use the function her	e	,
)
	find another	way to get the same result	here
EXAMPLE (Use the function her	·····)
			,
	find another	way to get the same result)
		,	
I. Definition Write the de	finition, giving variable nar	mes to all your input va	lues.
		, , , , , , , , , , , , , , , , , , ,	
dofino ()
define (nction name	variable names	

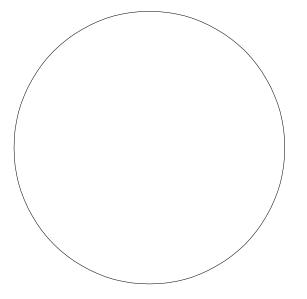
and / or

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.

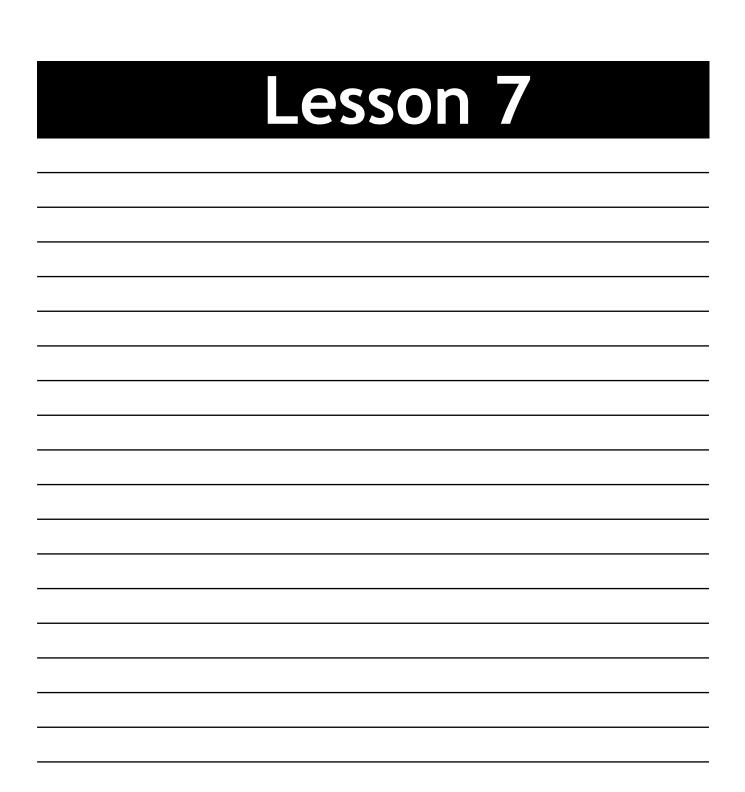


Word Problem: onscreen?

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

	•		->	
name	-	Domain	R	ange
		does the function do?		
Give Examples the computer, write		our function in action, usin	g EXAMPLE.	
(AMPLE ()	
	Use the funct	ion here	,	
	find a	another way to get the same resu	ult here)
(Use the funct	tion here)	
	Use the funct			
)
	find a	another way to get the same res	ult here	/
Definition				
	ition, giving variab	ble names to all your input	values.	
efine ()	
f	ion name	variable names		

...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	ract+Purpose Statement		
name	÷	Domain	-> Range
	Examples		
On the comp			
	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?
(EXAMPLE	(Use the function here)	What should the function produce?
ll. Defin	nition		
(define	(variable na)
	Tunction name	valiable lie	

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.

l. Contr	act+Purpose Statement		
•	•		->
name		Domain	Range
	Examples o examples we've started for you	, and make two	more
(EXAMPLE	(update-player 128 Use the function here	<u>"up"</u>)	What should the function produce?
(EXAMPLE	(update-player 451 Use the function here	"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?
(define)
	function name	variable na	ames
) —			

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.

I. Contr Every contrac	act+Purpose Staten ct has three parts:	nent					
•				Domain	>	Range	
ll. Give l	Examples						
(EXAMPLE	<u>(line-length</u> Use the funct	10 tion here	5)	<u>(- 10</u> What should the f	5) unction produce?)
	<u>(line-length</u> Use the funct	2 ion here	8)	<u>(- 8</u> What should the f	2) unction produce?)
III. Defin Write	ition the definition, givir	ng variabl	e names	to all your in	nput values.		
(define	. 2	-		variable na)		
							_
							-
							_
							_

...and the computer does this

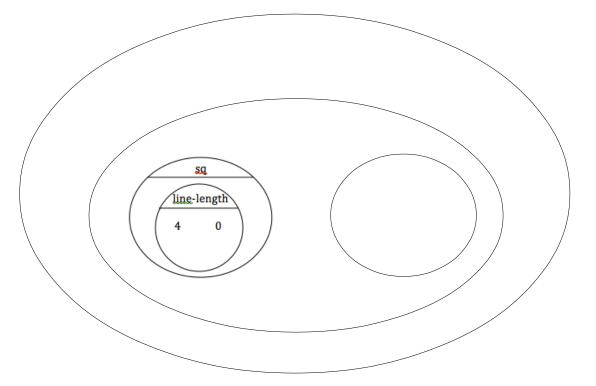
)

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 <u>distance</u>, 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!)

I. Contract+Purpo	se Statement			
•	•		->	
,	•	Domain	Range	
•				
,	What does the f	unction do?		_
II. Give Examples				
(EXAMPLE ()	
(Use the function here		/	
)
	find another wa	ly to get the same result h	ere	
(EXAMPLE (Use the function here)	
	Use the function here			
				`
	find another wa	y to get the same result h	ere)
III. Definition				
			`	
(define (n name	variable names)	
Tunctio	inname	variable names		
)

DESIGN RECIPE

Word Problem: collide?

Write a function collide?, which takes FOUR inputs:

- □ px: The x-coordinate of the player

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
lt should return true if the coordinates of the player are within 50 pixels of the coordinates of the other character. Otherwise, false.

name	• Domain	Range
		5
<u> </u>	What does the function do?	
. Give Examples	5	
EXAMPLE (Use the function here)
)
	find another way to get the same result h	iere /
EXAMPLE ()
(Use the function here	/
	find another way to get the same result h)
ll. Definition	, ,	
(define (ion name variable names)

Lesson 9

Catchy Intro:

Name, Age, Grade:

Game Title:

Back Story:

Characters:

Explain a piece of your code:



Drecontation Foodback			
Presentation Feedback For each question, circle the answer that	ut fits best.		
Was the introduction catchy?	No way!	A little.	Definitely!
Did they talk about their characters?	No way!	A little.	Definitely!
	NIl	A little.	
Did they explain the code well?	No way!	A nule.	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!
Dia mey make eye contact?	110 way:	1 X IIIII .	Deminicity:

Presentation Feedback For each question, circle the answer tha	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

. Contract+Purpose State	ement	
•• ••	Domain	> Range
. Give Examples		
Vrite some examples of red-sha	ape below. The first one has a	already been done for you.
(EXAMPLE <u>(red-shape</u>	<u>"circle"</u>)	(circle 50 "solid" "red"))
Use the fun	ction here	What should the function produce?
(EXAMPLE () .	
Use the fun	ction here	What should the function produce?
(EXAMPLE ()	
Use the fun	ction here	What should the function produce?
(EXAMPLE ()	
Use the fun	ction here	What should the function produce?
III. Definition		
(define (
function name	variable	e names
<u>(cond</u>		
	((circle 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	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))))				

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

I. Contract+Purpose Statement			
Every contract has t	three parts:		
; <u>D</u>	•		>
name		Domain	Range
II. Give Examp	les		
		for <u>some sample inputs</u>	
<u> </u>	=		
Use the function here		What should the function produce?	
<u> </u>			
Use the function here		What should the function produce?	
D()	=		
Use the function here		What should the function produce?	
	=		
Use the function here		What should the function produce?	
III. Definition			
Write the formula, giving variable names to all your input values.			
D() =			

Word Problem

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

		->
•	Domain	Range
Give Examples	unction for <u>some sample inputs</u>	
	some sample inputs	
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?	
=		
se the function here	What should the function produce?	
l. Definition		

=

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?

I. Contract+Purpose Sta Every contract has three parts			
;;	Domain	>	
name II. Give Examples	Domain	Range	
Write an example of your fund	ction 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, giv	ing variable names to all your input values		

=

Word Problem

I. Contract+Purpose Statement				
Every contract has three parts:				
:		->		
name	Domain	Range		
II. Give Examples				
Write an example of your fun	ction 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 variable names to all your input values.

=