Name: _____



BOOTSTRAP www.bootstrapworld.org

Class:



Workbook v2.0

A product of the Bootstrap team:

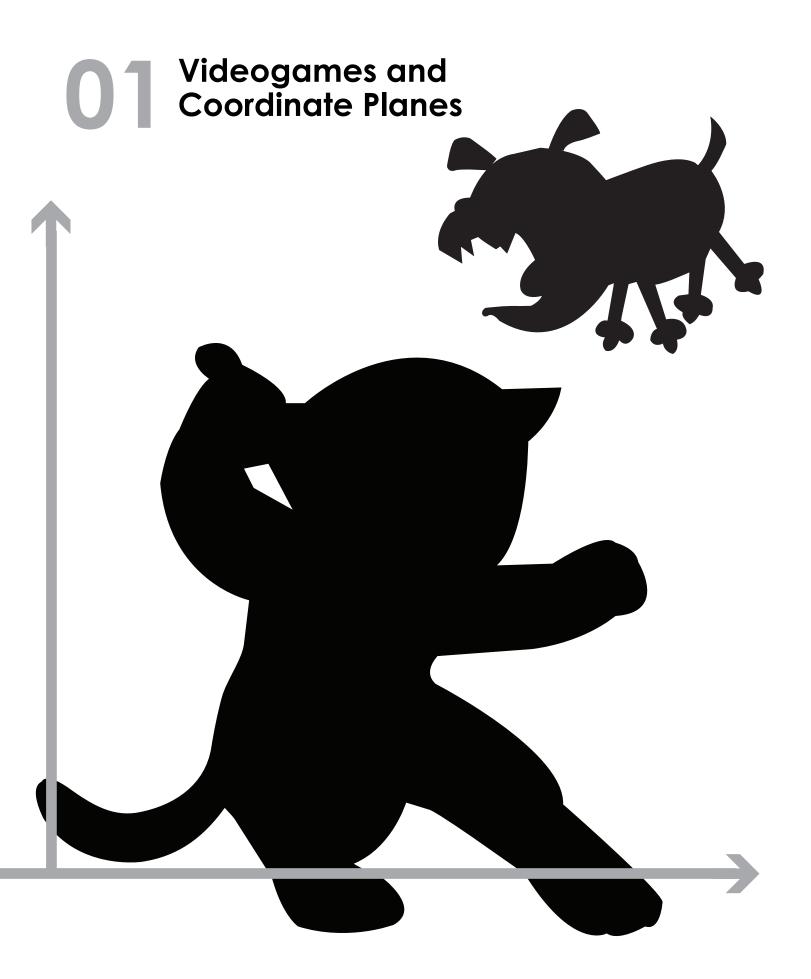
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- Kathi Fisler
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Visual Design: Colleen Murphy

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Bootstrap Units

01	Videogames and Coordinate Planes	06	Comparing Functions
02	Contracts, Strings, and Images	07	Conditional Branching
03	Intro to Definitions	08	Collision Detection
04	Design Recipe	09	Prepping for Launch
05	Game Animation	10	Additional Material



Lesson 1

Reverse-Engineering: How does NinjaCat work?

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

Game Parts - NinjaCat!



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:	(,)	

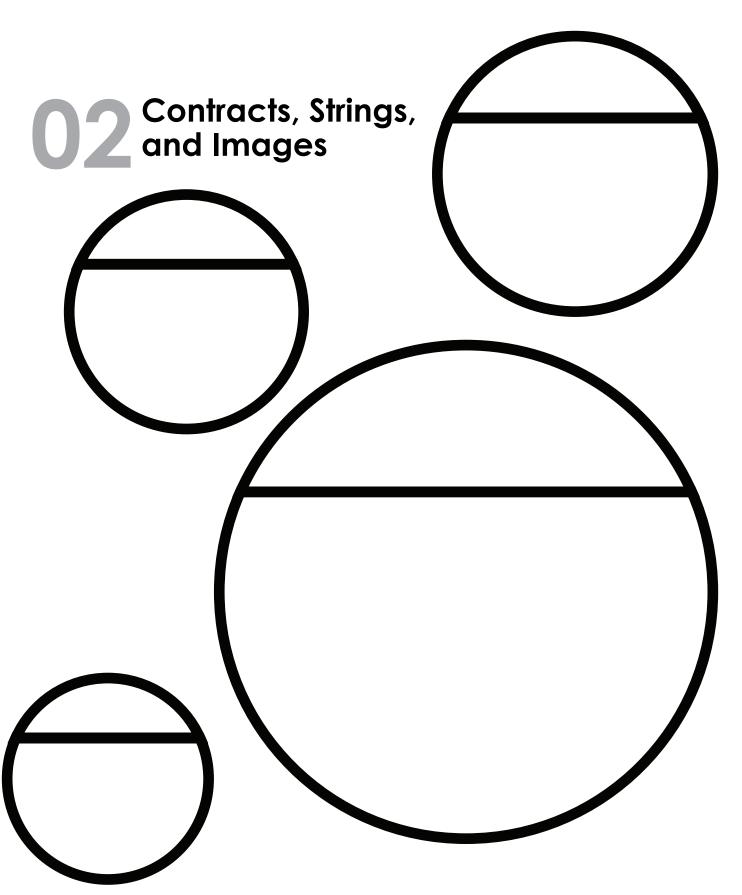
Our Videogame

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.

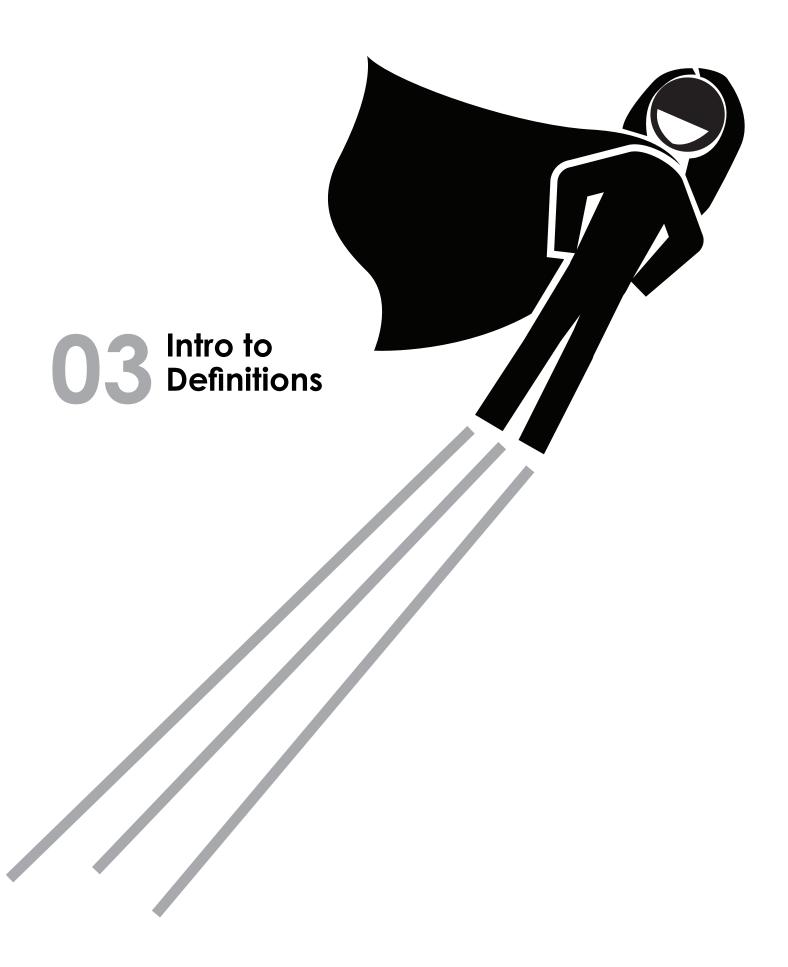
Circle of Evaluation Practice!

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)		
(0 · 2) (0 · x · ro)		
<u>5 x 10</u> 8 - 2		
0 - 2		

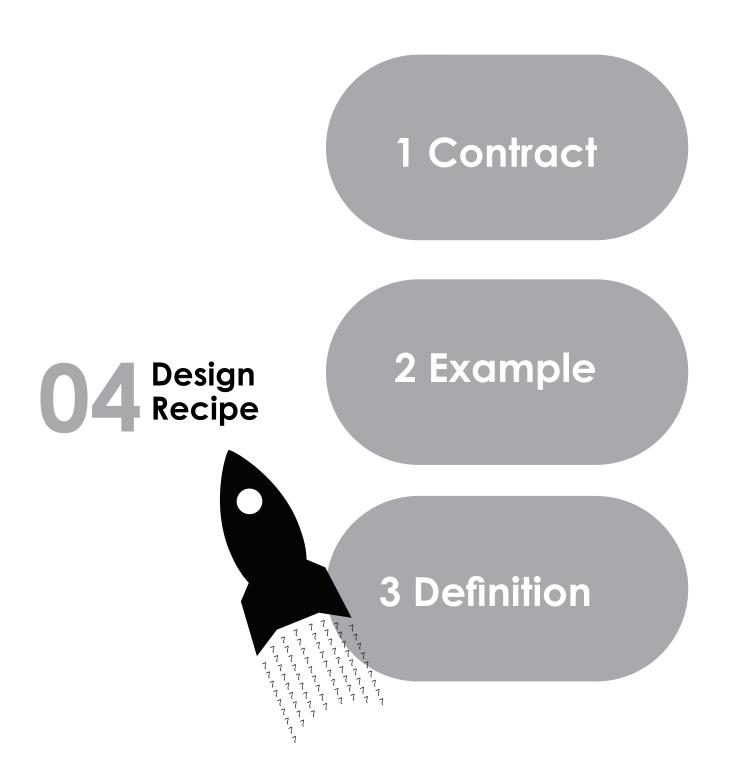


	Circles Co	mpetition	Time: 5 minutes
	Math	Circle of Evaluation	Racket Code
Round 1	(3 * 7) - (1 + 2)		
Round 2	3 - (1 + 2)		
Round 3	3 - (1 + (5 * 6))		
Round 4	(1 + (5 * 6)) - 3		



Fast Functions! name domain range (EXAMPLE ((EXAMPLE ((define (____) _____) name domain range (EXAMPLE (EXAMPLE ((define (____) domain name range (EXAMPLE (____) (EXAMPLE (define (name domain range (EXAMPLE (____ (EXAMPLE ((define ()

Fast Functions! name domain range (EXAMPLE ((EXAMPLE ((define (____ name domain range (EXAMPLE (EXAMPLE ((define (domain name range (EXAMPLE ((EXAMPLE (define (name domain range (EXAMPLE (____ (EXAMPLE (define (____) ____)



Word Problem: rocket-height

Directions: A rocket blasts off, traveling at 7 meters per second. Write a function called 'rocketheight' 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	and Purpose S	itatement		
Every contract h	nas three parts			
;	:		\rightarrow	
function n	ame	domain	range	;
;				
		what does the fu	unction do?	
Examples	;			
Write some exar	mples, then circle and	label what changes		
(EXAMPLE())
_	function name	input(s)	what the function produces	
(EXAMPLE())
_	function name	input(s)	what the function produces	
Definition				
Write the definiti	ion, giving variable na	mes to all your input value:	S	
(define()		
	function name	variables		
)

Word Problem: red-square

Directions: Use the Design Recipe to write a function '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.

i function name	: : -	dom what doe	ain es the function do?	→	range
function name	:			→	range
					range
;		what doe	as the function do?		
		what doe	as the function do?		
			es the function dos		
Examples					
Vrite some examples, then	circle and labe	l what changes			
(EXAMPLE()		
function i	name	input(s)		what the function produces	
(EXAMPLE()		
function i	name	input(s)		what the function produces	
Definition					
Write the definition, giving	variable names t	to all your input	values		
(define()		
function no	ime	variables	_		
					١

Word Problem: lawn-area

Directions: Use the Design Recipe to write a function 'lawn-area', which takes in the width and length of a lawn, and returns the area of the lawn. (Don't forget: area = length * width!)

Contract	and Purpose S	statement			
Every contract h	nas three parts				
;	:			\rightarrow	
function no	ame	doma	iin		range
;					
		what does	s the function do?		
Examples	3				
Write some exar	mples, then circle and	label what changes .			
(EXAMPLE())
_	function name	input(s)		what the function produces	
(EXAMPLE())
	function name	input(s)		what the function produces	
Definition					
Write the definiti	ion, giving variable na	mes to all your input v	alues		
(define()		
	function name	variables			
)

target



Game Animation

Word Problem: update-danger

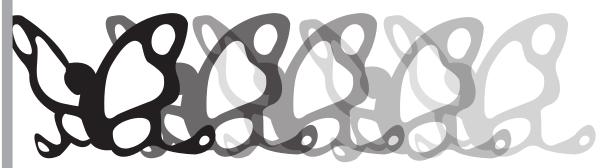
Directions: Use the Design Recipe to write a function 'update-danger', which takes in the danger's x-coordinate and produces the next x-coordinate, which is 50 pixels to the left.

	and Purpose S	ratement		
Every contract h	nas three parts			
;	:		\rightarrow	
function no	ame	domain	range	
;				
		what does the fund	ction do?	
Examples	;			
Write some exar	mples, then circle and	label what changes		
(EXAMPLE())
_	function name	input(s)	what the function produces	
(EXAMPLE())
_	function name	input(s)	what the function produces	
Definition				
Write the definiti	ion, giving variable na	mes to all your input values		
(define()		
	function name	variables		
)

Word Problem: update-target

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

Contract	and Purpose S	tatement		
Every contract h	nas three parts			
;	:		\rightarrow	
function no	ame	domain	range	
;				
		what does the func	tion do?	
Examples	;			
Write some exar	mples, then circle and	label what changes		
(EXAMPLE())
	function name	input(s)	what the function produces	
(EXAMPLE())
	function name	input(s)	what the function produces	
Definition				
Write the definiti	ion, giving variable na	mes to all your input values		
(define()		
	function name	variables		
)



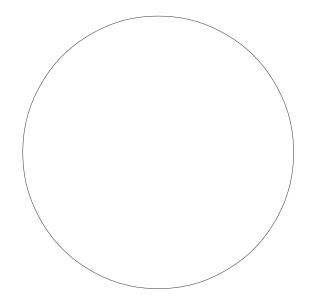
"safe-left?"

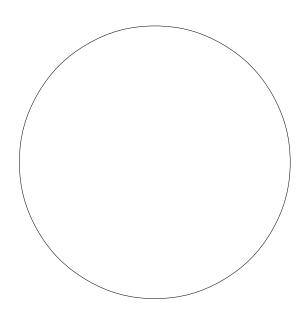
Comparing Functions

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?

Directions: 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

Contract	and Purpose S	Statement		
Every contract h	as three parts			
;	:		\rightarrow	
function no	ате	domain	range	
;				
		what does the funct	ion do?	
Examples				
Write some exan	nples, then circle and	label what changes		
(EXAMPLE())
	function name	input(s)	what the function produces	
(EXAMPLE())
	function name	input(s)	what the function produces	
Definition				
Write the definition	on, giving variable na	mes to all your input values		
(define()		
	function name	variables		
)

what the function does with those variables

20

Word Problem: safe-right?

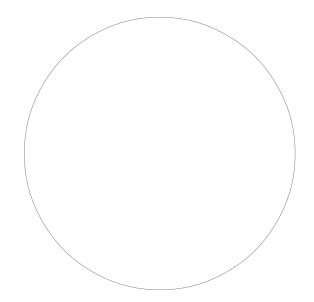
Directions: Use the Design Recipe to write a function 'safe-right?', which takes in an x-coordinate and checks to see if it is less than 690.

	and Purpose S	tatement			
ery contract h	nas three parts				
	:			\rightarrow	
function no	ame	don	nain	ra	nge
		what do	oes the function do?	?	
xamples	3				
ite some exar	nples, then circle and	label what changes	5		
EXAMPLE ()		•
_	function name	input(s)		what the function produces	
EXAMPLE ()		•
_	function name	input(s)		what the function produces	
Definition					
ite the definiti	on, giving variable na	mes to all your input	values		
define()		
	function name	variables	_		
	, on one of the	v dinazios			

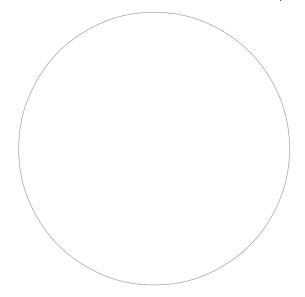
and / or

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.

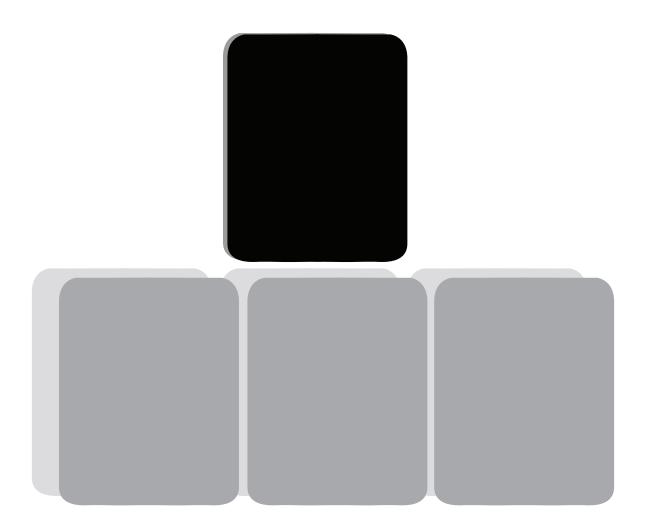


Word Problem: onscreen?

Directions: Use the Design Recipe to write a function 'onscreen?', which takes in the x-coordinate and checks to see if Sam is safe on the left AND safe on the right.

Contract	and Purpose S	itatement				
Every contract h	nas three parts					
;	:			\rightarrow		
function no	ame	do	main		range	
;						
		what d	loes the function do?			
Examples						
Write some exar	mples, then circle and	label what change	es			
(EXAMPLE()			
	function name	input(s)				
)
	w	hat the function produces	S			-
(EXAMPLE()			
	function name	input(s)				
)
		what the function produc	ces			
Definition						
Write the definiti	ion, giving variable na	mes to all your inpu	t values			
(define()			
	function name	variables	<u>—</u>			
)
		what the func	tion does with those variable	S		-

7 Conditional Branching



Word Problem: cost

Directions: 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.

	and Purpose	Statement			
very contract h	as three parts				
	:			→ 	
function no	ame	domain			range
		what does t	the function do?		
Examples					
rite some exan	nples, then circle an	d label what changes			
EXAMPLE(cost	"pepperoni"))
	function name	input(s)		what the function produces	
EXAMPLE())
	function name	input(s)		what the function produces	
EXAMPLE())
	function name	input(s)		what the function produces	
EXAMPLE())
_	function name	input(s)		what the function produces	
Definition					
	on, aivina variable r	names to all your input va	llues		
define(, ,)		
·	function name	variables			
(cc	ond				
·		_			
ſ					1
_					
ſ					1
-					
]]
-					
]]
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г					

Word Problem: update-player

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

Every contract	has three parts				
;	:			\rightarrow	
function	name	dom	ain	ranç	ge
;					
·		what doe	es the function do?		
Example	.c				
	amples, then circle and l	abel what changes			
	update-player	320 "up"			1
	function name	input(s)	,	what the function produces	
(EXAMPLE)	update-player	100 "up")		١
	function name	input(s)	,	what the function produces	
(EXAMPLE(F - 197)	, , , , , , , , , , , , , , , , , , , ,	١
(DAAH DD (function name	input(s)	,	what the function produces	
(EXAMPLE(,= 2.1(4))		,
(LAMII DD (_	function name	input(s)	,	what the function produces	
D of the site		,			
Definition					
	ition, giving variable nan	nes to all your input	values		
(define(
	function name	variables			
(_					
[[]
[]
ſ	[])

O8 Collision Detection

collision



Word Problem: line-length

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

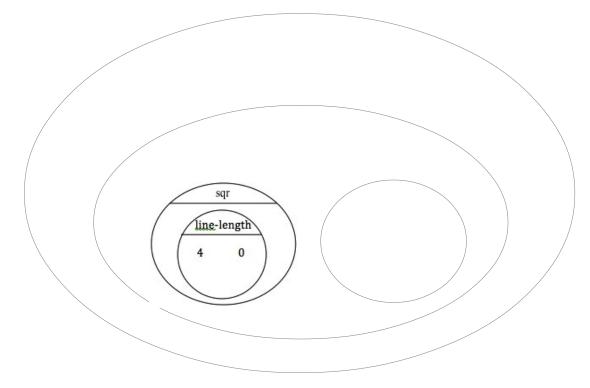
Contract	and Purpose S	tatement							
Every contract	has three parts								
;	:						\rightarrow		
function	name	dom	nain					range	
;									
		what do	es the fun	ction d) Š				
Example	\$								
Write some exc	amples, then circle and I	abel what changes							
(EXAMPLE(line-length	10 5)	(–	10	5))
	function name	input(s)					what the function produces		_
(EXAMPLE(line-length	2 8)	(–	8	2))
_	function name	input(s)					what the function produces		_
Definition	า								
Write the defini	ition, giving variable nar	mes to all your input	values						
(define()						
	function name	variables	_						
(0	cond								
[[]
									_
[[]))

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

Directions: 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 the previous page!)

Contract	and Purpose S	Statement		
Every contract h	nas three parts			
;	:			\rightarrow
function n	ame	do	pmain	range
;				
		what c	does the function do?	
Examples	<u> </u>			
Write some exar	mples, then circle and	label what change	es	
(EXAMPLE()	
	function name	input(s)		
)
		what the	e function produces	
(EXAMPLE()	
	function name	input(s)		
)
		wha	t the function produces	
Definition				
	ion, giving variable no	ımes to all your inpu	it values	
(define(5 0	, ,)	
	function name	variables		
		. =		1
		what the fund	tion does with those variables	· · · · · · · · · · · · · · · · · · ·

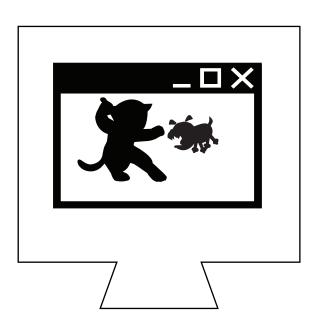
Word Problem: collide?

Directions: Write a function collide?, 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

Are the coordinates of the player within 50 pixels of the coordinates of the other character?

Contract	and Purpose S	Statement			
Every contract h	nas three parts				
;	:			\rightarrow	
function no	ame	dor	main	range	
;					
-		what do	oes the function do?	,	-
Examples	;				
Write some exar	mples, then circle and	l label what change.	S		
(EXAMPLE())
_	function name	input(s)		what the function produces	
(EXAMPLE())
_	function name	input(s)		what the function produces	
Definition					
Write the definiti	ion, giving variable no	ames to all your input	t values		
(define()		
	function name	variables	_		
)
		what the funct	tion does with those v	variables	



Presentation Preparation



Lesson 9

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

Presentation Feedback

Was the introduction catchy?

For each question, circle the answer that fits best.

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! Definitely! 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? A little. No way! Definitely!

No way!

Definitely!

A little.

Presentation Feedback

Was the introduction catchy?

For each question, circle the answer that fits best.

A little. Did they talk about their characters? No way! Definitely! Did they explain the code well? No way! A little. Definitely! Did they speak slowly enough? No way! Definitely! 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? A little. No way! Definitely!

No way!

Definitely!

A little.

Word Problem: red-shape

Directions: Write a function called red-shape, 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	and Purpose S	Statement						
Every contract I	has three parts							
;	:					\rightarrow		
function n	name	dom	nain				range	
;								
		what do	es the fu	nction do?				
Examples	S							
	mples, then circle and	label what changes	·					
(EXAMPLE(red-shape	"circle")	(circle	50	"solid"	"red"))
	function name	input(s)			who	at the function pro	oduces	
EXAMPLE ())
_	function name	input(s)			who	at the function pro	oduces	
EXAMPLE ())
_	function name	input(s)			who	at the function pro	oduces	
EXAMPLE ())
_	function name	input(s)			who	at the function pro	oduces	
Definition								
	tion, giving variable na	ımes to all your input	values	i				
(define()					
	function name	variables	_					
(c	ond							
[(circle 5	0 "	solid" "	red")]
•								
]]
•								
[]
•								
[]
г								1)

Translating into Algebra

Values: Translate the F	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)) (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.

I. Contract+Purpose	Statement	
Every contract has three	parts:	
;:		>
name	Domain	Range
II. Give Examples		
·	r function for <u>some sample inputs</u>	
wille all example of you		
D(1) =		
Use the function here	What should the function produce?	
D (0)		
D(2)=		
Use the function here	What should the function produce?	
D() =		
Use the function here	What should the function produce?	
<u> </u>		
Use the function here	What should the function produce?	
III D - C11		
III. Definition	variable names to all value input values	
wille the formula, giving	variable names to all your input values.	
D()		
υ () =		

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
II. Give Examples		
Write an example of your f	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?	
III. Definition		
Write the Formula, giving v	ariable 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
II. Give Examples		
Write an example of your f	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		
Write the Formula, giving v	ariable names to all your input values.	
=		

I. Contract+Purpose	Statement	
Every contract has three pa	arts:	
: :		->
name	Domain	Range
II. Give Examples		
	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		
	variable names to all your input values.	
=		

I. Contract+Purpose	Statement	
Every contract has three pa	arts:	
: :		->
name	Domain	Range
II. Give Examples		
	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		
	variable names to all your input values.	
=		

Contracts

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

Contracts

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