Name: _____

BOOTSTRAP

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BOOTSTRAP
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Workbook v2.0

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Bootstrap Units

01 Videogames and Coordinate Planes
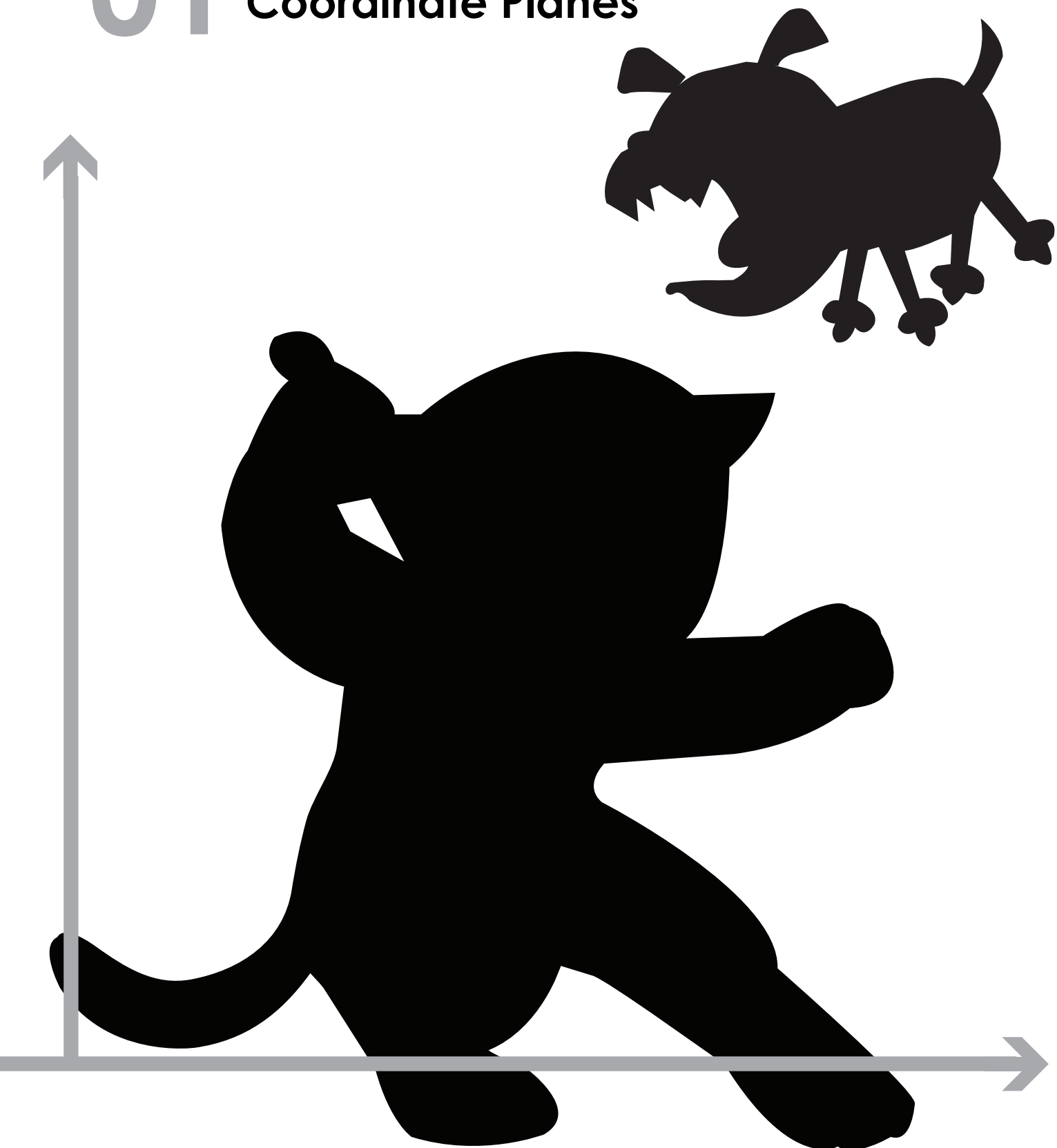
Lesson 1

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

Game Parts - NinjaCat!

(0,480) (640,480)

NinjaCat!   Score:10

(0,0) (640,0)

The coordinates for the PLAYER (NinjaCat) are: $(\underline{\hspace{2cm}} , \underline{\hspace{2cm}})$

x-coordinate   y-coordinate

The coordinates for the DANGER (Dog) are: $(\underline{\hspace{2cm}} , \underline{\hspace{2cm}})$

The coordinates for the TARGET (Ruby) are: $(\underline{\hspace{2cm}} , \underline{\hspace{2cm}})$

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 x 10		
8 + (5 x 10)		
(8 + 2) - (5 x 10)		
5 x 10 / 8 - 2		

02 Contracts, Strings, and Images

	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		
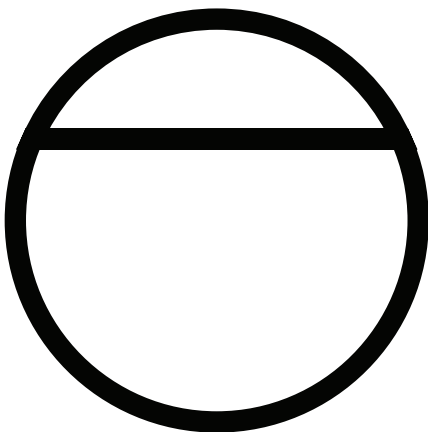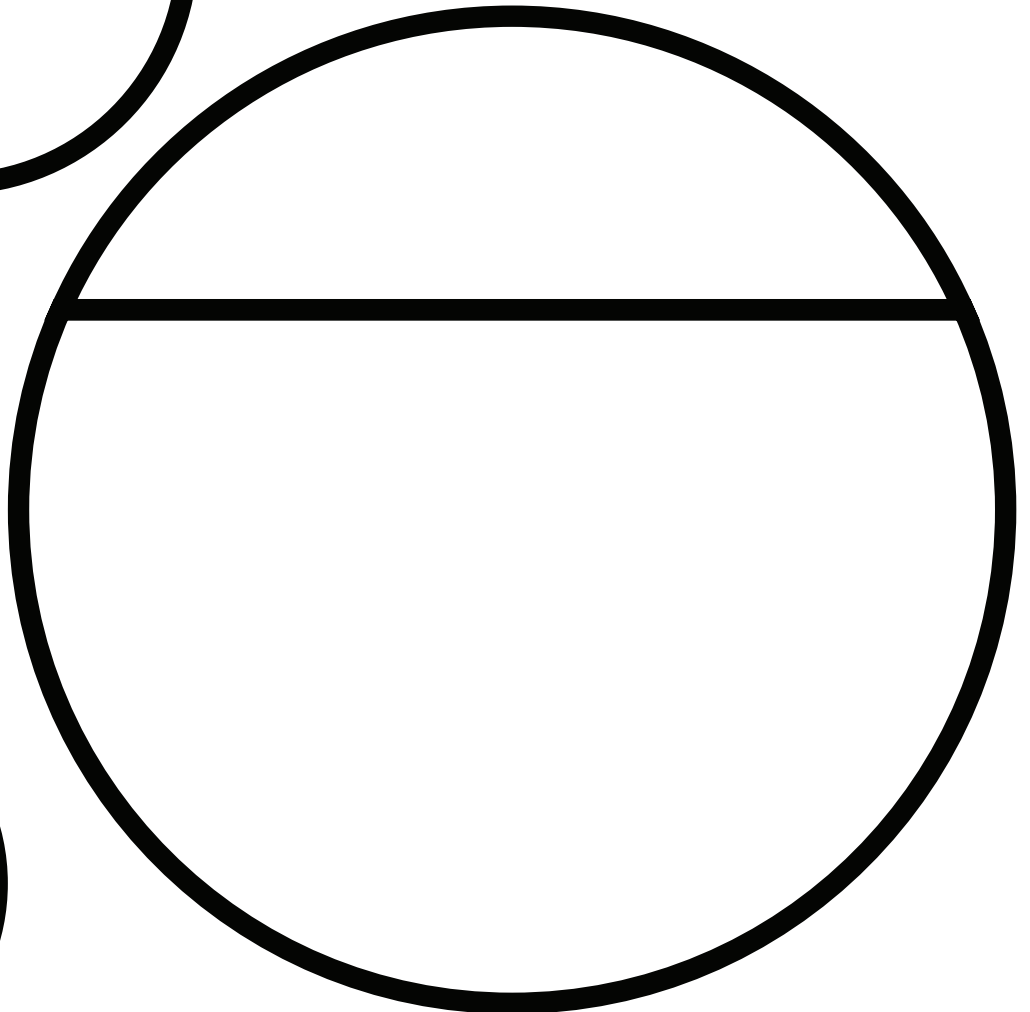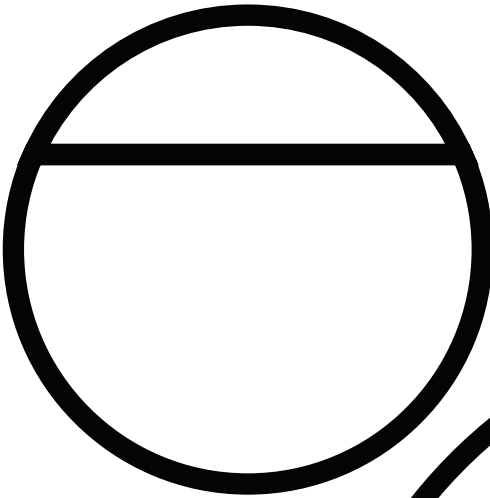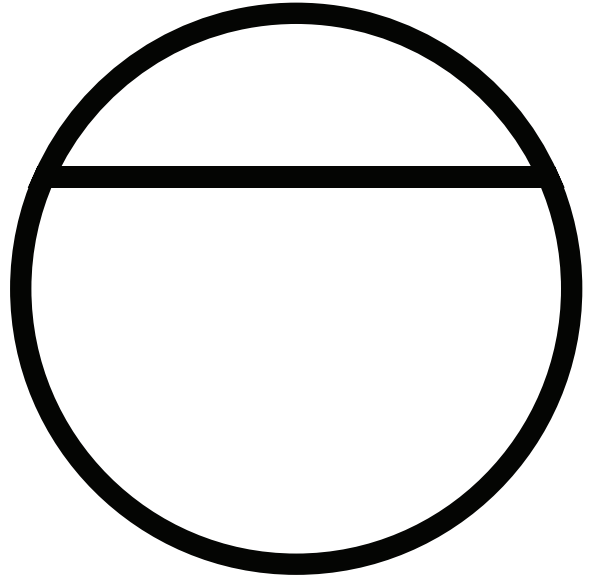
Circles Competition

Time: 5 minutes

03 Intro to Definitions

Fast Functions!

; _____ : _____ -> _____
            name   domain   range

(EXAMPLE (_____ _____) _____)

(EXAMPLE (_____ _____) _____)

(define (_____ _____) _____)

; _____ : _____ -> _____
            name   domain   range

(EXAMPLE (_____ _____) _____)

(EXAMPLE (_____ _____) _____)

(define (_____ _____) _____)

; _____ : _____ -> _____
            name   domain   range

(EXAMPLE (_____ _____) _____)

(EXAMPLE (_____ _____) _____)

(define (_____ _____) _____)

; _____ : _____ -> _____
            name   domain   range

(EXAMPLE (_____ _____) _____)

(EXAMPLE (_____ _____) _____)

(define (_____ _____) _____)

Fast Functions!

; _____:_____ -> _____
                name   domain   range

(EXAMPLE (_____ _____) _____)

(EXAMPLE (_____ _____) _____)

(define (_____ _____) _____)

; _____:_____ -> _____
                name   domain   range

(EXAMPLE (_____ _____) _____)

(EXAMPLE (_____ _____) _____)

(define (_____ _____) _____)

; _____:_____ -> _____
                name   domain   range

(EXAMPLE (_____ _____) _____)

(EXAMPLE (_____ _____) _____)

(define (_____ _____) _____)

; _____:_____ -> _____
                name   domain   range

(EXAMPLE (_____ _____) _____)

(EXAMPLE (_____ _____) _____)

(define (_____ _____) _____)

04 Design Recipe

1 Contract

2 Example

3 Definition

Word Problem: rocket-height

Directions: *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 and Purpose Statement

Every contract has three parts ...

; _____ **:** _____ **→** _____
  function name   domain   range

; _____
                                        what does the function do?

Examples

Write some examples, 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, giving variable names to all your input values ...

(define(_____   _____ **)**
          function name   variables

_____ **)**
                        what the function does with those 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.*

Contract and Purpose Statement

Every contract has three parts ...

; _____ : _____ → _____
       function name   domain   range

; _____
                      what does the function do?

Examples

Write some examples, 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, giving variable names to all your input values ...

(define(_____ _____)
       function name   variables

     _____)
               what the function does with those variables

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 Statement

Every contract has three parts ...

; _____ : _____ → _____
      function name   domain   range

; _____
                                   what does the function do?

Examples

Write some examples, 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, giving variable names to all your input values ...

(define(_____ _____)
         function name   variables

   _____)
               what the function does with those variables

target

danger

05 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.*

Contract and Purpose Statement

Every contract has three parts ...

; _____ : _____ → _____

       function name   *domain*   *range*

; _____

              what does the function do?

Examples

Write some examples, 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, giving variable names to all your input values ...

`(define(` _____ _____ `)`

       function name   *variables*

_____ `)`

              what the function does with those 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 Statement

Every contract has three parts ...

; _____ : _____ → _____
     function name   *domain*   *range*

; _____
               what does the function do?

Examples

Write some examples, 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, giving variable names to all your input values ...

(define(_____ _____)
       function name   *variables*

    _____)
              what the function does with those variables

"safe-left?"
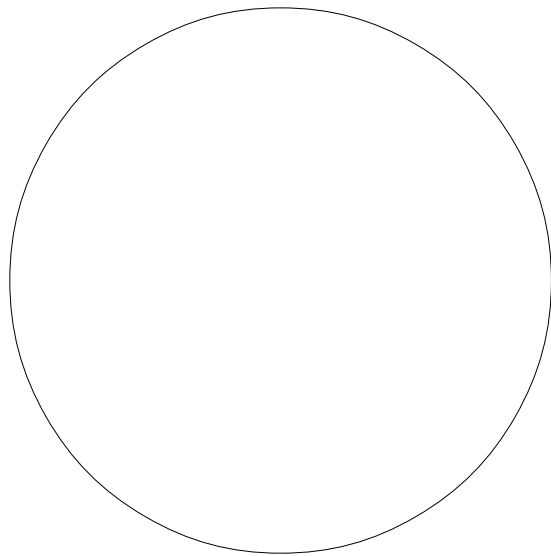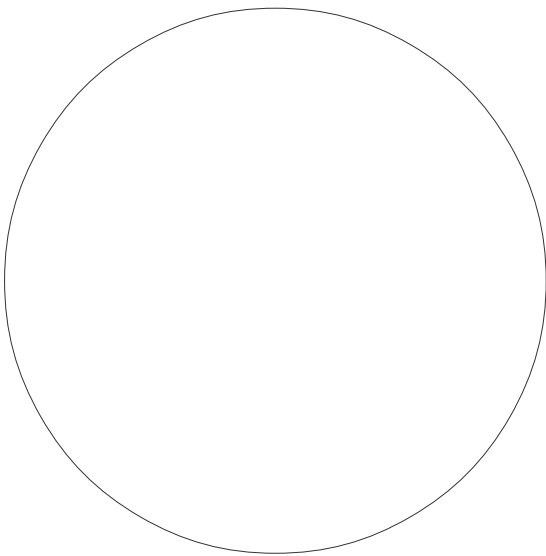
06 Comparing Functions

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... $(>$ $\underline{x \quad -50)}$

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 Statement

Every contract has three parts ...

; _____ : _____ → _____
         function name   domain   range

; _____
                   what does the function do?

Examples

Write some examples, 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, giving variable names to all your input values ...

(define(_____ _____)
         function name   variables

     _____)
               what the function does with those variables

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.

Contract and Purpose Statement

Every contract has three parts ...

; _____ : _____ → _____
     function name   *domain*   *range*

; _____
          what does the function do?

Examples

Write some examples, 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, giving variable names to all your input values ...

(define(_____ _____)
     function name   *variables*

     _____)
          what the function does with those variables

and / or

Write the Circles of Evaluation for these statements, and then convert them to Racket

    1. Two is less than five, _and_ zero is equal to six.
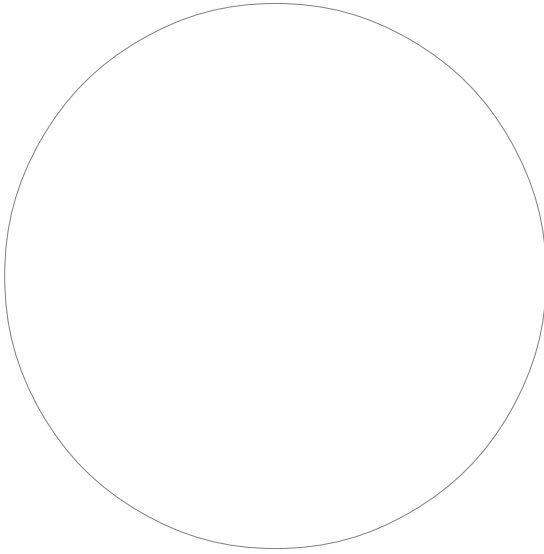
    2. Two is less than four _or_ four is equal to six.
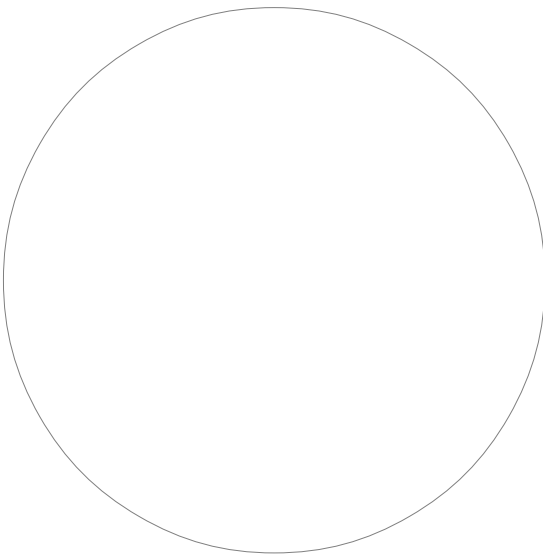
Word Problem: onscreen?

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 Statement

Every contract has three parts ...

; _____ : _____ → _____
      function name   *domain*   *range*

; _____
                               what does the function do?

Examples

Write some examples, 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

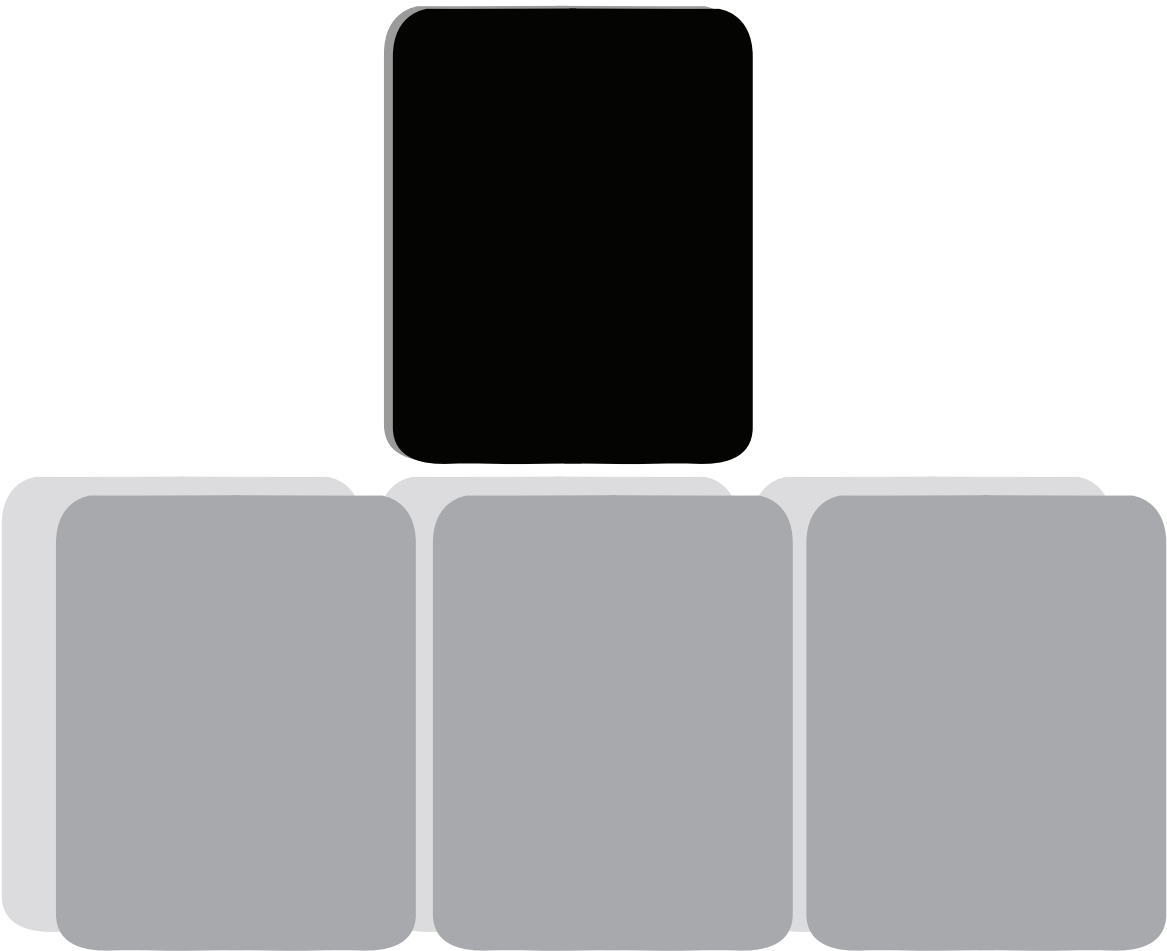*Write the definition, giving variable names to all your input values ...*

(define(_____ _____)
            function name   *variables*

    _____)
                what the function does with those variables

07 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.*

Contract and Purpose Statement

Every contract has three parts ...

; _____ : _____ → _____

     function name   *domain*   *range*

; _____

                   what does the function do?

Examples

Write some examples, then circle and 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

Write the definition, giving variable names to all your input values ...

`(define(` _____ _____ `)`

       function name   *variables*

     `(cond` _____

         `[` _____ _____ `]`

         `[` _____ _____ `]`

         `[` _____ _____ `]`

         `[` _____ _____ `]`

         `[` _____ _____ `]))`

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.*

Contract and Purpose Statement

Every contract has three parts ...

; _____ : _____ → _____
    function name   *domain*   *range*

; _____
                what does the function do?

Examples

Write some examples, then circle and label what changes ...

(EXAMPLE(update-player   320 "up"   )   )
         function name   *input(s)*   *what the function produces*

(EXAMPLE(update-player   100 "up"   )   )
         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

Write the definition, giving variable names to all your input values ...

(define(_____ _____)
         function name   *variables*

     (_____

       [_____]

       [_____]

       [_____]))

08 Collision Detection

collision

distance

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 Statement

Every contract has three parts ...

; _____ : _____ → _____
    function name   *domain*   *range*

; _____
              what does the function do?

Examples

Write some examples, then circle and label 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

Write the definition, giving variable names to all your input values ...

```
(define( _____ _____ )
```
        function name   *variables*

```
      (cond _____

        [ _____  _____ ]

        [ _____  _____ ]))
```
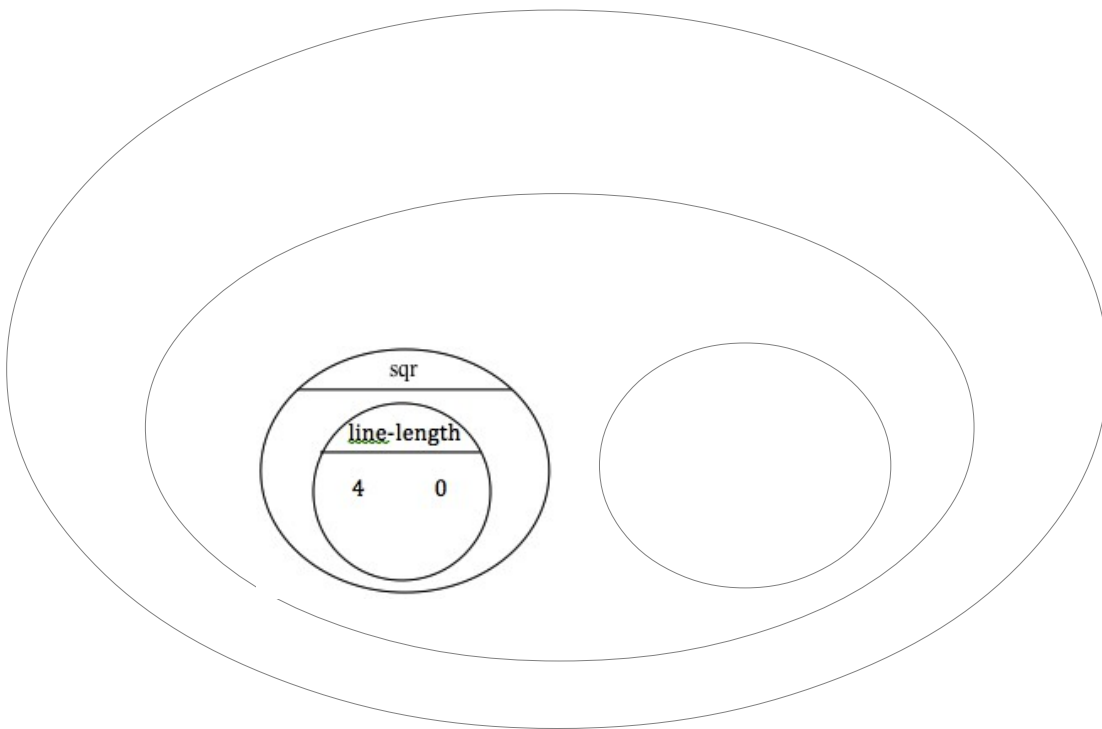
The Distance Formula, with Numbers

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 Statement

Every contract has three parts ...

; _____ **:** _____ **→** _____

       function name   domain   range

; _____

                  what does the function do?

Examples

Write some examples, 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, giving variable names to all your input values ...

`(define(` _____ _____ `)`

        function name   variables

_____ `)`

         what the function 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 Statement

Every contract has three parts ...

; _____ **:** _____ → _____
function name　　　　　　　　　　　domain　　　　　　　　　　　range

; _____
　　　　　　　　　　　what does the function do?

Examples

Write some examples, 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, giving variable names to all your input values ...

(define(_____ _____ **)**
　　　　　function name　　　variables

_____ **)**
　　　　　what the function does with those variables

09 Presentation Preparation

Lesson 9

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.

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.

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

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 Statement

Every contract has three parts ...

; _____ : _____ → _____
         function name   domain   range

; _____
                          what does the function do?

Examples

Write some examples, then circle and label what changes ...

(EXAMPLE(red-shape   "circle"   ) (circle 50 "solid" "red")   )
         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

Write the definition, giving variable names to all your input values ...

(define(_____   _____)
        function name   variables

    (cond _____

      [_____ (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 Racket Code into Algebra	
`(define (double x)` `   (* x 2))`	double(x) = x*2
`(define (area length width)` `   (* length width))`	area(length, width) = length * width
`(define (circle-area radius)` `   (* pi (sq radius)))`	

`(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 **<u>distance</u>** *D* that the rocket has traveled, as a function of **<u>time</u>** *t*.

I.   Contract+Purpose Statement

Every contract has three parts:

; _____D_____ : _____ -> _____

        name   Domain   Range

II.   Give Examples

Write an example of your function 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   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 **_time_** the rocket has been traveling, as a function of **_distance_**.

I.   Contract+Purpose Statement

Every contract has three parts:

; _____ : _____ -> _____

       name   Domain   Range

II.   Give Examples

Write an example of your 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 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?

I.   Contract+Purpose Statement
Every contract has three parts:

; _____ : _____ -> _____

       name   Domain   Range

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

_____ = _____

Contracts

Name		Domain	Range	example
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	
:	..		↑	

Contracts

Name		Domain	Range	example
:	::		↑	
:	::		↑	
:	::		↑	
:	::		↑	
:	::		↑	
:	::		↑	
:	::		↑	
:	::		↑	
:	::		↑	
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:	::		↑	
:	::		↑	
:	::		↑	
:	::		↑	
:	::		↑	
:	::		↑	