Contracts

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

Contracts

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

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!

(0,480)   (640,480

NinjaCat!   Score:10

(0,0)   (640,0)

The coordinates for the PLAYER (NinjaCat) are: (,   )

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): _____

Our game takes place: _____
(In space? The desert? A mall?)

The player is a _____.

The player moves only up and down.

Your player GAINS points when they hit the target.

The Target is a _____.

The Target moves only to the left and right.

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)		
5 x 10 *8 - 2*		

Lesson 2

(draw Circles of Evaluation here if you need extra scratch paper)

	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!

; _____:_____ -> _____
        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 (_____ _____) _____)

Lesson 4

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.

I.   Contract+Purpose Statement

Every contract has three parts:

; _____ : _____ -> _____
      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 (_____))
                        the user types...

     _____)
                    .....which should become

(EXAMPLE (_____))
                        the user types...

     _____)
                    .....which should become

III.   Definition

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

(define (_____   _____)
             function name   variable names

     _____)
               .....and the computer does this

Design Recipe

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.

I.   Contract+Purpose Statement

Every contract has three parts:

; _____ : _____ -> _____
       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 (_____)
                        the user says...

    _____)
                      …..Racket replies

(EXAMPLE (_____)
                        the user says...

    _____)
                      …..Racket turns that into

III.   Definition

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

(define (_____ _____)
             function name   variable names

    _____)
          …..and the computer does this

Design Recipe

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.   Contract+Purpose Statement
Every contract has three parts:

; _____ : _____ -> _____
　　　　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

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

(define (_____   _____)
　　　　　　function name　　　　　　　variable names

_____)
　　　　　…..and the computer does this

Lesson 5

Design Recipe

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.   Contract+Purpose Statement

Every contract has three parts:

; _____ : _____ -> _____
       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

III.   Definition

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

(define (_____ _____)
         function name   variable names

        _____)
            …..and the computer does this

Design Recipe: update-target

Word Problem: update-target

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.

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

; _____ : _____ -> _____
        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

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

(define (_____   _____)
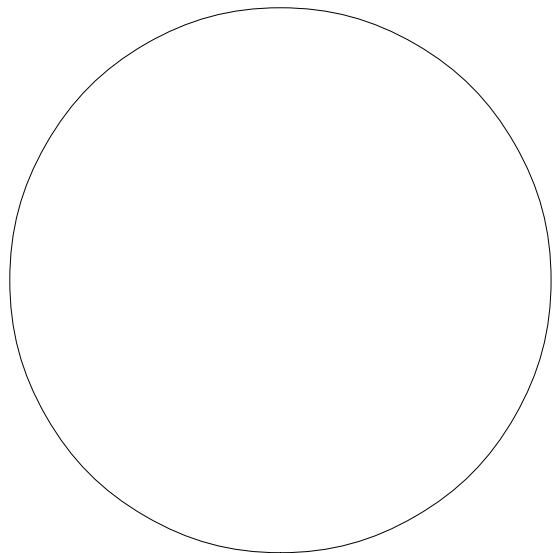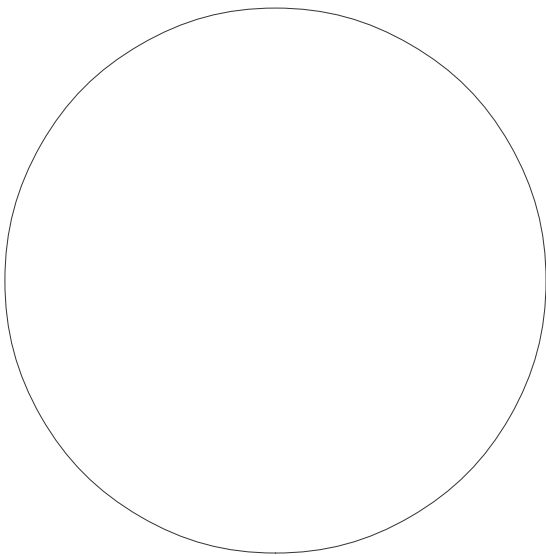   function name   variable names

        _____)
             …..and the computer does this

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...

$(>$ ___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:

Design Recipe

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.*

I.　Contract+Purpose Statement

Every contract has three parts:

; _____ : _____ -> _____
　　　　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

III.　Definition

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

(define (_____　_____)
　　　　　　function name　　　　　　variable names

　　　　_____)
　　　　　　　　　　...and the computer does this

Design Recipe

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 Statement
Every contract has three parts:

; _____ : _____ -> _____
       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

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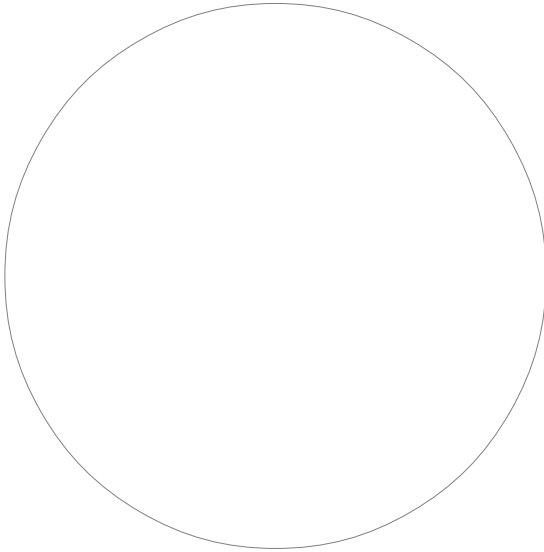Write the definition, giving variable names to all your input values.

(define (_____   _____)
         function name   variable names

_____)
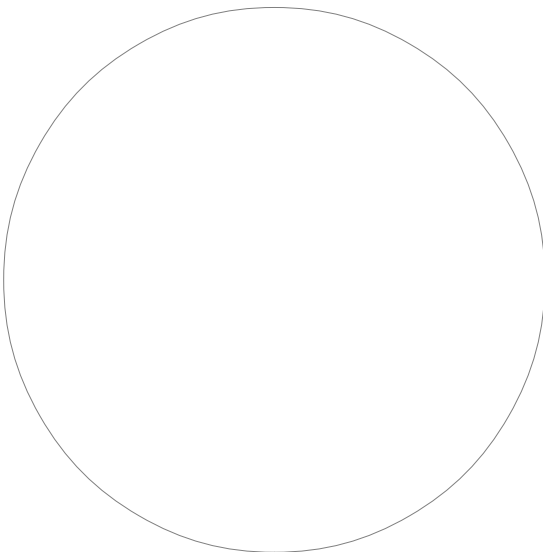   **...and the computer does this**

and / or

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

1. Two is less than five, _and_ zero is equal to six.

2. Two is less than four _or_ four is equal to six.

Design Recipe

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.

I.   Contract+Purpose Statement

Every contract has three parts:

; _____ : _____ -> _____
      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

III.   Definition

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

(define (_____ _____)
            function name   variable names

     _____)
                      …and the computer does this

Lesson 7

Design Recipe

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.

I.   Contract+Purpose Statement

; _____ : _____ -> _____
      name   Domain   Range

II.   Give Examples

On the computer, write an example of your function for each topping, using EXAMPLE.

(EXAMPLE (cost_____ "pepperoni") _____)
                 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?

III.   Definition

(define (_____   _____)
          function name   variable names

  _____

)

Design Recipe

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.　Contract+Purpose Statement

; _____ : _____ -> _____
　　　name　　　　　　　　　　　　Domain　　　　　　　　　　Range

II.　Give Examples

Finish the two examples we've started for you, and make two more

(EXAMPLE (<u>update-player　　128　　"up"</u>) _____)
　　　　　　Use the function here　　　　　　What should the function produce?

(EXAMPLE (<u>update-player　　451　"down"</u>) _____)
　　　　　　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.　Definition

(define (_____　_____)
　　　　　function name　　　　　variable names

_____

)

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.   Contract+Purpose Statement

Every contract has three parts:

; _____ : _____ -> _____
    name   Domain   Range

II.   Give Examples

(EXAMPLE   <u>(line-length   10   5   )</u>   <u>(-   10   5)   )</u>
                    Use the function here   What should the function produce?

(EXAMPLE   <u>(line-length   2   8   )</u>   <u>(-   8   2)   )</u>
                    Use the function here   What should the function produce?

III.   Definition

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

(define (_____   _____)
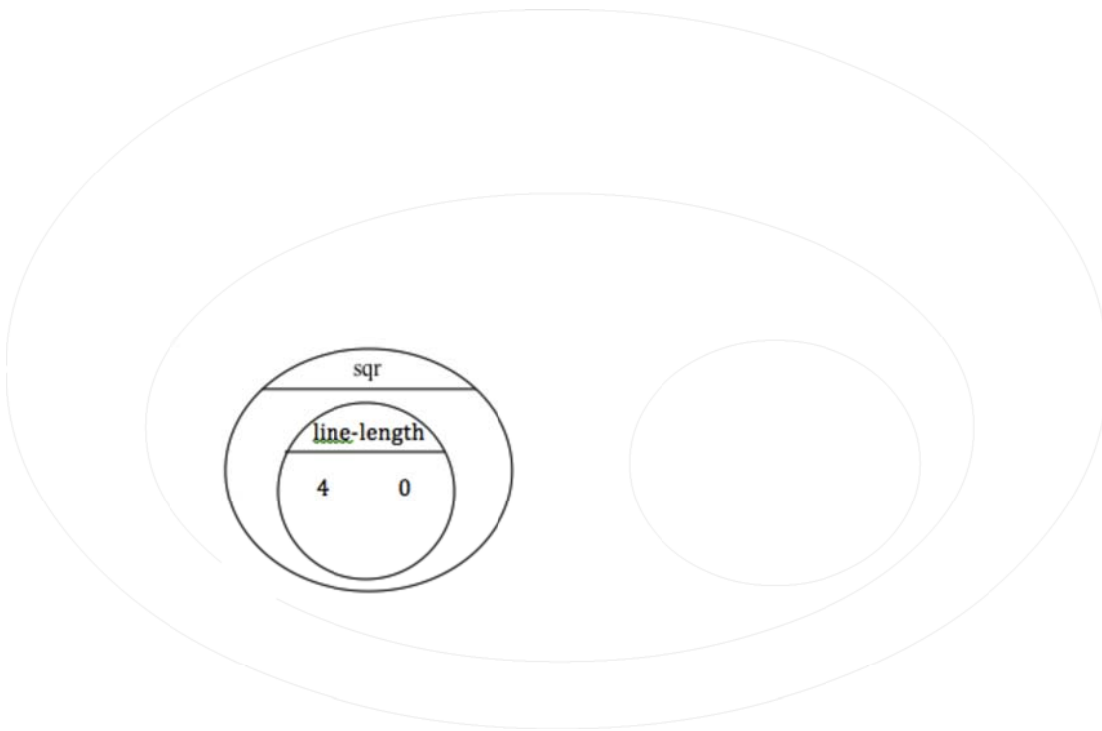   function name   variable names

    _____

)

...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+Purpose Statement

; _____ : _____ -> _____
        name   Domain   Range

; _____
                                          What does the function do?

II.   Give Examples

(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

III.   Definition

(define (_____   _____)
                   function name   variable names

                  _____)

WORD PROBLEM: COLLIDE?

Write a function <u>collide?</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 `true` if the coordinates of the player are within 50 **pixels** of the coordinates of the other character. Otherwise, `false`.

I. Contract+Purpose Statement

; _____ : _____ -> _____
name   Domain   Range

; _____
What does the function do?

II. Give Examples

(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

III. Definition

(define (_____ _____)
                 function name   variable names
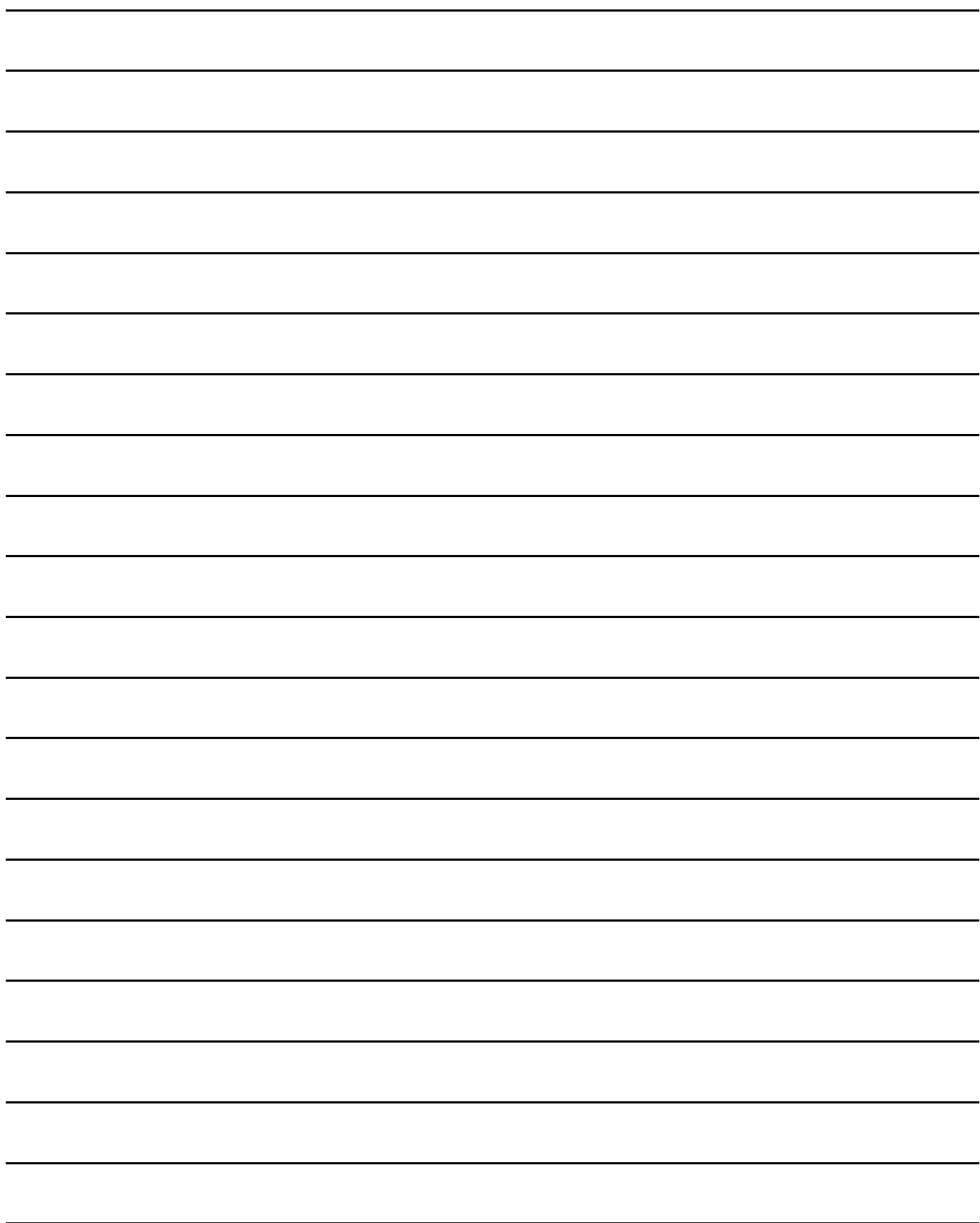
_____)

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!

Design Recipe

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.   Contract+Purpose Statement

; _____ : _____ -> _____
      name   Domain   Range

II.   Give Examples

Write some examples of red-shape below. The first one has already been done for you.

(EXAMPLE <u>(red-shape   "circle"   )</u>   <u>(circle 50 "solid" "red"))</u>
                    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?

III.   Definition

(define (_____   _____)
             function name   variable names
     (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.

_____ = _____