Contracts

| Name | Domain | Range | example |
|------|--------|----------|---------|
| •• | • | ↑ | |
| : | : | ↑ | |
| •• | • | ↑ | |
| •• | | ↑ | |
| • | • | ^ | |
| •• | • | ^ | |
| •• | : | ↑ | |
| •• | | ↑ | |
| •• | • | ↑ | |
| • | • | ↑ | |
| •• | | ↑ | |
| •• | : | ↑ | |
| ; | | ^ | |
| •• | • | ↑ | |
| • | | + | |
| •• | : | ↑ | |
| • | • | ↑ | |

Contracts

| example | | | | | | | | | | | | | | | | | |
|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Range | 1 | 1 | 1 | 1 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | 1 | ↑ | ↑ | ↑ | ↑ | ↑ | 1 |
| Domain | | | | • | • | • | • | : | • | • | | : | • | • | • | • | <u></u> |
| Name | •• | •• | •• | •• | •• | •• | •• | •• | •• | •• | •• | • | •• | •• | •• | : | •• |

Reverse-Engineering: How does NinjaCat work?

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

Finding Coordinates



| The coordinates for the PLAYER (NinjaCat) are: | (| , |) |
|--|-----|----------------|----------|
| | X-C | oordinate y-co | ordinate |
| 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 Time: 5 minutes Don't forget to use the computer's symbols for things like multiply and divide!

| Math | Circle of Evaluation | Racket Code |
|------------------------|----------------------|-------------|
| | | |
| | | |
| | | |
| 5 x 10 | | |
| | | |
| | | |
| | | |
| | | |
| 8 + (5 x 10) | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| (8 + 2) - (5 x 10) | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| <u>5 x 10</u> 8 - 2 | | |
| 0 - 2 | | |
| | | |
| | | |
| | | |

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

| C | ircles Com | npetition | Time: 5 minutes |
|-------------|-------------------|-------------------------------|-----------------------|
| | Math | Round 1 -Circle of Evaluation | Round 2 - Racket Code |
| Challenge A | (3 * 7) - (1 + 2) | | |
| Challenge B | 3 - (1 + 2) | | |
| Challenge C | 3 - (1 + (5 * 6)) | | |
| Challenge D | (1 + (5 * 6)) - 3 | | |

| | Fast Funct | ions | |
|------------|------------|-------|---|
| ;: | | > | _ |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |
| | | | |
| ; | <u>:</u> | > | |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |
| | | | |
| ; | <u>:</u> | > | |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |
| | | | |
| · | : | > | |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |

| | Fast Funct | ions | |
|------------|------------|-------|---|
| ; | | > | _ |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |
| | | | |
| ; | : | > | |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |
| | | | |
| ; | <u>:</u> | > | |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |
| | | | |
| ; | : | -> | |
| name | domain | range | |
| (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.

| | pose Statement | |
|---|---|-------|
| Every contract has th | ree parts: | |
| | | |
| • | _:> | |
| name | Domain | Range |
| • | | |
| , | What does the function do? | |
| | | |
| II. Give Example On the computer, wri | ≆S te an example of your function in action, using EXAMPLE | |
| on the compacer, with | as an example of your function in decion, asing 270 th 22 | •• |
| (EXAMPLE (| |) |
| (====================================== | the user types | / |
| | | |
| | | , |
| | which should become |) |
| | | |
| | | |
| | | |
| (EXAMPLE (| |) |
| | the user types | |
| | | |
| | | 1 |
| | which should become | / |
| III. Definition | | |
| | nition, giving variable names to all your input values. | |
| | | |
| (define (| |) |
| | tion name variable names | / |
| | | |
| | | |
| | |) |
| | and the computer does this | , |

Word Problem: red-square

Use the Design Recipe to write a function <u>red-square</u>, which takes in a number (the size of the square) and outputs a solid red rectangle whose length and width are the same size.

| Contract+Purpose State | ement | |
|--|---|-------------|
| Every contract has three parts: | | |
| | | |
| | | _ |
| ;:: | | -> |
| Name | Domain | Range |
| • | | |
| , | What does the function do? | |
| | | |
| II. Give Examples | and of very fraction in action raise EVAA | ADI E |
| On the computer, write an exam | nple of your function in action, using EXAM | MPLE |
| (EXAMPLE (| |) |
| the | e user says | |
| | | |
| | | |
| | |) |
| | Racket replies | |
| | | |
| | | |
| (EXAMPLE (| |) |
| the | e user says | / |
| | | |
| | | |
| | |) |
| | Racket turns that into | |
| III. Definition | | |
| | ing variable names to all your input val | ues. |
| | | |
| (define (| |) |
| function name | variable names | |
| | | |
| | | 1 |
| | 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. Contro | act+Purpose Stateme | ent | | |
|----------------|---------------------|--|---------------------------|---|
| Every contract | t has three parts: | | | |
| | | | | |
| • | : | | -> | |
| name | · | Domain | Range | |
| _ | | | | |
| ; | | What does the function do? | | |
| | | What does the function do: | | |
| | xamples | of your function in action using EVAA | ADI E | |
| On the compu | | of your function in action, using EXAM | WPLE. | |
| (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. Definit | ion | | | |
| | | variable names to all your input val | ues. | |
| | | | | |
| (define (| | _ |) | |
| | function name | variable names | | |
| | | | | ` |
| | and the course | utor does this | |) |
| | and the comp | uter uoes tilis | | |

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. Contra | ct+Purpose Statement | | | |
|----------------------------|---|---|----------|---|
| Every contract | has three parts: | | | |
| | | | | |
| • | • | | -> | |
| name | • | Domain | Range | - |
| • | | | | |
| , | | hat does the function do? | | - |
| | | | | |
| | camples er, write an example of | f your function in action, using EXA | AMPLE. | |
| | | | | |
| (EXAMPLE | Use the fu | nction here |) | |
| | 030 4.10 14 | | | |
| | | | | |
| - | fir | nd another way to get the same result her |) | |
| | 111 | another way to get the same result her | | |
| | | | | |
| (EXAMPLE | (| | , | |
| (LAAMPLL | Use the fu | nction here | <i>'</i> | |
| | | | | |
| | | | , | |
| - | fir | nd another way to get the same result her | <i>)</i> | |
| D | | , , | | |
| III. Definition Write the | | ariable names to all your input vo | alues. | |
| | , | , | | |
| (define (_ | | |) | |
| | function name | variable names | | |
| | | | | |
| | | | |) |
| | and the compute | er does this | | |

DESIGN RECIPE

Word Problem: update-target

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

| I. Contract | +Purpose Statement | |
|-------------------|--|-------------|
| Every contract ha | | |
| | | |
| • | • | -> |
| name | • | |
| | | 9 |
| · | | |
| | What does the function do? | |
| II. Give Exa | imples (| |
| | r, write an example of your function in action, usin | ng EXAMPLE. |
| (EXAMPLE (_ | |) |
| (2/0-4/11 22 (_ | Use the function here | / |
| | | |
| | | |
| | find another way to get the come rec |) |
| | find another way to get the same res | utt nere |
| | | |
| | | |
| (EXAMPLE (_ | Has the five-time have |) |
| | Use the function here | |
| | | |
| | |) |
| | find another way to get the same res | ult here |
| III. Definition | 1 | |
| | e definition, giving variable names to all your inp | out values. |
| | | |
| (define (| |) |
| | function name variable names | |
| | | |
| | |) |
| | and the computer does this | , |

Sam the Butterfly

Sam is in a 640 x 480 yard. How far he can go to the left and right before he's out of sight?

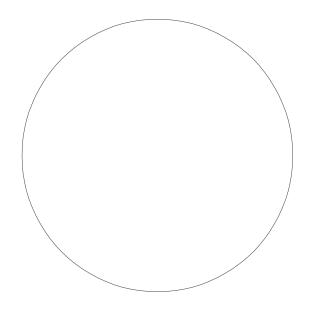
1. A piece of Sam is still visible on the left as long as...

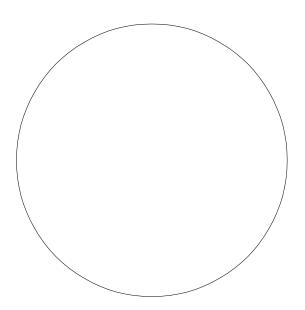
$$(> x -50)$$

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?

Use the Design Recipe to write a function <code>safe-left?</code>, 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: | |
| | | |
| • | | |
| • • | Domain | > Range |
| name | Domain | Ralige |
| • | | |
| , | What does the function do? | |
| II Cive Evamples | | |
| II. Give Examples On the computer, write or | n example of your function in action, us | sing FXAMPIF. |
| · | , | _ |
| (EXAMPLE (| |) |
| | Use the function here | |
| | | |
| | |) |
| | find another way to get the same result | here |
| | | |
| | | |
| /EVAMDLE / | | , |
| (EXAMPLE (| Use the function here |) |
| | | |
| | | |
| | |) |
| | find another way to get the same result | here |
| III. Definition | | |
| | , giving variable names to all your input | values. |
| | | |
| (define (| me variable names |) |
| function na | me variable names | |
| | | |
| | |) |
| | | |

...and the computer does this

Word Problem: safe-right?

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

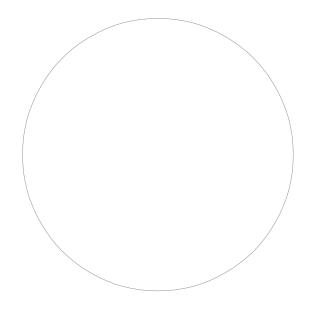
| | act+Purpose Statement | | | |
|---------------------------------------|--------------------------------------|-----------------------------|-------|---|
| | t has three parts: | | | |
| | | | | |
| • | • | | -> | |
| name | <u> </u> | Domain | Range | |
| Hame | | Domain | Nange | |
| ; | | | | |
| • | What does the fu | ınction do? | | |
| II Give I | xamples | | | |
| | ter, write an example of your functi | on in action, using EXAM | MPLE. | |
| · · · · · · · · · · · · · · · · · · · | | , - | | |
| (EXAMPLE | Use the function here | |) | |
| | ose the function here | | | |
| | | | | |
| | | |) | |
| | find another way | to get the same result here | , | |
| | | | | |
| | | | | |
| (EXAMPLE | (| |) | |
| (LXX-XXII LL | Use the function here | | / | |
| | | | | |
| | | | | |
| | find another way | |) | |
| | find another way | to get the same result here | | |
| III. Defini | | | | |
| Write | the definition, giving variable nam | es to all your input valu | ues. | |
| (| , | | • | |
| (define (| | |) | |
| | function name | variable names | | |
| | | | | , |
| | | | |) |
| | | | | |

...and the computer does this

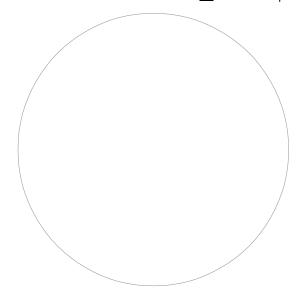
and / or

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

1. Two is less than five, <u>and</u> zero is equal to six.



2. Two is less than four <u>or</u> four is equal to six.



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 | |
| 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 | |
| | |
| | ١ |
| ; | _J |

...and the computer does this

Word Problem: cost

Luigi's Pizza has hired you as a programmer. They offer "pepperoni" (\$10.50), "cheese" (\$9.00), "chicken" (\$11.25) and "broccoli" (\$10.25). Write a function called cost which takes in the name of a topping and outputs the cost of a pizza with that topping.

| Contract+Purpose Stateme | nt | |
|---------------------------------|-----------------------------------|-----------------------------------|
| • | | -> |
| name | Domain | Range |
| l. Give Examples | | |
| On the computer, write an examp | ole of your function for <u>e</u> | each topping, using EXAMPLE. |
| (EXAMPLE (<u>cost</u> " | pepperoni''_) | What should the function produce |
| (EXAMPLE (| here | What should the function produce: |
| (EXAMPLE (|)) | What should the function produce: |
| (EXAMPLE (|) | What should the function produce: |
| II. Definition | | |
| (define (| variable r | 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. Contro | act+Purpose Statement | | | |
|--------------|---|--------------|-------------------|-----------------------------------|
| , | <u>.</u> | | Domain | > Range |
| | xamples examples we've started | for you | and make tv | vo more |
| | • | 128 | <u>"up"</u>) _ | What should the function produce? |
| (EXAMPLE | (<u>update-player</u> Use the function here | <u>451 '</u> | <u>'down"</u>) _ | What should the function produce? |
| (EXAMPLE | Use the function here | |) | What should the function produce? |
| (EXAMPLE | Use the function here | |) | What should the function produce? |
| III. Definit | | | variable na | imes) |
| | | | | |
| | | | | |

| | · | | _ |
|--|---|--|---|

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.

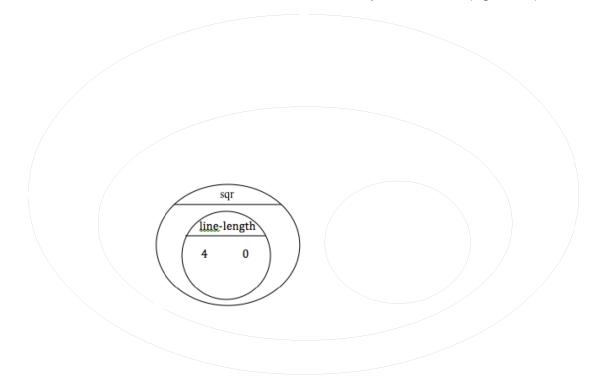
| | act+Purpose State | ment | | | | | |
|--------------------|---|-----------------|------|--------------|-----------------------------------|-----------------------|---|
| Every contrac | ct has three parts: | | | | | | |
| name | : | | | omain | > | Range | |
| II. Give | Examples | | | | | | |
| (EXAMPLE | (line-length Use the func | 10 tion here | 5 |) | (- 10 What should the fu | |) |
| (EXAMPLE | (line-length Use the func | 2 tion here | 8 |) | <u>(- 8</u> What should the fu | 2) nction produce? |) |
| III. Defini | i <mark>tion</mark> the definition, givi | ng variable | namo | s to all you | ur input valuos | | |
| (define | _ | | | · |) | | |
| | | | | | | | |
| | | | | | | | |
| _ | | | | | | | |
|) | | | | | | | |

The Distance Formula (an example)

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 to code, then label the numbers with (x1,y1) & (y1,y2):

DESIGN RECIPE

| Write a function distan | e, which takes | FOUR inp | outs: |
|-------------------------|----------------|----------|-------|
|-------------------------|----------------|----------|-------|

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

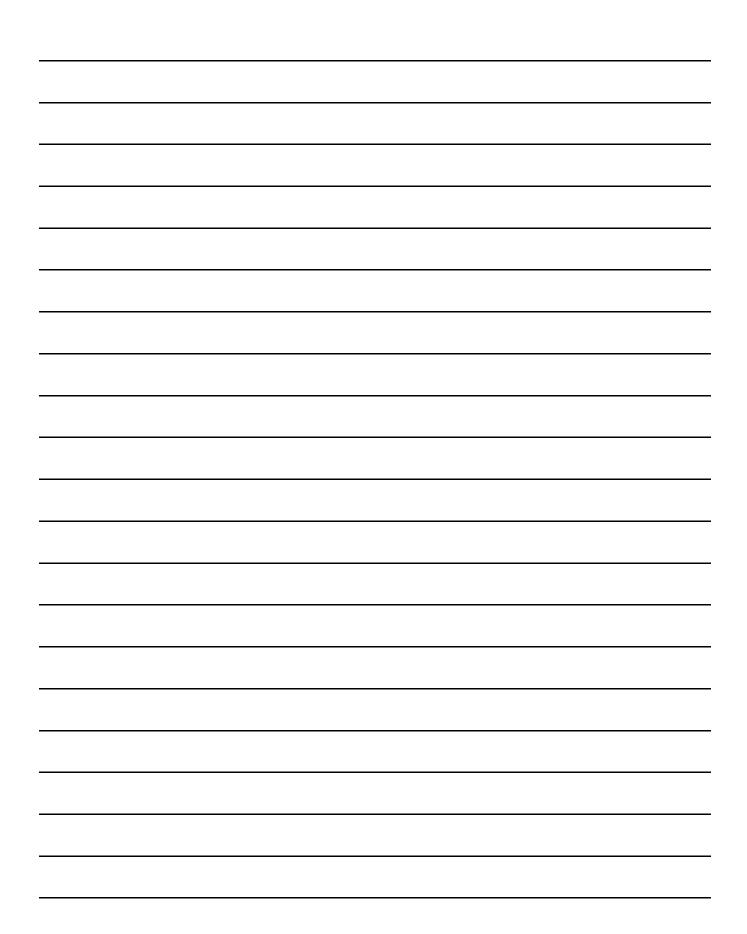
It should return the distance between the two, using the Distance formula. (HINT: look at what you did on page 27!)

| name • _ | | Domain | > Range | _ |
|-------------------|------------------|----------------------------------|------------|---|
| • | | | | |
| , | | oes the function do? | | _ |
| II. Give Examples | | | | |
| (EXAMPLE (| | |) | |
| (| Use the function | n here | , | |
| | | | | |
| | find and | other way to get the same result | t here | |
| | Tilla alla | other way to get the same result | t here | |
| /EVAMBLE / | | | ` | |
| (EXAMPLE (| Use the function | n here |) | |
| | | | | |
| | | | | |
| | find and | other way to get the same result | t here | · |
| III. Definition | | | | |
| (define (| | |) | |
| function na | ame | variable names | / | |
| | | | | |
| | | | | ` |
| | | | |) |

DESIGN RECIPE

| | px: The y py: The y cx: The y cy: The y It should coordina | a-coordinate of the a-coordinate of the a-coordinate of ano a-coordinate of ano a-cturn true if the | player ther game character ther game character coordinates of the player are within 50 paracter. Otherwise, false. | pixels of the | |
|-------------|---|---|--|----------------------|---|
| | | | | _ | |
| , | name | • | Domain | -> Range | |
| ; | | | What does the function do? | | |
| II. (EXA | Give Exc | | e function here |) | |
| | _ | | find another way to get the same result here |) | |
| (EXA | MPLE (| Use th | e function here |) | |
| | _ | | find another way to get the same result here |) | |
| III. | Definitio | n | | | |
| (def | fine (_ | function name | variable names |) |) |

| 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? Definitely! No way! 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? 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

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 • Do | omain | > Range |
| What does the f | function do? | |
| II. Give Examples Write some examples of red-shape below. The first o | one has already beer | done for you. |
| (EXAMPLE <u>(red-shape</u> "circle" Use the function here | | e 50 "solid" "red") ould the function produce? |
| (EXAMPLE (|)What sho | ould the function produce? |
| (EXAMPLE (|)What sho | ould the function produce? |
| (EXAMPLE (|)What sho | ould the function produce? |
| III. Definition | | |
| (define (| variable names |) |
| | (circle 50 | "solid" "red") |
| | | |
| | | |
| | | |
| | (circle 50 | "solid" "red") |

Translating into Algebra

Value Definitions

| 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)) | |

Function Definitions

| Racket Code | Algebra |
|--|--------------------------------------|
| <pre>(define (area length width) (* length width))</pre> | area(length, width) = length * width |
| (define (circle-area radius) (* pi (sqr radius))) | |
| (define (distance x1 y1 x2 y2) (sqrt (+ (sqr (- x1 x2)) | |

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.

| <u>D</u> : | | -> |
|----------------------------|---|-------|
| name | Domain | Range |
| | What does the function do? | |
| Give Examples | | |
| rite an example of your to | unction for <u>some sample inputs</u> | |
| D(1) = | | |
| e the function here | What should the function produce? | |
| D(2)= | | |
| e the function here | What should the function produce? | |
| D() = | | |
| e the function here | What should the function produce? | |
| = | | |
| e the function here | What should the function produce? | |
| Definition | | |
| | ariable names to all your input values. | |

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 |
| | What does the function do? | |
| Give Examples an example of your func | ction for <u>some sample inputs</u> | |
| = | | |
| ne function here | What should the function produce? | |
| = | | |
| ne function here | What should the function produce? | |
| = | | |
| ne function here | What should the function produce? | |
| = | | |
| ne function here | What should the function produce? | |
| le function here | | |
| Definition | able 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 |
| | What does the function do? | |
| Give Examples | | |
| e an example of your | function for <u>some sample inputs</u> | |
| e function here | What should the function produce? | |
| = | | |
| e function here | What should the function produce? | |
| = | | |
| e function here | What should the function produce? | _ |
| | | |
| = | | |
| = e function here | What should the function produce? | |
| | What should the function produce? | |

| • <u></u> | > | |
|---|--|-------|
| name | Domain | Range |
| | What does the function do? | |
| Give Examples | unction for <u>some sample inputs</u> | |
| = | metion for <u>some sample inputs</u> | |
| | | |
| e the function here | What should the function produce? | |
| e the function here = | What should the function produce? | |
| | What should the function produce? What should the function produce? | |
| = | | |
| = the function here | | |
| = the function here | What should the function produce? | |
| = the function here = the function here | What should the function produce? | |