Question 1: Lists are fun!

Someone wrote this procedure `list-fun`.

```
(define (list-fun x)
 (if (or (null? x) (not (list? x)))
     (list x)
     (let ((elem (car x)))
               (map (lambda (y) (cons elem (list-fun y))) x))))
```

a) What does the procedure `list-fun` return for x = a

`(list-fun 'a)` ➔ (a)

b) What does the procedure `list-fun` return for `x = '(a)`

`(list-fun '(a))` ➔ ((a a))

c) What does the procedure `list-fun` return for `x = '(a b c)`

`(list-fun '(a b c))` ➔ ((a a) (a b) (a c))

d) What is the length of the list returned for `x = '((a) (b) (c))`

`(length (list-fun '((a) (b) (c)))` ➔ 3
(list-fun '((a) (b) (c))) → (((a) (a a)) ((a) (b b)) ((a) (c c)))

e) What is the domain of `list-fun`?

Anything, lists are treated specially, but everything else is packaged into a list

Question 2: Party!

To plan an upcoming party you make an association list of ingredients that you need and their cost.

```
(define simple-grocery-L  '((cake-mix 2) (eggs 3) (soda 2)))
```

But what would be really cool is if you could figure out how much a `cake`, which is made up of `cake-mix` and `eggs`, would cost. You've made up a more complicated version of your old grocery list. It has both individual items and their costs AND composite items and their ingredients. For example:

```
(define complex-grocery-L
        '((cake cake-mix eggs)
         (strawberry-shortcake cake strawberries whipped-cream)
         (cake-mix      2)
         (eggs          3)
         (strawberries  4)
         (whipped-cream 3)
         (soda          5)
         (salsa         3)
         (chips         4)))
```

Now you can write a procedure to calculate the total cost of your menu. For example:

```
(total-cost '(chips soda) complex-grocery-L) ➔ 9
(total-cost '(cake) complex-grocery-L) ➔ 5
(total-cost '(strawberry-shortcake) complex-grocery-L) ➔ 12
(total-cost '(strawberry-shortcake chips soda) complex-grocery-L)
➔   21
```

```
(define (total-cost menu grocery-info)
  (if (null? menu)
      0
      (let ((ingred (cdr (assoc (car menu) grocery-info))))
           (if (number? (car ingred))
               (+ (car ingred)
                  (total-cost (cdr menu) grocery-info))
               (+ (total-cost ingred grocery-info)
                  (total-cost (cdr menu) grocery-info))))))
```

NOTE: short version (above), long version that we went over during the review session (below)

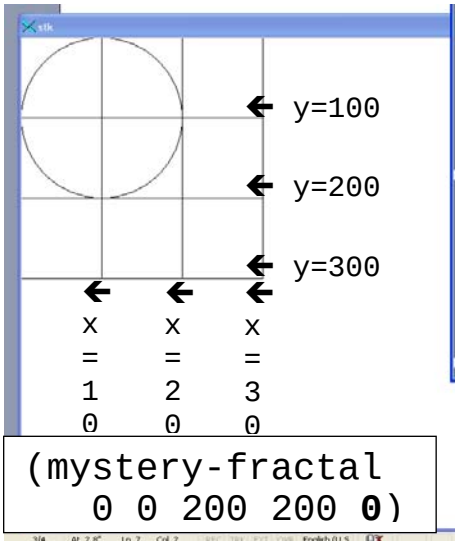
```
(define (total-cost menu grocery-info)
  (reduce + (map (lambda (food) (cost-of-item food grocery-info))
                 menu)))
(define (cost-of-item food grocery-info)
  (let ((ingred (cdr (assoc food grocery-info))))
    (if (number? (car ingred))
        (car ingred)
        (total-cost ingred grocery-info))))

;; note the last line is different from how I did it during
;; the review session, but I was essentially copying the
;; total-cost procedure.
```

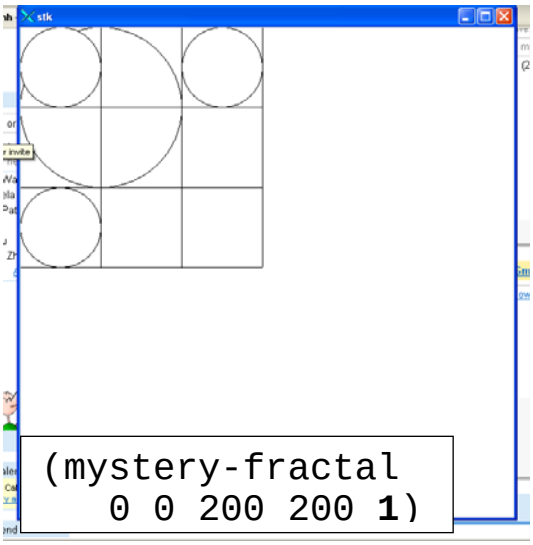
Question 3: Fractals

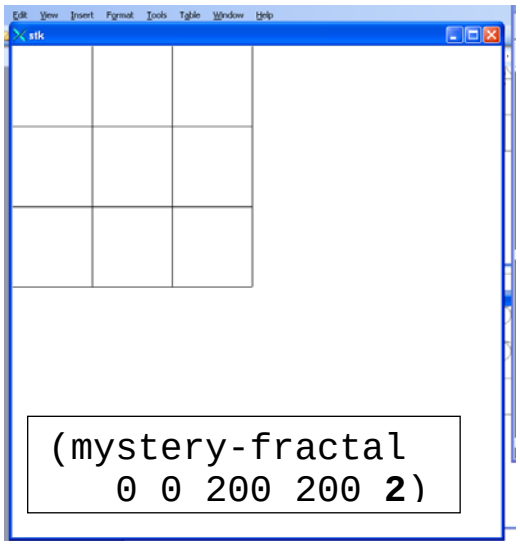
We've got a cool new fractal for you to try! It has ovals in it – so here is a helper procedure to draw ovals. The new fractal is called `mystery-fractal`. **The squares are NOT part of the fractal! They are just to show scale! The scale is the same in each image.**

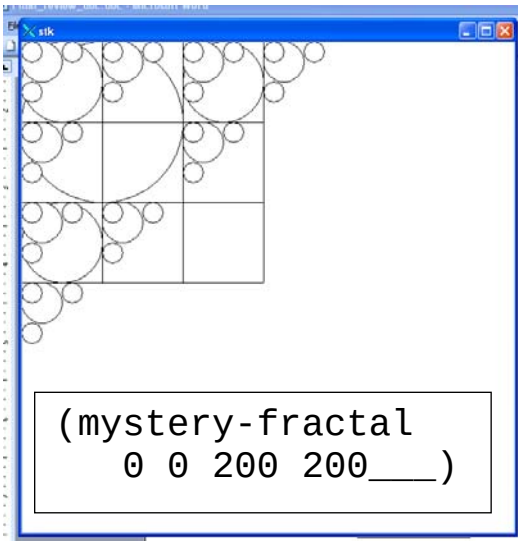
```
(define (draw-white-oval x1 y1 x2 y2)
        (draw-oval x1 y1 x2 y2 'fill 'white))
```

a) Draw the picture for `mystery-fractal` for `n=2`.
b) Fill in the blank for `n` in the 4th picture









Complete the implementation

```
(define (mystery-fractal x1 y1 x2 y2 n)
     (if (< n 0)
           'done
           (let ((xmid (/ (+ x1 x2) 2))
                 (ymid (/ (+ y1 y2) 2))
```

```
    (xplus (+ x2 (/ (- x2 x1) 2)))
    (yplus (+ y2 (/ (- y2 y1) 2))))
```

```
        (draw-white-oval x1 y1 x2 y2)
        (mystery-fractal x1 y1 xmid ymid (- n 1))
        (mystery-fractal x2 y1 xplus ymid (- n 1))
        (mystery-fractal x1 y2 xmid yplus (- n 1))
```

)))