



## Multiple choice exercises

### Exercise 1

What will be the output of the `print` statement?

```
C = 22
F = 9*C/5 + 32
print F
```

- 71.6
- 32
- 68
- 71

### Exercise 2

For which values of `q` (a `float` or `int`) is the following boolean expression `True`?

```
q < -2 and q > 2
```

- All values in `[-2,2]`
- None
- All finite values that can be represented on the computer
- All values in `[0,∞)`

### Exercise 3

Pick the construction that generates the same list `values` as the program below:

```
values = []
value = 0.5
end_value = 1
while value <= end_value:
    values.append(value)
    value += 0.1
```

- `[0.1*i for i in range(10)]`
- `range(0.5, 1.05, 0.1)`
- `[0.5+i for i in range(10)]`
- `[(i+1)*0.1 for i in range(10)]`
- `[0.5+i*0.1 for i in range(6)]`

*(Continued on page 3.)*

### Exercise 4

What will be the output of the `print` statement?

```
def f(x):  
    return Q*x**p  
  
Q = 4; p = 2; x = -1; z = 1  
print '%g' % f(2*x - z)
```

- 4
- 64
- 24
- 36

### Exercise 5

What will be printed by this program?

```
n = 5  
C = []  
for i in range(n):  
    x = i**2  
    C.append(i + x)  
print C
```

- [0, 2, 6, 12, 20, 30]
- [0, 2, 6, 12, 20]
- [2, 6, 12, 20, 30]
- [2, 6, 12, 20, 30, 42]

### Exercise 6

What is the correct `numpy` syntax for allocating a one-dimensional array (or vector) with four elements?

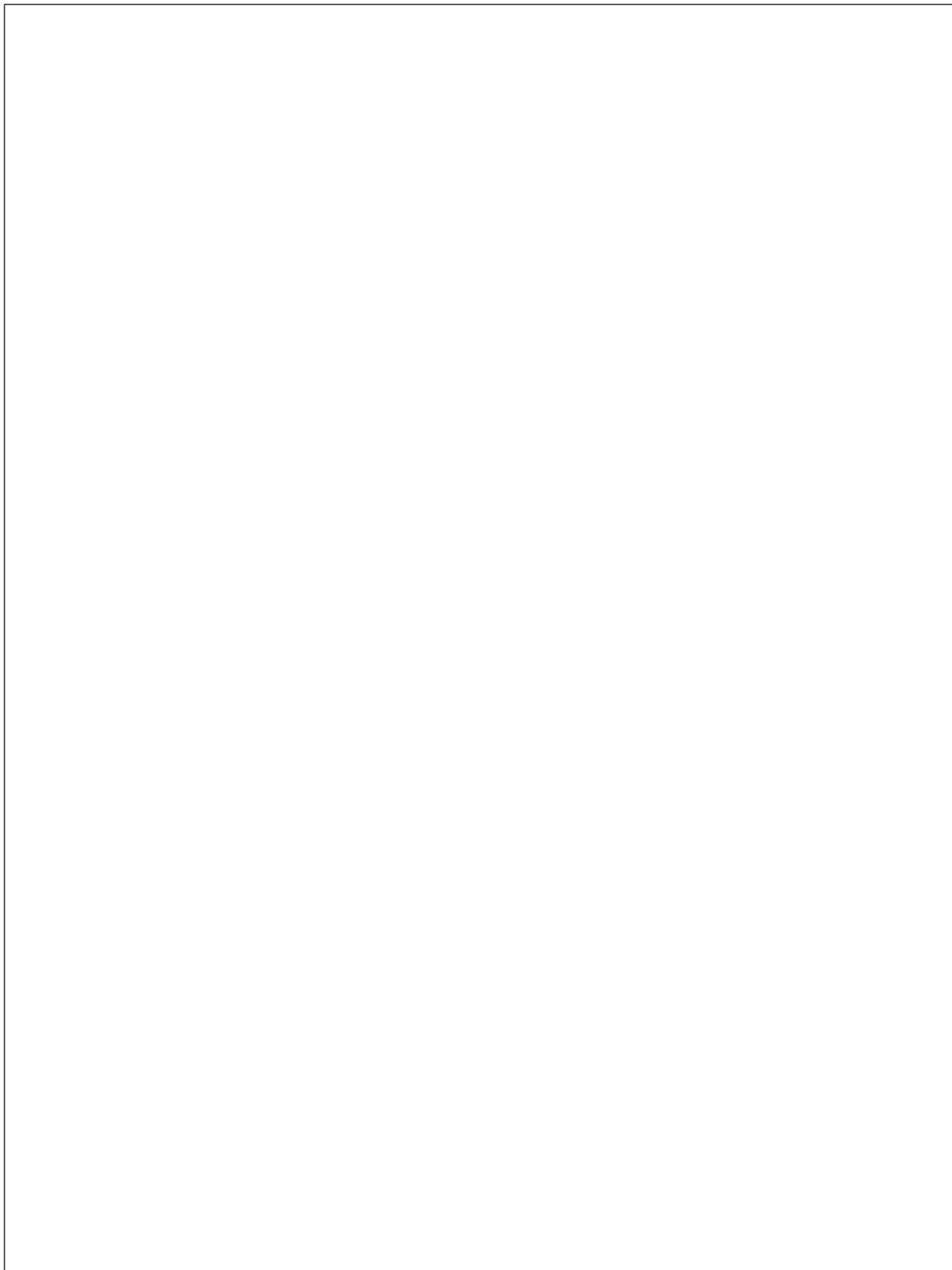
- `a = zeros(4)`
- `a = eye(4)`
- `a = array(4)`
- `a = linspace(4)`

*(Continued on page 4.)*

## Programming exercises

### Exercise 7

Make a Python function `sumk2(M,N)` for computing the sum  $\sum_{j=M}^N j^{-4}$ . Let the function return the sum. Also, exemplify how you would call the function and store its return argument.



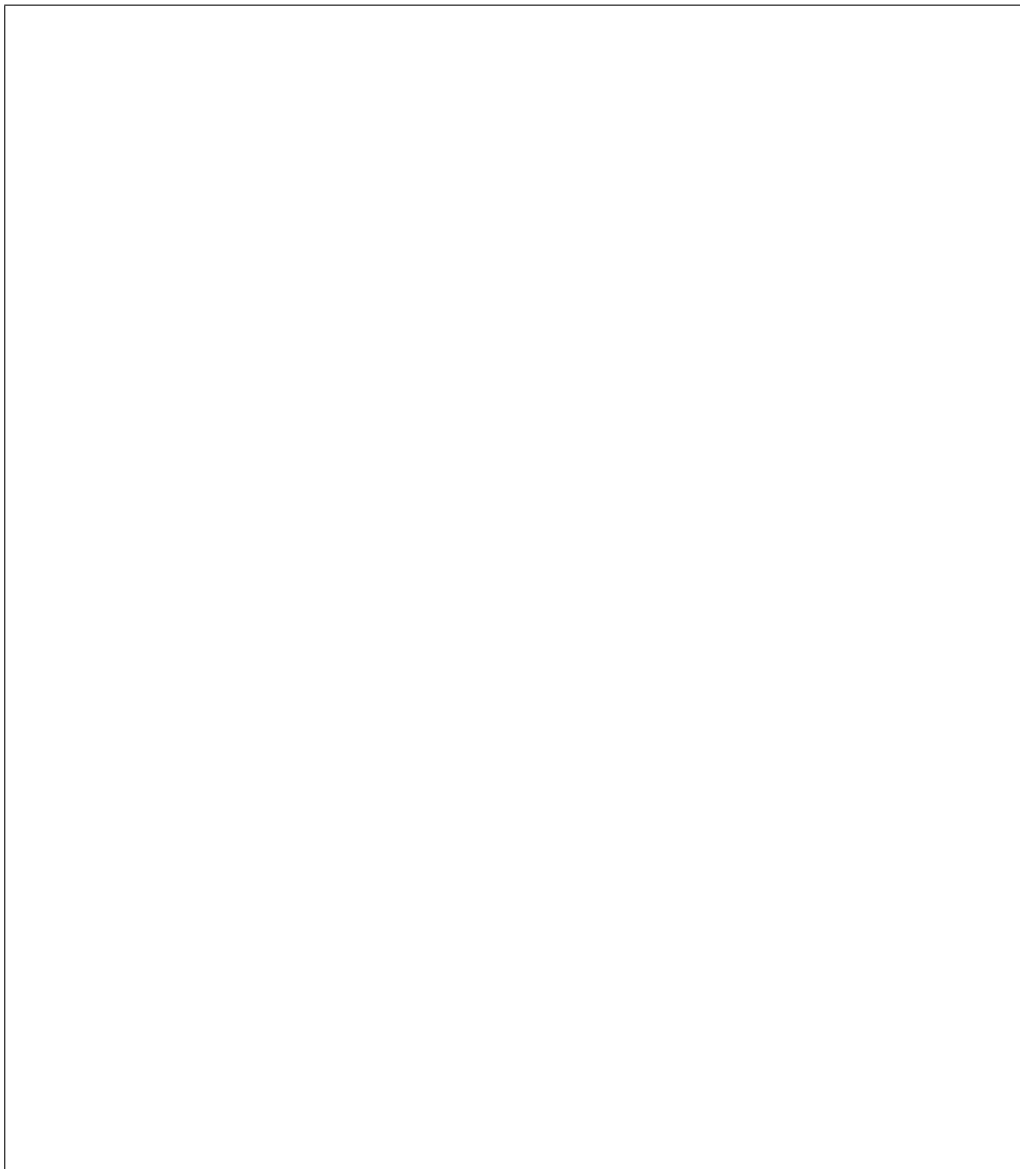
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**Exercise 8**

An arbitrary triangle can be described by the coordinates of its three vertices:  $(x_1, y_1)$ ,  $(x_2, y_2)$ ,  $(x_3, y_3)$ . The area of the triangle is given by the formula

$$A = \frac{1}{2} [x_2y_3 - x_3y_2 - x_1y_3 + x_3y_1 + x_1y_2 - x_2y_1] .$$

Write a function `area(vertices)` that returns the area of a triangle whose vertices are specified by the argument `vertices`, which is a nested list of the vertex coordinates. For example, `vertices` can be `[[0,0], [1,0], [0,2]]` if the three corners of the triangle have coordinates  $(0,0)$ ,  $(1,0)$  and  $(0,2)$ . You do not need to exemplify calling the function for this exercise.



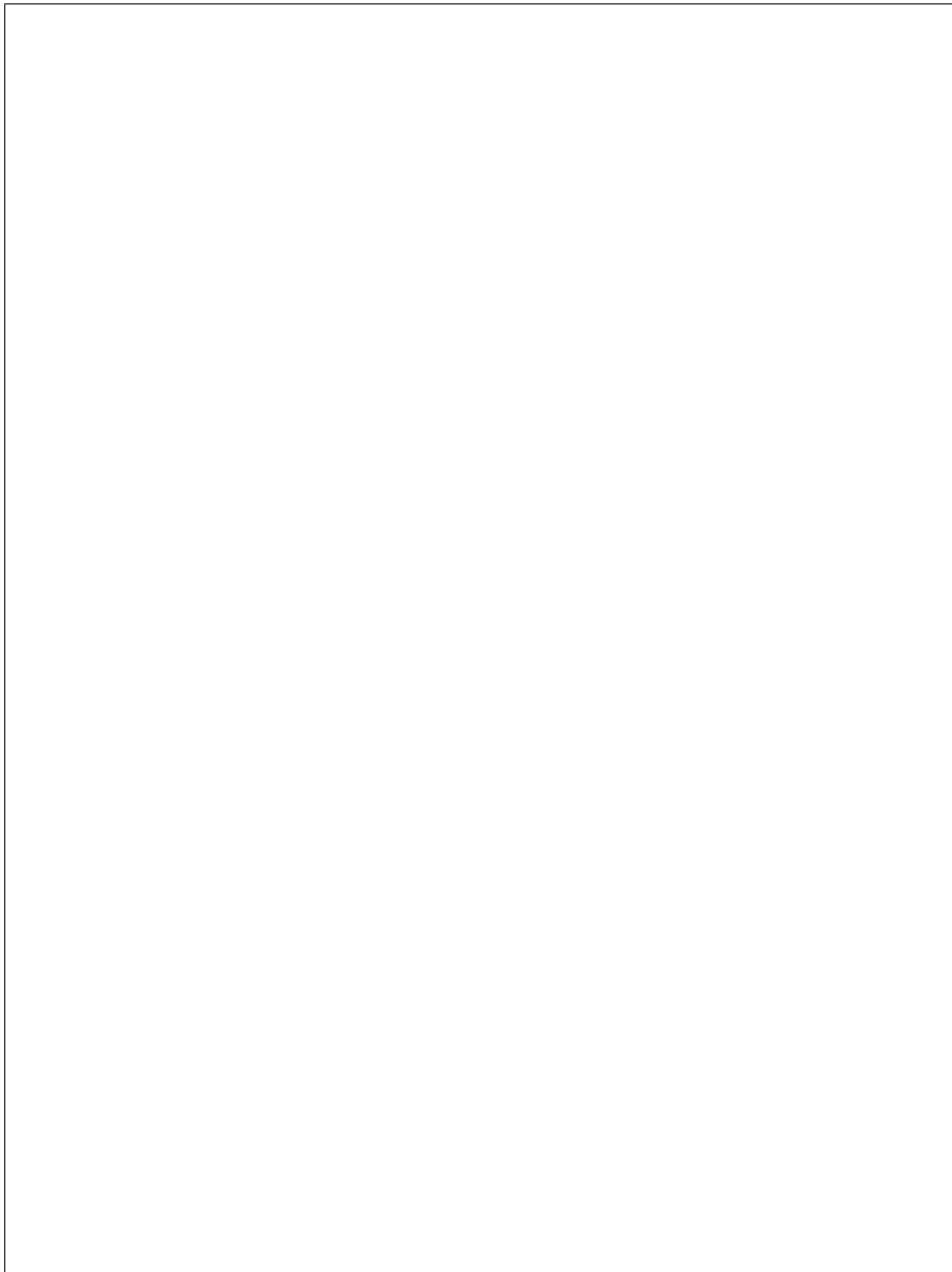
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**Exercise 9**

Make a program that can plot the expression

$$e^{-(kx-\omega t)^2} \sin(kx - \omega t)$$

as a function of  $x$  on  $[x_{\min}, x_{\max}]$  for given values of  $k$ ,  $\omega$ , and  $t$ . Let  $k$ ,  $\omega$ ,  $t$ ,  $x_{\min}$ ,  $x_{\max}$ , and the number of  $x$  points in the plot be read from the command line. Notify the user of the program and exit in a proper way if there are not enough command-line arguments.



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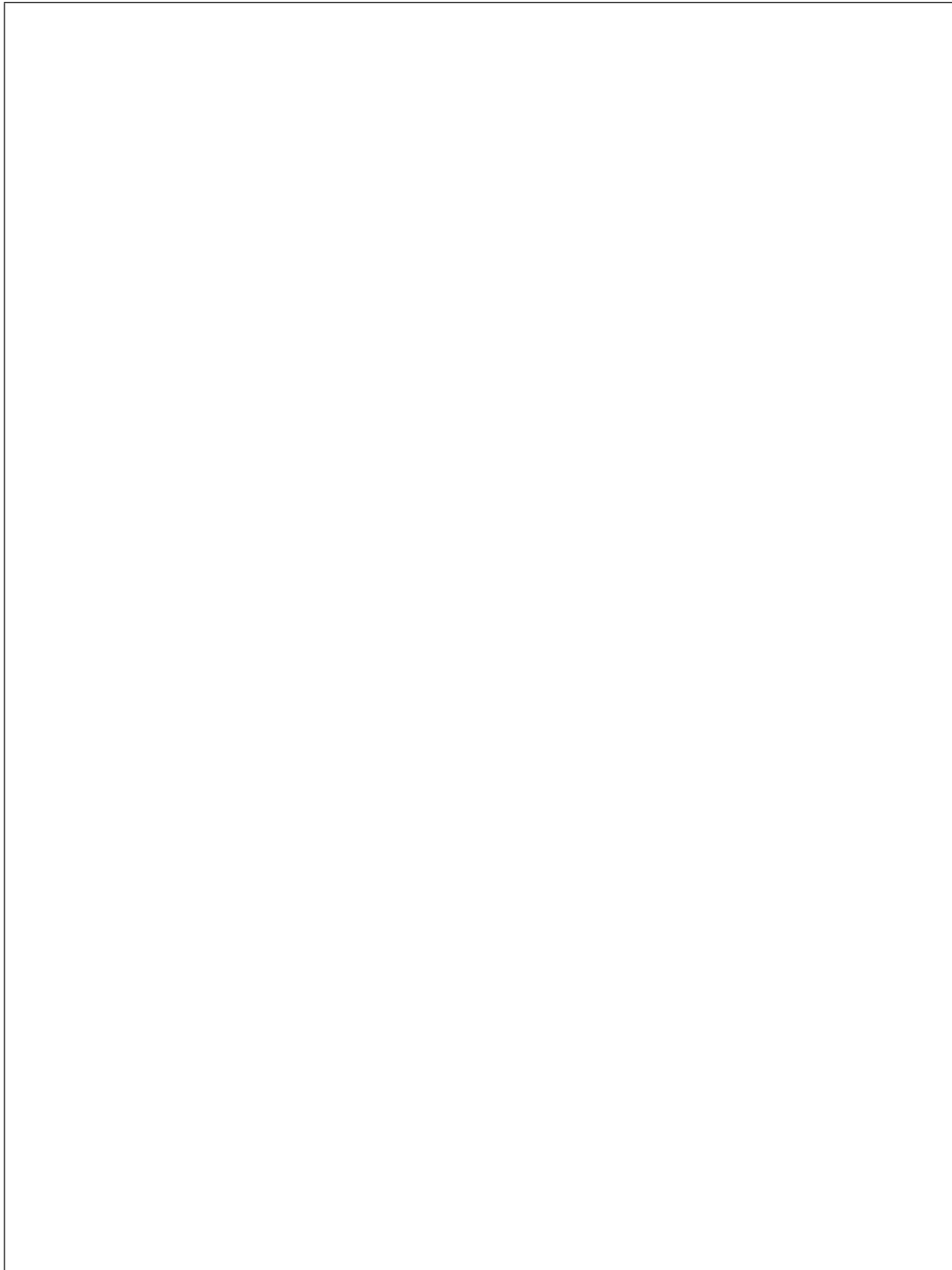
**Exercise 10**

Make a function for solving the system of difference equations

$$s_j = s_{j-1} + a_{j-1}, \quad (1)$$

$$a_j = -x^2 ((2j+1)2j)^{-1} a_{j-1}, \quad (2)$$

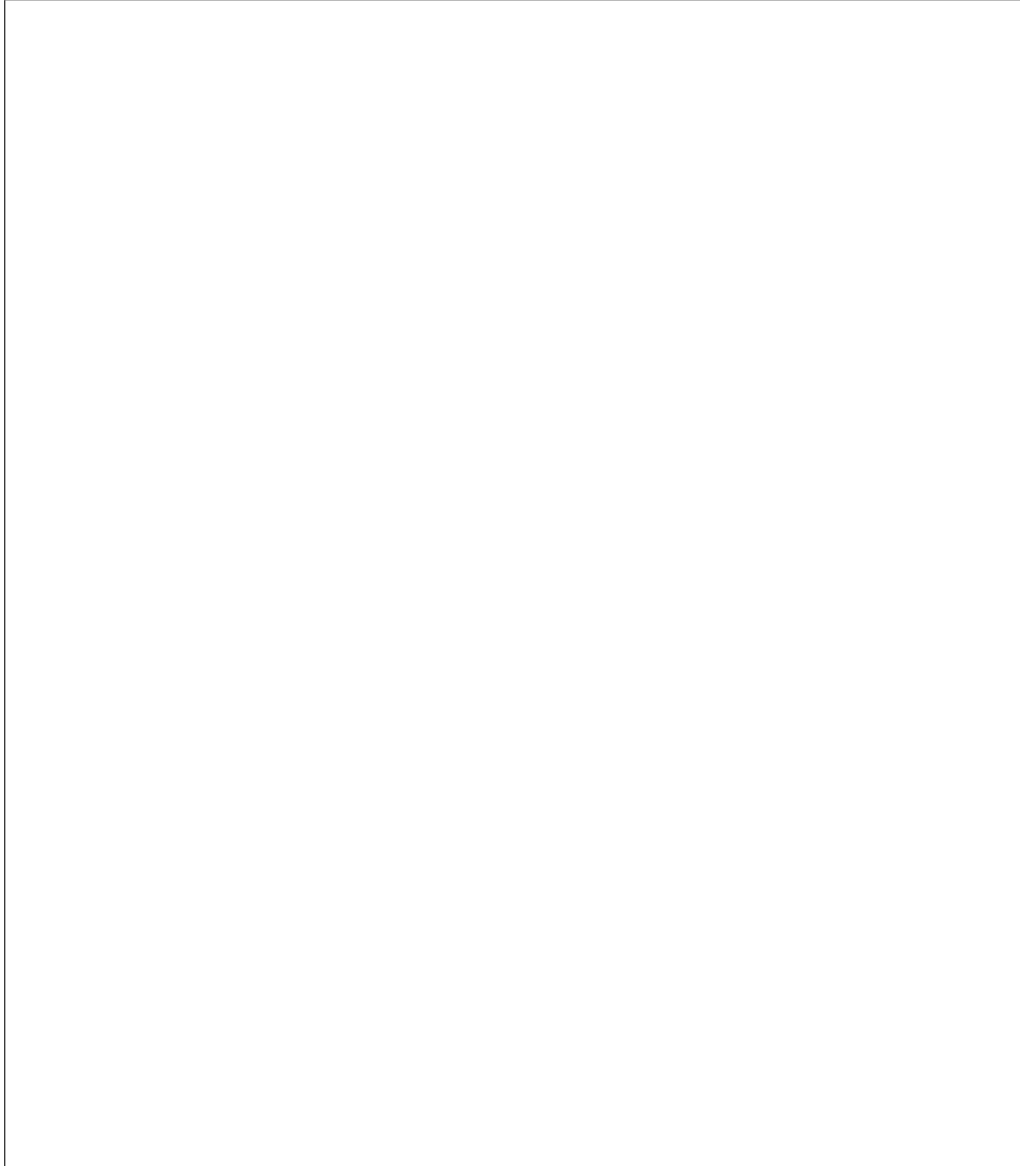
with initial conditions  $s_0 = 0$  and  $a_0 = x$ . In the program, store only the newest two  $s_j$  and  $a_j$  values (i.e., do not store all the  $s_j$  and  $a_j$  values in arrays). The function should take two arguments,  $x$  and  $N$ , and return two values,  $s_N$  and  $a_N$ . Write a main program that writes out the value of  $s_{20}$  for  $x = \pi$ .



(Continued on page 8.)

### **Exercise 11**

Explain how you can test if the function developed in Exercise 10 works correctly (i.e., returns the correct result).



END