

**The Effect of a Drug on Heart Rate**

Read Section 8.1 of the text. You will notice a similar example. Then complete the following.

This table below shows the relationship between  $Q$ , the quantity of drug in a patient's body (in milligrams), and  $r$ , the patient's heart rate (in beats per minute).

*Heart rate,  $r = f(Q)$ ,  
as a function of drug level,  $Q$*

$Q$	$r$
0	60
50	85
100	110
150	135
200	160
250	185

Suppose the patient is given a 200 mg. injection of the drug. Over time, the level of drug in the patient's bloodstream falls. The following table gives the drug level,  $Q$ , (mg) as a function of time,  $t$  (hours).

*Drug level,  $Q = g(t)$ , (milligrams)  
as a function of time,  $t$ , (hours)  
since the medication was given*

$t$	$Q$
0	200
1	150
2	112
3	84
4	64

The third table relates the heart rate,  $r$ , as a function of time,  $t$ , in hours since the last dose was given. (The previous two tables are shown again.)

$g$

$t$	$Q$
0	200
1	150
2	112
3	84
4	64

$f$

$Q$	$r$
0	60
50	85
100	110
150	135
200	160
250	185

*Heart rate,  $r = h(t)$ ,  
as a function of time,  $t$*

$t$	$r$
0	160
1	

- (1) 1. How do you know the first entry in the table for  $h$  is 160?
- (1) 2. Use the table representations for  $g$  and  $f$  to complete the **second** entry in the table for  $h$ .
- (1) 3. Using function notation, we can write the result of Question 1 as  $h(0) = f(g(0)) = 160$ .  
Use function notation to write a similar result which follows from Question 2:

$$h(\underline{\quad}) = f(g(\underline{\quad})) = \underline{\quad}$$

- (1) Interpret your function notation in **practical** terms (referring to the patient's heart rate, medication, etc.)

(3) 4. Suppose more data for table  $f$  is given. Complete the remaining entries in the table for  $h$ .

$g$

$t$	$Q$
0	200
1	150
2	112
3	84
4	64

$f$

$Q$	$r$
0	60
50	85
52	86
54	87
56	88
58	89
60	90
62	91
64	92
66	93
68	94
70	95
72	96
74	97
76	98
78	99
80	100
82	101
84	102
86	103
88	104
90	105
92	106
94	107
96	108
98	109
100	110
102	111
104	112
106	113
108	114
110	115
112	116
114	117
116	118
118	119
120	120

$h$

$t$	$r$
0	160
1	
2	
3	
4	

(3) 5. Is  $f$  linear or exponential? \_\_\_\_\_

What about  $g$ ? \_\_\_\_\_

Construct formulas for  $f$ ,  $g$  and complete the blanks.  $r = f(Q) =$  \_\_\_\_\_

Show work on the back of this page.  $Q = g(t) =$  \_\_\_\_\_

Use the table feature of a graphing calculator to check that your formulas match your work above.

(2) BONUS (+2): Give a formula for the function  $h$ .  $r = h(t) =$  \_\_\_\_\_

Again, check your work with a grapher.