Supplemental Solutions for the Functions, Derivatives, and Antiderivatives Lab

Exercise 4.1

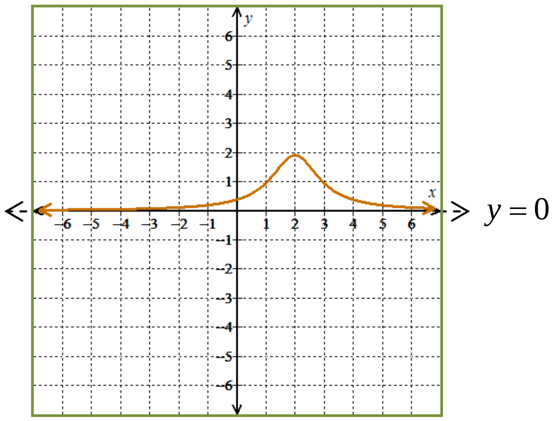

Figure E4.1bK

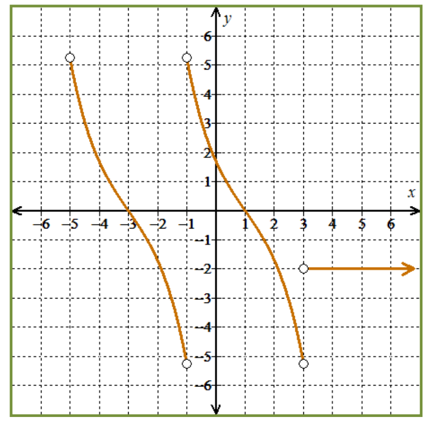

Figure E4.2bK

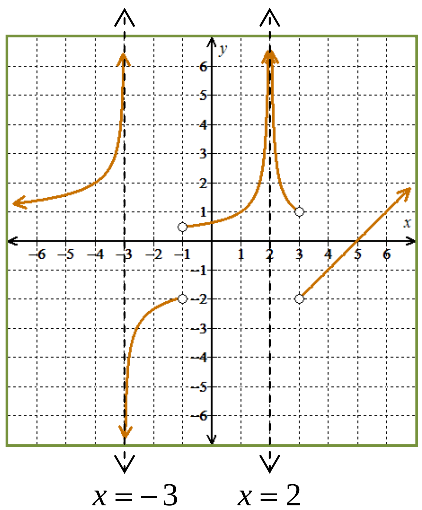

Figure E4.3bK

Exercise 4.2

E4.2.1	C, D, E	**E4.2.2**	B. D
E4.2.3	A, C	**E4.2.4**	C, D, E
E4.2.5	C, D, E	**E4.2.6**	E, F, G
E4.2.7	G	**E4.2.8**	E, F, G
E4.2.9	A, C, E, F, G	**E4.2.10**	E, F, G

Exercise 4.3

Initial observations … The average drainage rate is 60 gal/min which is equivalent to 1 gal/s. Initially the tank drains faster than this rate and towards the end of the drainage the tank is draining slower than this rate.

E4.3.1 The unit for $V'(45)$ is gal/s and the unit for $V''(45)$ is $\dfrac{\text{gal}/\text{s}}{\text{s}}$.

Since the amount of water left in the tank is decreasing, the value of $V'(45)$ cannot be positive. Since 45 seconds is early in the drainage process the drainage rate is almost certainly greater than the average rate of 1 gal/s. Hence the most realistic value for $V'(45)$ is -1.2.

E4.3.2 The unit for $R'(45)$ is $\dfrac{\text{gal}/\text{s}}{\text{s}}$ and the unit for $R''(45)$ is $\dfrac{\text{gal}/\text{s}}{\text{s}} \Big/ \text{s}$.

Since the flow rate decreases over time, the value of $R'(45)$ cannot be positive. Since the average flow rate over the 360 seconds is 1 gal/s, it is not believable that 45 seconds into the process the flow rate was decreasing at a rate 1 gal/s/s. Hence the most realistic value for $R'(45)$ is -0.001.

E4.3.3 This question is similar to question E4.5.2 with one key difference; because V is defined as the amount of water *left* in the tank, V' has negative values. Since the value of V' is getting closer to zero, V' is increasing and, consequently, V'' cannot be negative. So the most realistic value for $V''(45)$ is 0.001.

Exercise 4.4

The answer to each question is ii.

Exercise 4.5

E4.5.1 Lisa is right. Maybe g is discontinuous at -3, but maybe it simply is pointy at -4.

E4.5.2 Janice is right although Lisa is pretty darn close to being right. The graph of g'' is ***basically*** the line $y = 0$, but because g' is nondifferentiable at -3, g'' has a hole at -4.

Exercise 4.6

E4.6.1 False: $f'(t) < 0$ on $(2,3) \Rightarrow f$ decreasing on that interval

E4.6.2 True: f concave up on $(2,3) \Rightarrow f'$ increasing on that interval

E4.6.3 False: $f'(1) < 0$ while $f''(1) \geq 0$

E4.6.4 False: $f'(6) \approx -1.7$, so the tangent line to f at 6 is a decreasing line.

E4.6.5 False: f'' is periodic; it would be increasing over each period, however (e.g. $(0,4), (4,8), \ldots$

E4.6.6 False: $f'(4) \approx 4.2$; if f were nondifferentiable at 4 then f' would have no value at 4.

E4.6.7 True

E4.6.8 True

E4.6.9 False: Although the "shape" if the antiderivatives is periodic, the antiderivatives clearly end up higher then they started after each interval of length 4.

E4.6.10 False: The amount of air in your lungs was increasing the entire two seconds.

E4.6.11 True

E4.6.12 True: Negative velocity corresponds to downward motion (because the "position" is decreasing when the velocity is negative).

Exercise 4.7

Table E4.1K

f''	f'	f	F
		Positive	Increasing
		Negative	Decreasing
		Constantly Zero	Constant
	Positive	Increasing	Concave Up
	Negative	Decreasing	Concave Down
	Constantly Zero	Constant	Linear
Positive	Increasing	Concave Up	
Negative	Decreasing	Concave Down	
Constantly Zero	Constant	Linear	

Exercise 4.8

E4.8.1 -1, 1, and 4

E4.8.2 nowhere

E4.8.3 $(-5,6)$

E4.8.4 $(-6,-3)$ and $(-1,1)$

E4.8.5 $(4,6)$

E4.8.6 $(-3,-1)$, $(1,4)$, and $(4,6)$

E4.8.7 $(-6,-5)$

E4.8.8 there's no way to tell

E4.8.9 -5

E4.8.10 $y=-4x+2$

Exercise 4.9

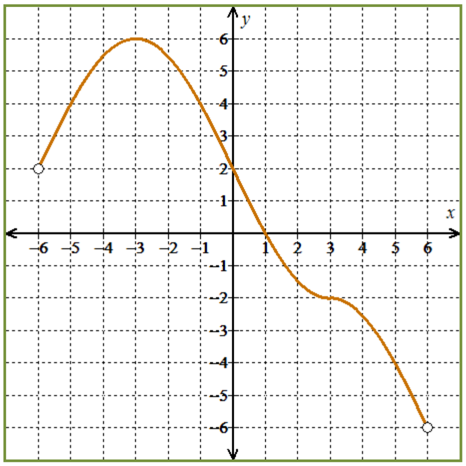

Figure E4.6bK: F

Exercise 4.10

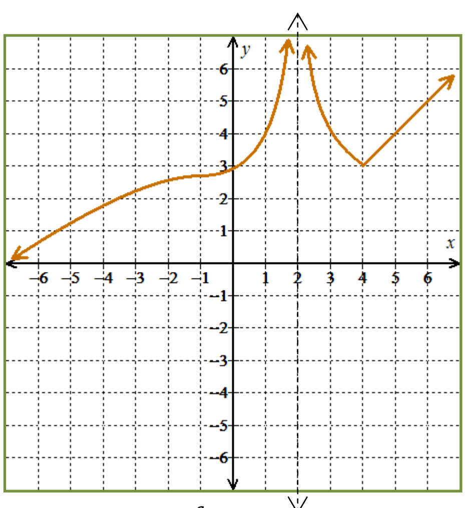

Figure E4.7K f