

Name:

Homework 4 solutions

Math 151, Applied Calculus, Spring 2018

Section 2.1 – 1,4,5,6,9,11,12,18,30

1. Recall that $f(x)$ gives the y -coordinate of a point while $f'(x)$ gives the slope of the function at the point.
4. C and D
5. A and B
6. A and D
9. (a) $f'(1950)$ is negative (b) $f'(1960)$ is more negative than $f'(1980)$.
11. (a) 2.5 ft/sec (b) 6.5 ft/sec (c) 4.5 ft/sec.
12. a(i) 8.4m/sec a(ii) 8.04m/sec a(iii) 8.004 m/sec. (b) 8m/sec
18. Using the interval $x = 1$ to $x = 1.01$: $g'(1) \approx 5.583$ and using $x = 1$ to $x = 11.001$: $g'(1) \approx 5.549$.
30. (a) $f(7) = 3$.
(b) $f'(7) = 4$

Section 2.2 – 9,10,12,18-21

9. (a) x_3 , (b) x_4 , (c) x_5 (d) x_3

x	0	5	10	15	20
$f'(x)$	-6	-3	-1.8	-1.2	-1.2

- 10.
12. $f'(x)$ should be a constant function.
18. VIII
19. IV
20. II
21. VI

Section 2.3 – 7,8,10,15,16,17,22,28,30,31,57,58

7. (a) The units of 0.073 are million square kilometers per day
(a) (b).] $\Delta F = (0.073 \cdot 5) = 0.365$ million km^2 .
8. (a) The 12 represents the weight of the chemical; therefore, its units are pounds. The 5 represents the cost of the chemical; therefore, its units are dollars. The statement $f(12) = 5$ means that when the weight of the chemical is 12 pounds, the cost is 5 dollars.

- (b) We expect the derivative to be positive since we expect the cost of the chemical to increase when the weight bought increases.
- (c) Again, 12 is the weight of the chemical in pounds. The units of the 0.4 are dollars/pound since it is the rate of change of the cost as a function of the weight of the chemical bought. The statement $f'(12) = 0.4$ means that the cost is increasing at a rate of 0.4 dollars per pound when the weight is 12 pounds, or that an additional pound will cost about an extra 40 cents.
10. (a) The turbine generates the most power when the wind speed is 10 meters per second. Maximum power is approximately 54,000 watts.
- (b) Since $p'(7)$ is positive, the function is increasing, the turbine generates more power from faster winds.
- (c) The statement $p(7) = 17,500$ means that the turbine generates 17,500 watts when the wind is blowing at a speed of 7 meters per second. The statement $p'(7) = 8000$ means that when the wind speed is around 7 meters per second, a 1 msec increase in wind speed corresponds to about an 8000 watt increase in power.
- (a) The statement $p(15) = 50,000$ means that the turbine generates 50,000 watts when the wind is blowing at a speed of 15 meters per second. The statement $p'(15) = -800$ means that when the wind speed is around 15 meters per second, a 1 msec increase in wind speed corresponds to about an 800 watt decrease in power.
15. $f'(4.3) \approx 55$
16. (a) The units of $S'(t)$ are acre-feet per week (b) For $S'(t) > 0$ to occur, the amount of water in the reservoir has to increase. This can happen if more water flows into the reservoir than flows out of the reservoir, for example after a recent storm or if the water agency reduces the water outflow to let the reservoir fill
17. (a) The yam is colling off so T is decreasing and $f'(t)$ is negative. (b) F/min
22. (a). The derivative $f'(t)$ appears to be negative for most of the period 2011–2015, because according to the table, gold production is decreasing. There appears to have been a recovery during 2008–2009 because production has increased so $f'(t)$ appears to be positive during this period.
- (b). The derivative (or rate of change) appears to be greatest between 2013 and 2014
- (c). $f'(2015) \approx 10$ metric tons/year.
- (d). 3010, 3050.
- 28 (a). Since $f'(c)$ is negative, the function $P = f(c)$ is decreasing: on average, pelican eggshells are thinner if the PCB concentration, c , in the eggshell is higher
- (b). The statement $f(200) = 0.28$ means that the thickness of pelican eggshells is 0.28 mm when the concentration of PCBs in the eggshell is 200 parts per million (ppm). The statement $f'(200) = -0.0005$ means that when the PCB concentration is 200 ppm, a 1 ppm increase in the concentration typically corresponds to about a 0.0005 mm decrease in eggshell thickness
30. 65, 71, 53
31. 5.14
57. (a). The company hopes that increased advertising always brings in more customers instead of turning them away. Therefore, it hopes $f'(a)$ is always positive.

- (b). If $f'(100,000) = 2$, it means that if the advertising budget is \$100,000, an extra dollar spent on advertising will bring in about \$2 worth of sales. If $f'(100,000) = 0.5$, an extra dollar above \$100 thousand spent on advertising will bring in about \$0.50 worth of sales.
- (c). If $f'(100,000) = 2$, then as we saw in part (b), spending slightly more than \$100,000 will increase revenue by an amount greater than the additional expense, and thus more should be spent on advertising. If $f'(100) = 0.5$, then the increase in revenue is less than the additional expense, hence too much is being spent on advertising. The optimum amount to spend, a , is an amount that makes $f'(a) = 1$. At this point, the increases in advertising expenditures just pay for themselves. If $f'(a) < 1$, too much is being spent; if $f'(a) > 1$, more should be spent.
58. If $f'(80,000) = 2$, it means that if the budget for materials is \$80,000, another dollar spent on materials will bring in about \$2 more in revenue. If $f'(80,000) = 0.5$, another dollar spent on materials will bring in about \$0.50 more in revenue.

Section 2.5 – 1,8,11,13,14,15,17

1. 3.
8. (a). \$8,500
(b). \$4.65
(c). \$5.15
(d). $q > 17000$
(e). \$0.50
11. (a) \$2408 (b) \$2192
13. (a) 4348 (b) \$11 (c) Since marginal revenue is less than marginal cost, the company should not produce the 101th item.
14. (a). At $q = 75$, we see that the cost function is larger than the revenue function, so the company is losing money. The company needs to increase production in order to make a profit
(b). At $q = 150$, the revenue function is larger than the cost function so the company is making money. Since marginal revenue is greater than marginal cost here, the company should increase production.
(c). At $q = 225$, the revenue function is larger than the cost function so the company is making money. Since marginal revenue is less than marginal cost here, the company should decrease production.
(d). At $q = 300$, the cost function is larger than the revenue function so the company is losing money. The company needs to decrease production in order to make a profit
15. At $q = 50$, the slope of the revenue is larger than the slope of the cost. Thus, at $q = 50$, marginal revenue is greater than marginal cost and the 50th bus should be added. At $q = 90$ the slope of revenue is less than the slope of cost. Thus, at $q = 90$ the marginal revenue is less than marginal cost and the 90th bus should not be added.
17. (a) \$1850 (b) 0.4 dollars (increase production $MR > MC$) (c) -0.45 dollars (decrease production $MR < MC$)