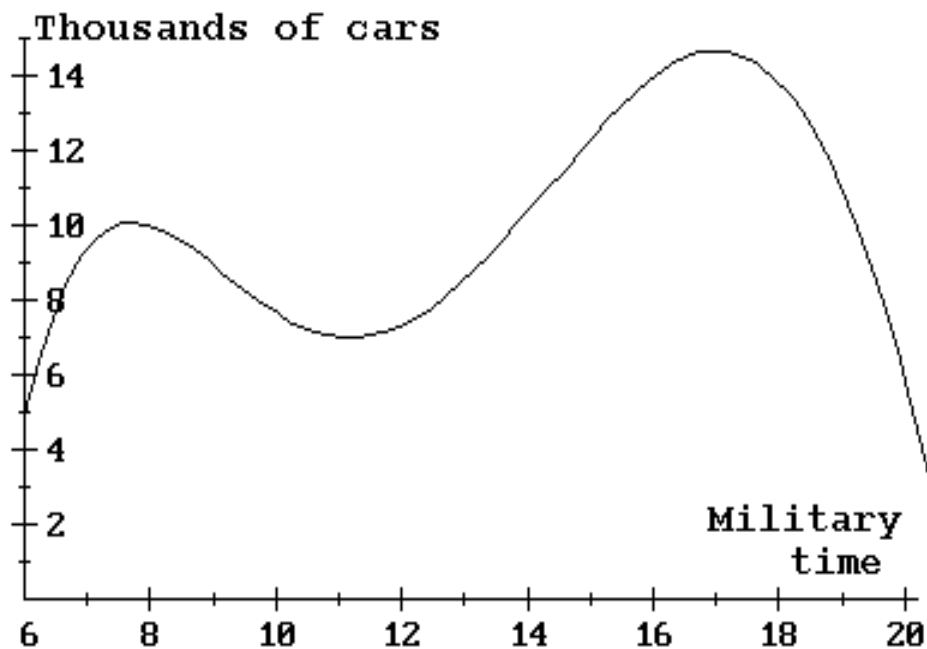


1. The following graph shows the average number of cars (in thousands) traveling on the Gridlock Expressway in Gotham City during a typical weekday from 6 am to 8 pm (the input axis is marked off in military time). For example, military time 14 corresponds to 2 pm. Suppose C is the number of cars (in thousands) on this expressway at time t (military time).



- 1a. Sketch the tangent line to the graph at the input $t = 16$.

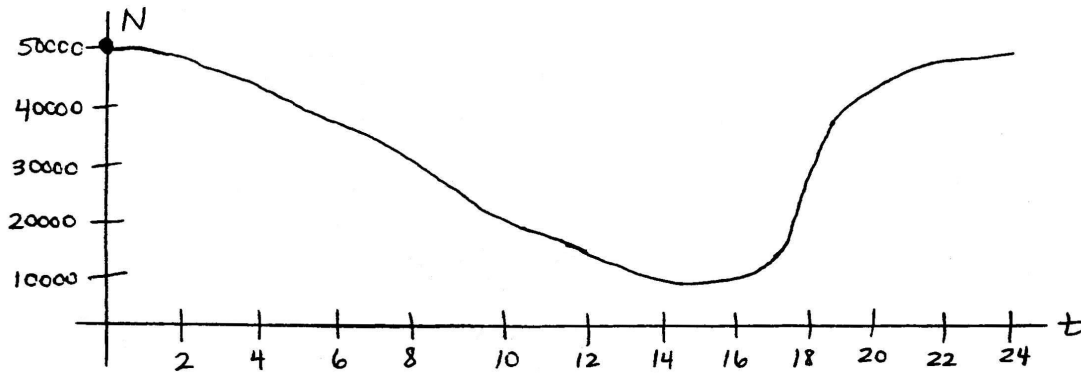
- 1b. Estimate the slope of the tangent line drawn in part 1a. $m =$

- 1c. Estimate the instantaneous rate of change of C at the input $t = 16$.

- 1d. Interpret your answer from part 1c in the problem context using a complete sentence.

- 1e. Evaluate $C'(17) =$

2. Victims of the wombat fever virus are treated with a drug that slows the replication of the virus in their bodies. Unfortunately, the virus develops resistance to this drug over time and the effect of the drug slowly wears off. The function $N(t)$ graphed below outputs the typical number of virus particles circulating per milliliter of blood in a patient being treated for wombat fever. The input variable t represents the elapsed time (in months) after the patient begins treatment.



2a. Evaluate $N(0)$ and interpret this value in the context of the problem.

2b. Sketch the tangent line to the graph of N at the input $t = 20$.

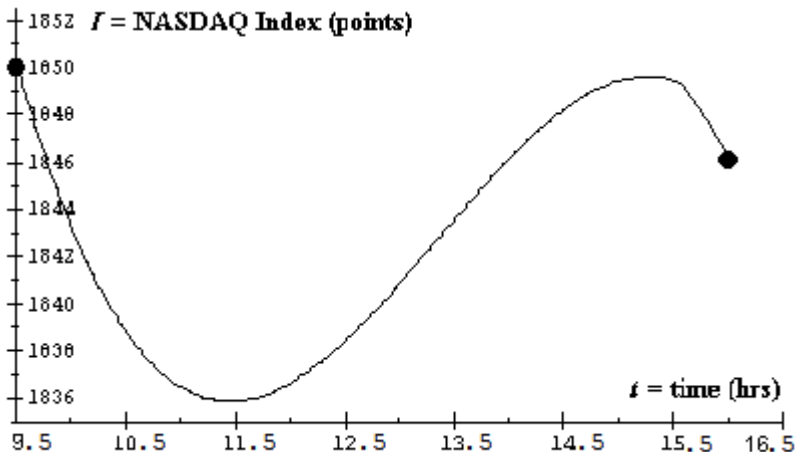
2c. Estimate the slope of the tangent line drawn in Part 2b. $m =$

2d. Estimate $N'(20) \approx$. Explain how you got your estimate.

2e. Interpret your estimate from Part 2d in the context of the problem.

3. The NASDAQ Composite Index is a numerical value that roughly measures the price of all stocks traded on the NASDAQ Stock Exchange. This exchange has become more

important in recent years, since the stocks of many high-tech companies are traded there. The following graph depicts the value of the NASDAQ index (I) over the course of a recent trading day. The input axis is marked off in military time, where $t = 9.5$ corresponds to 9:30 am and $t = 16$ corresponds to 4 pm.



3a. Sketch the tangent line to the graph at the input $t = 14$.

3b. Estimate the slope of the tangent line drawn in part 3a. $m =$

3c. Estimate the instantaneous rate of change of I at the input $t = 14$.

3d. Interpret your answer from part 3c in the problem context using a complete sentence.

3e. Evaluate $I'(11) =$

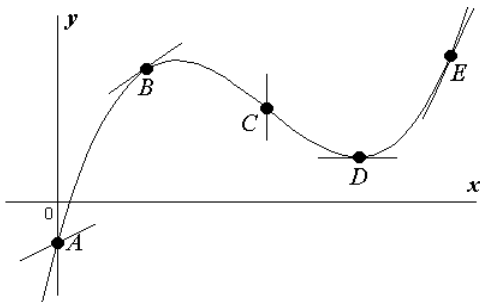
4. Suppose $L(d)$ is the illumination from a spotlight (measured in units called lumens) recorded at a distance d feet from the spotlight.

4a. What are the units of measure for $L'(50)$?

4b. What is the sign ($+$, $-$, 0) of $L'(50)$?

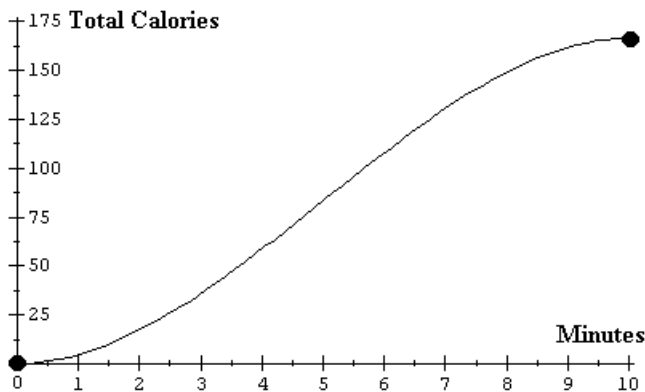
5. Five points labeled A through F have been marked along the function curve shown below. At each point, a portion of a line has been drawn that touches the curve at only the

marked point. For each of these lines, determine if it is tangent to the curve at the corresponding point.



- 5a. A Yes No
- 5b. B Yes No
- 5c. C Yes No
- 5d. D Yes No
- 5e. E Yes No

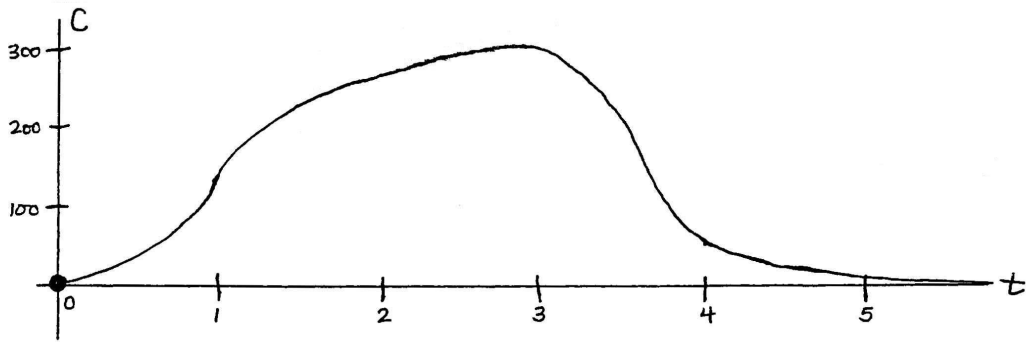
6. The Hard-Body Elliptical Crosstrainer fitness machine has an LCD display that graphs the total calories burned during a workout. Suppose the display appeared roughly as shown below after Imani's last workout on the machine. Let T be the total calories burned after m minutes of the workout.



- 6a. Sketch the tangent line to the graph at the input $m = 8$.
- 6b. Estimate the slope of the tangent line drawn in part 6a. $slope =$
- 6c. Estimate the instantaneous rate of change of T at the input $m = 8$.
- 6d. Interpret your answer from part 6c in the problem context using a complete sentence.

6e. Evaluate $T'(8) =$

7. The function C graphed below outputs the amount of aspirin circulating in the bloodstream of a person t hours after 350 mg of aspirin is consumed.



7a. Evaluate $C(1)$ and interpret this value in the context of the problem.

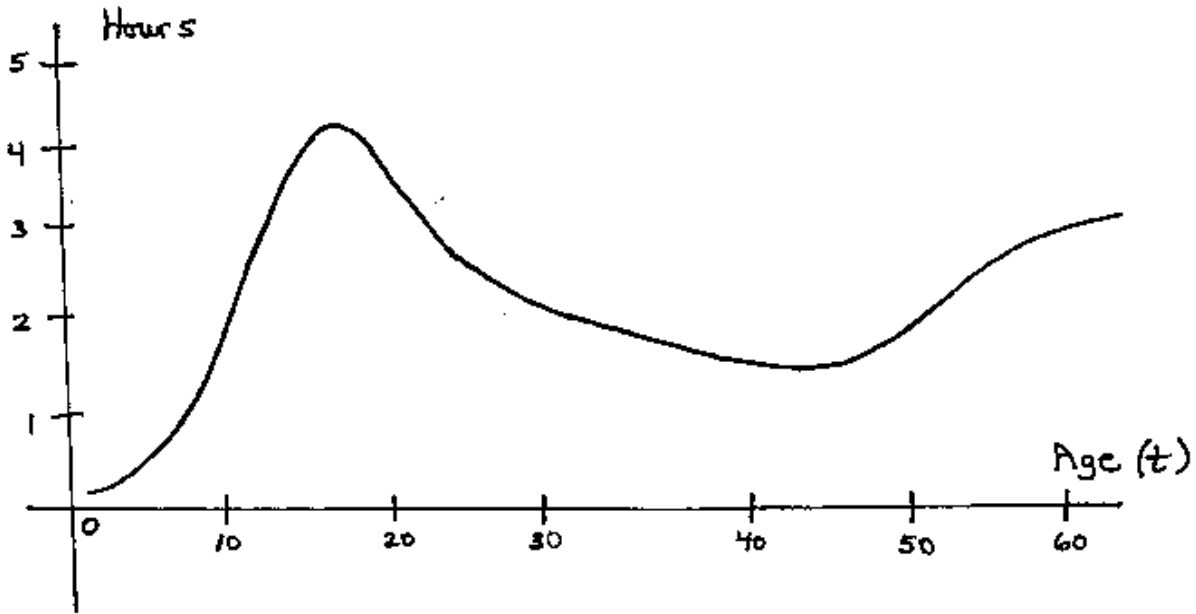
7b. Sketch the tangent line to the graph of C at the input $t = 2$.

7c. Estimate the slope of the tangent line drawn in Part 7b. $m \approx$

7d. Estimate $C'(2) \approx$. Explain how you got your estimate.

7e. Interpret your estimate from Part 7d in the context of the problem.

8. The function V graphed here depicts the number of hours each day typical Americans from age 3 years to age 60 years spend watching TV.



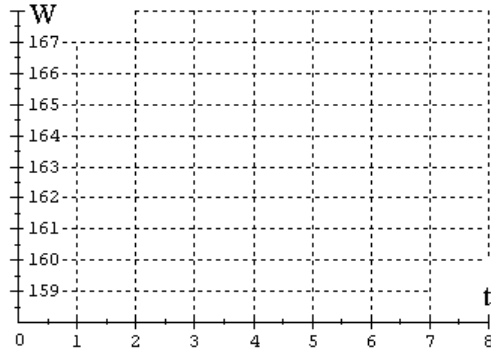
Suppose you are given that $V'(40) = -0.025$. Interpret this value in the problem context using a complete sentence.

9. In 1990, the average weight of an American adult was 160 lbs. By 1998, the average weight had risen to 166 lbs. Let $W(t)$ be the average weight of an American adult in year t , where $t = 0$ corresponds to 1990.

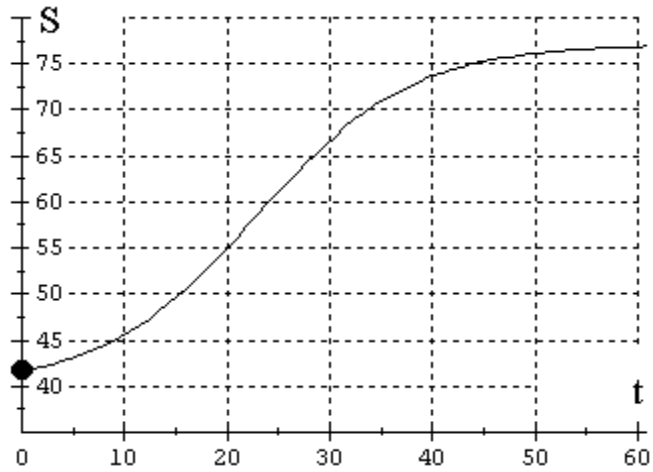
9a. Compute $W_{[0,8]} =$ Interpret this value in the problem context using a complete sentence.

9b. Find the y -intercept of W . Interpret this value in the problem context using a complete sentence.

9c. Suppose the average weight of an American adult increased at a steady rate between 1990 and 1998. Draw the graph of W on the axes shown here.



10. The function S graphed here outputs the number of millions of persons predicted to be receiving Social Security benefits t years after 1990.



10a. Evaluate $S(0)$ and interpret this value in the context of the problem.

10b. Sketch the tangent line to the graph of S at the input $t = 40$.

10c. Estimate the slope of the tangent line drawn in Part 10b. $m \approx$

10d. Estimate $S'(40) \approx$. Explain how you got your estimate.

10e. Interpret your estimate from Part 10d in the context of the problem.

MATH 2401 – Handout # 4
Answers To Selected Odd-numbered Problems

- 1b. tangent line slope = 1.42 (Answers may vary)
- 1c. 1.42 is the instantaneous rate of change of C at $t = 16$ since this is the slope of the tangent line at this point.
- 1d. At 4 pm ($t=16$), the number of cars on the expressway is increasing by 1.42 thousand cars per hour, on a typical weekday.
- 1e. $C'(17) = 0$ since the tangent line is a horizontal line and so has slope 0
-
- 3b. tangent line slope = 3.5 (Answers may vary)
- 3c. 3.5 is the instantaneous rate of change of I at $t=14$ since this is the slope of the tangent line at this point.
- 3d. At 2 pm ($t=14$) on a recent trading day, the NASDAQ was increasing 3.5 points per hour.
- 3e. $I'(11) = 0$ since the tangent line at $t = 11$ is a horizontal line and so has slope 0
-
- 5a. No
- 5b. Yes
- 5c. No
- 5d. Yes
- 5e. Yes
-
- 7a. $C(1) = 140$ (Answers may vary); One hour after consuming 350 mg of aspirin, there 140 mg of aspirin circulating in the person's bloodstream.
- 7c. tangent line slope ≈ 350 (Answers may vary)
- 7d. $C'(2) \approx 60$ since this equals the slope of the tangent line at $t=2$. (slope answers may vary)
- 7e. Two hours after consuming 350 mg of aspirin, the amount of aspirin circulating in the person's bloodstream is increasing at the rate of 60 mg/hr.
-
- 9a. $W_{[0,8]}=0.75$; The weight of American adults increased by 0.75 lbs/yr between 1990 and 1998, on average.
- 9b. y-intercept = 160; In 1990, the average weight of American adults was 160 lbs.
- 9c. Hint: Linear functions increase at a steady rate.