

HW 225

Name _____ Pd _____

Physics and unit analysis

Q1 Displacement in miles based on t hours is given by: $s(t) = x^3 - x + 5$
Find $s(4)$, $v(4)$, $a(4)$

Q2 Displacement in meters based on t seconds is given by: $s(t) = x^3 - 4x^2$
Find the velocity and speed at $t = 3$ seconds. Is the object speeding up?

Q3 Displacement in miles based on t hours is given by: $s(t) = 10 - 3(x)^{0.5}$
Find $s(4)$, $v(4)$, $a(4)$

5. The cost, $C = f(w)$, in dollars of buying a chemical is a function of the weight bought, w , in pounds.
- (a) In the statement $f(12) = 5$, what are the units of the 12? What are the units of the 5? Explain what this is saying about the cost of buying the chemical.
 - (b) Do you expect the derivative f' to be positive or negative? Why?
 - (c) In the statement $f'(12) = 0.4$, what are the units of the 12? What are the units of the 0.4? Explain what this is saying about the cost of buying the chemical.

6. The time for a chemical reaction, T (in minutes), is a function of the amount of catalyst present, a (in milliliters), so $T = f(a)$.

(a) If $f(5) = 18$, what are the units of 5? What are the units of 18? What does this statement tell us about the reaction?

(b) If $f'(5) = -3$, what are the units of 5? What are the units of -3 ? What does this statement tell us?

7. An economist is interested in how the price of a certain item affects its sales. At a price of $\$p$, a quantity, q , of the item is sold. If $q = f(p)$, explain the meaning of each of the following statements:

(a) $f(150) = 2000$ (b) $f'(150) = -25$

8. Figure 2.27 shows the length, L , in cm, of a sturgeon (a type of fish) as a function of the time, t , in years.⁸ Estimate $f'(10)$. Give units and interpret your answer.

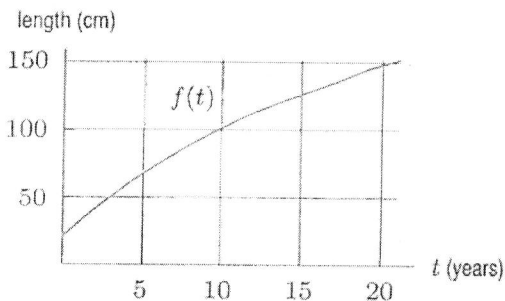


Figure 2.27

9. The temperature, T , in degrees Fahrenheit, of a cold yam placed in a hot oven is given by $T = f(t)$, where t is the time in minutes since the yam was put in the oven.

(a) What is the sign of $f'(t)$? Why?

(b) What are the units of $f'(20)$? What is the practical meaning of the statement $f'(20) = 2$?

12. Meteorologists define the temperature lapse rate to be $-dT/dz$ where T is the air temperature in Celsius at altitude z kilometers above the ground.

(a) What are the units of the lapse rate?

(b) What is the practical meaning of a lapse rate of 6.5?