

Related Rates Problems

MATH 104

2020W

1. The workers in a union are concerned whether they are getting paid fairly or not. They are specifically concerned at the rate at which wages are increasing per year is lagging behind the rate of increase in the company's profit's per year. In order for the wage increase to be fair, the rate that the wage increases per year should be the same as the rate that the company's profit is increasing per year. Currently, the wage (L) is \$24.00 per hour on average for each worker. Determine whether this is fair or not given that the profit function is the following:

$$P = \frac{21}{100}L^3 - 4L^2.$$

2. The monthly revenue R (in dollars) of a telephone polling service is related to the number x of completed responses by the function

$$R(x) = -13450 + 60\sqrt{6x^2 + 20x},$$

where $0 \leq x \leq 1500$. If the number of completed responses is increasing at the rate of 10 forms per month, find the rate at which the monthly revenue is changing when $x = 700$.

3. The owner of Cazio Watches Co. wants to predict how interest rates effect monthly sales. If the current interest rate r is 4% and the monthly change in interest rate is 0.8%, what is the change in sales per month if sales are determined by the function:

$$S = \frac{150000}{\sqrt{r^2 + 5}} - \frac{4900r^2}{3},$$

where S is in hundreds of dollars?

4. General Farms Cereal makes q thousand packs of Fruit Loops Cereal in the marketplace each week when the wholesale price is $\$p$ per box. The relationship between x and p is governed by the supply equation

$$6q^2 - 5qp + 2p^3 = 5.$$

How fast is the supply of cereals changing when the price per box is \$6.50, the quantity supplied is 10,000 boxes, and the whole sale price per box is increasing at the rate of \$0.10 per box box each week?

5. It is estimated that the number of housing starts, $N(t)$ (in units of a million), over the next 5 years is related to the mortgage rate $r(t)$ (percent per year) by the equation

$$9N^2 + r = 36.$$

What is the rate of change of the number of housing starts with respect to time when the mortgage rate is 6% per year and is increasing at the rate of 0.25% per year?