

YOUR NAME: _____

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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. An adjustable rate mortgage (ARM) is a mortgage whose interest rate varies over the life of the loan. The interest rate is often tied in some fashion to the prime rate, which may go up or down. The monthly payment M in dollars, given the amount P borrowed in dollars, the term t of the loan in months and the monthly interest rate r as a decimal, where $r = \frac{\text{APR}}{12}$, is given by

$$M = \frac{Pr(1+r)^t}{(1+r)^t - 1}.$$

Suppose that you purchased a home in 2005, securing a mortgage of \$325,000, with a 30-year ARM. (Please round r to five decimal places in the following questions.)

- (a) In 2005 interest rates were at historical lows. Suppose that at the time of the loan the rate for your ARM was 4.5% APR. Calculate your monthly payment.
- (b) Suppose you earn \$ 6,000 per month. What percentage of your income is going toward your house payment?
- (c) Suppose that after 24 payments your ARM rate adjusted to 7% APR. We will assume that after 24 months your loan balance is still \$325,000. What is your monthly payment now? (Caution: The term of your loan now is not 30 years.)
- (d) Using the assumptions of the previous part, what percentage of your income is going to your house payment now?

2. Data were collected comparing the weight W in pounds of a yellowfin tuna to its length L in centimeters:

$L = \text{Length}$	70	80	90	100	110	120	130	140	160	180
$W = \text{Weight}$	14.3	21.5	30.8	42.5	56.8	74.1	94.7	119	179	256

- (a) What is the average rate of change in weight per centimeter of length in going from a length of 100 cm to a length of 110 cm?
- (b) What is the average rate of change in weight per centimeter in going from 160 cm to 180 cm?
- (c) Use the average rate of change to estimate the weight of a yellowfin tuna that is 167 centimeters long.
- (d) What is the average rate of change in length per pound of weight in going from a weight of 179 pounds to a weight of 256 pounds?
- (e) What would you expect to be the length of a yellowfin tuna weighing 225 pounds?

4. The total weight of a rock depends on its size and is proportional to its density. Density is the weight per cubic inch. Let w denote the weight of the rock in pounds, s the size of the rock in cubic inches and d the density of the rock in pounds per cubic inch.
- (a) What is the total weight of a 3-cubic-inch rock that weighs 2 pounds per cubic inch?
- (b) Write an equation that shows the proportionality relation. What is the constant of proportionality?
- (c) Use the equation that you found to find the total weight of a 14-cubic-inch rock with density 0.3 pound per cubic inch.