Name:_____
MQ 114   Absolute change and percentage change

One way to describe the change in a quantity over time is to calculate *absolute (or total) change*. To find this number, subtract the new quantity from the original quantity.
absolute change = new quantity – original quantity

Example 1: On September 20, a gallon of gas at my usual gas station cost $2.83. On September 30, I noticed that the price had gone down to $2.65 per gallon.

The absolute change in the price of gas between September 20 and September 30 is
2.65 – 2.83 = - 0.18 dollars per gallon
We say that the price of gas *decreased* by $0.18 (or 18 cents). Notice that when we use the word "decreased," we don't need to use the negative in front of the number.

Example 2: Last month, I paid $3.99 per gallon of heating oil. This month, when I got my bill, I saw that the price was $4.10 per gallon.

The absolute change in the price of heating oil during that month was
4.10 – 3.99 = 0.11 $ per gallon
We say that the price of heating oil *increased* by 11 cents that month.

You can also use *percentage change* to describe change. To calculate the percentage change: find the absolute change, then divide that number by the original amount. To turn your answer into a percentage, multply by 100.
Percentage change =   absolute change (100)
                              original quantity

Example 1 revisited: On September 20, a gallon of gas at my usual gas station cost $2.83. On September 30, I noticed that the price had gone down to $2.65 per gallon.

The percentage change in the price of gas between September 20 and September 30 is
(2.65 – 2.83) 100 = - 0.064(100) = -6.4% per gallon
        2.83

We say that the price of gas *decreased* by 4.7% per gallon.

Example 2 revisted Last month, I paid $3.99 per gallon of heating oil. This month, when I got my bill, I saw that the price was $4.10 per gallon.

The percentage change in the price of heating oil is:
(4.10 – 3.99) 100 = (0.028)100 = 2.8% per gallon
        3.99

We say that the price of heating oil *increased* by 2.8% per gallon.

Summary: Let a be the original quantity and b be the new quantity.
- The **absolute change** between the quantities is $b - a$.
- The **percentage change** between the quantities is $\left(\dfrac{b - a}{a}\right)100$.

Practice problems

1. In 1950, the world population was estimated to be 2,520,000,000. By 1980, the population had increased to 4,440,000,000.
a) find the absolute change in world population between 1950 and 1980. Write your answer in a complete sentence.
b) find the percentage change in world population between 1950 and 1980. Write you answer in a complete sentence.
c) If you were writing an analysis of world population change, which number would make a more dramatic point: the absolute change or the percentage change? Explain your answer.

For the rest of the problems, find the absolute change and the percentage change. In your opinion, which number is better expresses change for that particular problem? Circle your answer in each case.

2. During the past two years, median household income for families living in the Midwest went from $44,531 to 43,622.

3. The census Bureau reported that the number of Americans without health insurance grew from 41.4 million in 2002 to 43.6 million in 2003.

4. UMass Boston tuition cost per credit (not counting fees) was 79.50 in 1988. In 2004 the per credit tuition is $71.50.

5. Undergraduate enrollment at UMass Boston was 10,071 in 2002, down from 10,656 in 2001.

6. In fiscal year 2001 UMass Boston received $85.6 million from the State, compared to $60.7 million this year (fiscal year 2004).

7. The chart below shows sales of used books nationally between 2003 and 2004.

Used Books Sales Revenue (in millions)

Year	Online sales	Book store sales	Other locations	Total
2003	$457	$1498	$45	$2001
2004	$609	$1567	$48	$2223

a. By what percent did Online sales of used books increase from 2003 to 2004?

b. By what percent did <u>all sales</u> of used books increase from 2003 to 2004?