**Barron’s Let’s Review Regents – Algebra I**

# Chapter 9: Creating and Interpreting Equations from Real-World Scenarios

## 9.1 Creating and Interpreting Linear Equations

Many real-world scenarios can be modeled with two-variable linear equations. The scenarios generally have a fixed part, which is the same for every situation, and a variable part, which changes depending on the situation. These equations often resemble the slope-intercept form .

**Identifying the Fixed and Variable Parts of a Real-World Scenario**

**Interpreting Linear Equations**

When an equation has the form , *b* generally represents the *fixed* part and the *mx* is the *variable* part. The variable part is the part that changes depending on the value of *x*.

### Check Your Understanding of Section 9.1

1. Multiple-Choice
2. It costs $10 to go to the movies and $3 for each bag of popcorn. What equation relates the total cost © to the number of bags of popcorn purchased (P)?  
   **(1)**
3. A salad costs $6 for the lettuce and $2 for each topping. Which equation relates the total cost (C) to the number of toppings purchased (T)?  
   **(4)**
4. A tablet computer costs $400 and $2 for each app. Which equation relates to the total cost (C) to the number of apps purchased (A)?  
   **(4)**
5. An ice cream store collects $5 for each ice cream. At the end of the day, the store must pay $300 total for all the employees. Which equation relates the total amount of money remaining (M) after paying the employees the number of ice creams sold(I).  
   **(2)**
6. A cable TV plan costs $80 a month plus $10 extra for each premium channel. Which equation relates the monthly bill (B) to the number of premium channels ordered (C)?  
   **(2)**
7. Muhammad has saved $40. Each week he earns $15 delivering newspapers. Which equation relates the amount Muhammad has saved (S) to the number of weeks working?  
   **(3)**
8. Lydia wants to buy a DVD player and some DVDs. The equation that relates the total cost for the DVD player and N DVDs is   
   . What does the number in the equation represent?  
   **(1) The cost of the DVD player**
9. Amelia buys an empty sticker album and some sticker sheets. The equation that relates the total cost for the empty sticker album and N sticker sheets is   
   . What does the 0.75 in the equation represent?  
   **(2) The cost of each sticker sheet.**
10. Riley has a cell phone that requires a certain amount of money to be paid for each gigabyte of data. If the equation that relates the cost of the phone together with N gigabytes of data is , what is the cost of 1 gigabyte of data?  
    **(3) 5**
11. Colton is training to run a marathon. The first month he runs 1 mile a day. The second month he runs 3 miles a day. The third month he runs 5 miles a day. Which equation relates the number of months of training (M) to the distance he runs each day (D) in the Mth month?  
    **(4)**
12. Show how you arrived at your answers.
13. A teacher has a starting salary of $40,000 and each year she gets a $5,000 raise. Create an equation that relates her salary (S) to the number of years (Y) she has been working.
14. For a taxi ride, it costs a certain amount to get into the taxi and an additional amount for each mile driven. If the equation that relates the total cost (C) to travel M is . What do the numbers 2 and 4 represent?  
      
    2 represents the $2 cost per mile.  
    4 represents the $4 cost to get into the taxi.
15. A 5-foot tree was planted in the year 2000. This chart shows four sets of values where Y is the number of years since 2000 and H is the height of the tree in that year. Create an equation that relates H and Y.  
      
    Each year, the three feet each year.

|  |  |
| --- | --- |
| x | y |
| 0 | 5 |
| 1 | 8 |
| 2 | 11 |
| 3 | 14 |

1. Owen, who weighs 260 pounds, goes on a diet where he loses the same amount of weight each month. Below is a chart where M represents the number of months Own has been on the diet and W represents Owen’s weight after M months on the diet. Create an Equation that relates W and M.

|  |  |
| --- | --- |
| x | y |
| 0 | 260 |
| 1 | 258 |
| 2 | 256 |
| 3 | 254 |

1. Make up a real world situation that can be represented with the equation .  
     
   The cost of getting into a carnival is $20 and it costs $6 per ride.

## 9.2 Creating and Interpreting Exponential Equations

Many real-life scenarios are more accurately modeled with two-variable exponential equation rather than a linear equation. These include population growth, money and interest, and cooling liquids. Many exponential equations can be written in the form , where a is related to the starting value and r is related to how fast something is growing or decaying.

**Percent Increases**

Exponential equations are about something that is increasing (or decreasing) by the same percent each time period. Calculating how something changes when it is increased or decreased by a certain perct is the key to creating exponential equations.

**Percent Decrease**

If instead of getting interest of 15% at a bank you had to pay a fee of 15% of the amount you have, each year your savings would decrease.

**Two-Variable Percent Increase Equations**

If in a real-world scenario a starting value is given and the percent increase, or growth rate, is also given, a two-variable equation can be created to model the scenario.

The exponential growth equation is where P is the starting value, r is the growth rate, and T is the amount of time periods that have happened.

**Two-Variable Percent Decrease Problems**

The difference between a percent increase equation and a percent decrease equation is that instead of multiplying by 1 plus the growth rate each time, you multiply by 1 minus the growth rate each time.

**Interpreting Exponential Growth Equations**

Subtract 1 from the number that gets raised to the power, 1.07, to find the growth rate. In this case, the growth rate is 0.07 or 7%.

**Interpreting Exponential Decay Equations**

The number that is being subtracted from 1 is the growth rate. When the growth rate is between 0 and 1, it is also known as the decay rate or rate of decay.

### Check Your Understanding of Section 9.2

1. Multiple-Choice
2. There were 900 birds in a forest. Each year the bird population increases by 12%. Which equation relates the bird population (P) to the number of years that have passed (t)?  
   **(1)**
3. Clara deposits $300 into a bank. The bank offers 5% interest compounded annually. Which equation relates the amount of money in the bank (A) to the number of years that have passed (t)?  
   **(1)**
4. A bouncing ball is dropped from 20 feet high. After each bounce, the height of the next bounce is 65% as high as the last bounce. Which equation relates the height of the bounce (H) to number of bounces that have happened (N)?  
   **(3) (book got it wrong)**
5. Food that is 80 degrees is put into a freezer. Each minute the temperature of food decrease by 18%. Which equation relates the temperature of the food(T) to the number of minutes since the food was put into the freezer(M).  
   **(2)**
6. The population (P) of a town after t years can be modeled with the equation . What does the 20,000 represent?  
   **(4) The starting population of the town**
7. Trinity deposits some money into a bank that offers interest compounded annually. The amount of money in the bank (A) after t years can be modeled with the equation   
   . What does 1.03 represent?  
   **(2) One plus the growth rate**

**Book got it wrong**

1. After Allie takes some medicine, the number of milligrams of medicine (M) remaining in her body after t minutes can be modeled with the equation . What number represents the decay rate?  
   **(3) 0.27**
2. A ball is dropped from the window of a building. The height of the bounce (H) is related to the number of bounces (N) by the equation . Which number represents the height of the ball when the ball was originally dropped from?  
   **(1) 50**
3. Mason puts money into a bank that offers interest compounded annually. The formula relating the amount of money in the bank (A) to the number of years it has been in the bank (t) is . What is the interest rate the bank offers?  
   **(3) 20%**
4. An exponential equation models exponential decay. What is known about the value of b?  
   **(4) It is between 0 and 1**
5. Show how you arrived at your answers.
6. The population of a city is 300,000. If the population increases by 4% each year, create an equation that relates the population of the city (P) to the number of years that have passed (t).
7. Blake is trying to quit drinking soda. At the beginning of the year he drinks 64 ounces a day. Each week the amount of soda he drinks each day is 75% of the amount he drank each day the week before. Create an equation that relates the amount of soda he drinks each day (S) to the number of weeks (t) that have passed since he started trying to quit.
8. When Aria started school in kindergarten, she had 40 minutes of homework each night. Each year the number of minutes of homework she had was equal to 1.15 times the number of minutes of homework she had the year before. Create an equation that relates the number of minutes of homework she has each night (H) to the number of years that have passed since kindergarten (t).
9. A company’s annua profits can be modeled by the equation , where P is the amount of profit and t is the number of years the company has been in business. What do the numbers 200,000 and 0.36 represent.  
     
   200,000 represents the initial profit of the company, and 0.36 represents 36% increase in profits each year.
10. Bailey is training to run a marathon. The number of minutes it takes to run the marathon after t weeks of training is   
    . What do the numbers 300 and 0.05 represent?  
      
    The number 300 represents the time in minutes it takes to run the marathon without any training.  
      
    The 0.05 number represents a 5% decrease in the amount of time it takes to run the marathon after each week of training.