Name _____   Date_____

Interpreting Rate of Change and Initial Value

In 2008, a collector of sports memorabilia purchased 5 specific baseball cards as an investment. Let y represent each card's resale value (in dollars) and x represent the number of years since purchase. Each of the cards' resale values after 0, 1, 2, 3, and 4 years could be modeled by linear equations as follows:

Card A: $y = 5 - 0.7x$

Card B: $y = 4 + 2.6x$

Card C: $y = 10 + 0.9x$

Card D: $y = 10 - 1.1x$

Card E: $y = 8 + 0.25x$

1. Which card(s) are decreasing in value each year? How can you tell?

2. Which card(s) had the greatest initial values at purchase (at 0 years)?

3. Which card(s) is increasing in value the fastest from year to year? How can you tell?

4. If you were to graph the equations of the resale values of Card B and Card C, which card's graph line would be steeper? Explain.

5. Write a sentence explaining the 0.9 value in Card C's equation.

1. A rental car company offers the following two pricing methods for its customers to choose from for a one-month rental:

>   Method 1: Pay $400 for the month, or
>
>   Method 2: Pay $0.30 per mile plus a standard maintenance fee of $35.

   a. Construct a linear function that models the relationship between the miles driven and the total rental cost for Method 2. Let x represent the number of miles driven and y represent the rental cost (in dollars).

   b. If you plan to drive 1,100 miles for the month, which method would you choose? Explain your reasoning.

2. Recall from a previous lesson that Kelly wants to add new music to her MP3 player. She was interested in a monthly subscription site that offered its MP3 downloading service for a monthly subscription fee PLUS a fee per song. The linear function that modeled the total monthly cost (y) based on the number of songs downloaded (x) is $y = 5.25 + 0.30x$.

   The site has suddenly changed its monthly price structure. The linear function that models the new total monthly cost (y) based on the number of songs downloaded (x) is $y = 0.35x + 4.50$.

   a. Explain the meaning of the new 4.50 value in the equation. Is this a better situation for Kelly than before?

   b. Explain the meaning of the new 0.35 value in the equation. Is this a better situation for Kelly than before?

   c. If you were to graph the two equations (old vs. new), which line would have the steeper slope? What does this mean in the context of the problem?

   d. Which subscription plan provides the best value if Kelly will download fewer than 15 songs per month?

In 2008, a collector of sports memorabilia purchased 5 specific baseball cards as an investment. Let y represent each card's resale value (in dollars) and x represent the number of years since purchase. Each of the cards' resale values after 0, 1, 2, 3, and 4 years could be modeled by linear functions as follows:

Card A: $y = 5 - 0.7x$

Card B: $y = 4 + 2.6x$

Card C: $y = 10 + 0.9x$

Card D: $y = 10 - 1.1x$

Card E: $y = 8 + 0.25x$

1.   Which cards are decreasing in value each year? How can you tell?

   Cards A and D are decreasing in value as shown by the negative values for rate of change in each equation.

2.   Which card(s) had the greatest initial values at purchase (at 0 years)?

   Since all of the models are in slope-intercept form, Cards C and D have the greatest initial values at $10 each.

3.   Which card is increasing in value the fastest from year to year? How can you tell?

   The value of Card B is increasing in value the fastest from year to year. Its model has the greatest rate of change.

4.   If you were to graph the equations of the resale values of Card B and Card C, which card's graph line would be steeper? Explain.

   The Card B line would be steeper because the function for Card B has the greatest rate of change; the card's value is increasing at a faster rate than the other values of other cards.

5.   Write a sentence explaining the 0.9 value in Card C's equation.

   For Card C, the 0.9 value means that Card C's value increases by 90 cents per year.

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1.   A rental car company offers the following two pricing methods for its customers to choose from for a one-month rental:

   Method 1: Pay $400 for the month, or

   Method 2: Pay $0.30 per mile plus a standard maintenance fee of $35.

   a.   Construct a linear function that models the relationship between the miles driven and the total rental cost for Method 2. Let x represent the number of miles driven and y represent the rental cost (in dollars).

   $y = 35 + 0.30x$

   b.   If you plan to drive $1,100$ miles for the month, which method would you choose? Explain your reasoning.

   Method 1 has a flat rate of $400 regardless of miles. Using Method 2, the cost would be $365 ($y = 35 + 0.3(1100)$). So, Method 2 would be preferred.

2. Recall from a previous lesson that Kelly wants to add new music to her MP3 player. She was interested in a monthly subscription site that offered its MP3 downloading service for a monthly subscription fee PLUS a fee per song. The linear function that modeled the total monthly cost (y) based on the number of songs downloaded (x) is $y = 5.25 + 0.30x$.

The site has suddenly changed its monthly price structure. The linear function that models the new total monthly cost (y) based on the number of songs downloaded (x) is $y = 0.35x + 4.50$.

a. Explain the meaning of the new 4.50 value in the equation. Is this a better situation for Kelly than before?

The initial value is 4.50 and means that the monthly subscription cost is now $\$4.50$. This is lower than before, which is good for Kelly.

b. Explain the meaning of the new 0.35 value in the equation. Is this a better situation for Kelly than before?

The rate of change is 0.35. This means that the cost is increasing by $\$0.35$ for every song downloaded. This is more than the download cost for the original plan.

c. If you were to graph the two equations (old vs. new), which line would have the steeper slope? What does this mean in the context of the problem?

The slope of the new line is steeper because the new linear function has a greater rate of change. It means that the total monthly cost of the new plan is increasing at a faster rate per song compared to the cost of the old plan.

d. Which subscription plan provides the best value if Kelly will download fewer than 15 songs per month?

If Kelly were to download 15 songs, both plans will cost the same ($\$9.75$). Therefore, the new plan is cheaper if Kelly will download fewer than 15 songs.