Exploring Slope
High Ratio Mountain

My Notes

Misty Flipp worked odd jobs all summer long and saved her money
to buy passes to the ski lift at the High Ratio Mountain Ski Resort.
In August, Misty researched the lift ticket prices and found several
options. Since she worked so hard to earn this money, Misty
carefully investigated each of her options.

> **High Ratio Mountain**
> **Ski Resort**
> **Student Lift Ticket prices**
>
> Daily Lift Ticket $30
>
> 10-Day Package $80 upon purchase and
> $20 per day (up to 10 days)
>
> Unlimited Season Pass $390

1. Suppose Misty purchased a daily lift ticket each time she goes
skiing. Complete the table below for the total cost of the lift
tickets.

Number of Days	0	1	2	3	4	5	6
Total Cost of Lift Tickets							

2. Use the table to complete the statement: When the number
of days in the row increases by _____, Misty's cost increases
by _____.

3. Does the data in the table represent a linear relationship?
Explain your reasoning.

4. Determine the following:
  a. Does the data represent a function?

  b. Is the data discrete or continuous in this context?

My Notes

5. State the domain and the range of the data in the table.

6. Plot the data from the table on the grid below.
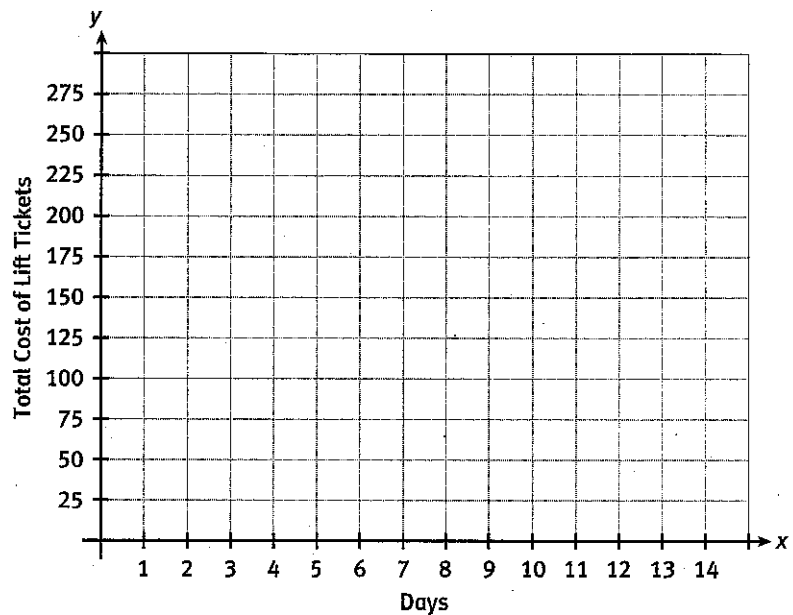
7. Label the left most point on the graph point *A*. Label the next 6 points, from left to right, points *B*, *C*, *D*, *E*, *F*, and *G*.

8. Use the graph to complete the statement: When the number of days increases by _____, Misty's cost increases by _____.

9. Describe how you move along the grid to get from one point to another.

From *A* to *B*:   Go Up $ ____ and Go Right ____ Day(s)

From *B* to *C*:   Go Up $ ____ and Go Right ____ Day(s)

From *C* to *D*:   Go Up $ ____ and Go Right ____ Day(s)

From *D* to *E*:   Go Up $ ____ and Go Right ____ Day(s)

From *E* to *F*:   Go Up $ ____ and Go Right ____ Day(s)

From *F* to *G*:   Go Up $ ____ and Go Right ____ Day(s)

My Notes

10. The movements you traced in Question 9 can be written as a ratio, $\frac{up}{right}$. Write ratios in the form $\frac{up}{right}$ that describe how to move from:

A to B: B to C:

C to D: D to E:

> **MATH TERMS**
> A **ratio** is an expression that compares two values or quantities.
>
> The *rate of change* of a relation is a ratio.
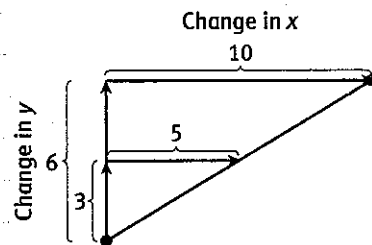
Another way to think of the movement "Go Up" is as the *change in y*. Similarly, the movement "Go Right" is the *change in x*. With this in mind, the ratio, $\frac{up}{right}$, can be rewritten as $\frac{change\ in\ y}{change\ in\ x}$. The illustration to the right shows the change in y and the change in x between two points on a line.

$$\frac{\text{Change in } y}{\text{Change in } x} = \frac{3}{5} = \frac{6}{10}$$

11. Find the change in y, the change in x, and write the ratio:

From A to C:

From B to E:

From A to E:

12. What do you notice about these ratios?

13. What are the units of the ratios you created?

14. Explain how the ratios relate to Misty's situation.

> **WRITING MATH**
> When writing a ratio, you can also represent the relationship by separating each quantity with a colon. For example, the ratio 1:4 is read "one to four."

15. Find the change in x, the change in y, and write a ratio:

From B to A:

From E to B:

16. How do these ratios compare to those you found in Question 10?

My Notes

ACADEMIC VOCABULARY

Slope is the ratio of vertical change to horizontal change or

$$\frac{\text{change in } y}{\text{change in } x}$$

y-intercept

READING MATH

The slope of a line, $\frac{\text{change in } y}{\text{change in } x}$, is also expressed symbolically as $\frac{\Delta y}{\Delta x}$.

Δ is the Greek letter, delta.

The **slope** of a line is determined by the ratio $\frac{\text{change in } y}{\text{change in } x}$ between any two points that lie on the line. The slope is the *constant rate of change* of a line. All linear relationships have a constant rate of change. The slope of a line is what determines how steep or flat it looks on a graph.

The **y-intercept** of a line is the *y*-coordinate when the *x*-coordinate is 0. It is the point at which the line crosses the *y*-axis, $(0, y)$.

17. Let *d* represent the number of days Misty plans to ski and let *C* represent Misty's total cost. Write an equation for *C* in terms of *d*.

TRY THESE A

Find the slope and *y*-intercept for the following.

a.

b.
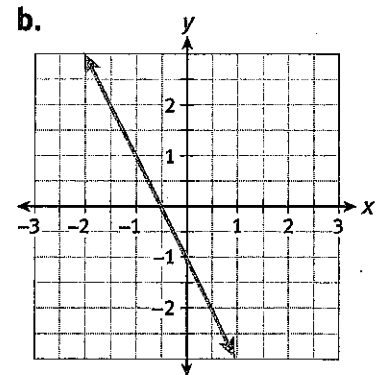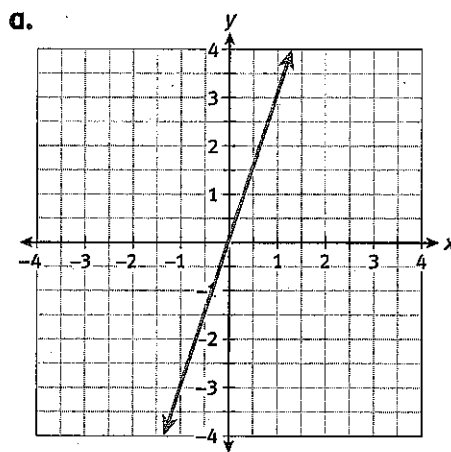
c.

x	y
0	0
1	2.5
2	5
4	10

d.

x	y
−1	4
0	2
1	0
3	−4

e. John is longboarding at a constant rate down the road. If 2 min after he leaves his house he is 1000 ft away and at 5 minutes he is 2500 ft from his house what would his average rate of change be?

CONNECT TO **SPORTS**

Longboards are larger than the more trick-oriented skateboards. Longboards are heavier and sturdier than skateboards. Some people even use them instead of bicycles.

18. Draw a line that contains the points you plotted in Question 6. Using the graph, find the slope and *y*-intercept of the line.

My Notes

19. Suppose Misty purchased the 10-Day Ticket Package that costs $80 plus $20 per day.

 a. Complete the table below for the total cost of the lift tickets in the 10-day package for 0 through 6 days. Be sure to include the initial cost of $80.

Number of Days	0	1	2	3	4	5	6
Total Cost of Lift Tickets							

 b. Explain how you know the data in the table above is linear.

20. Plot the data from the table on the given axes.

21. Draw a line that contains the points you plotted in Item 20.
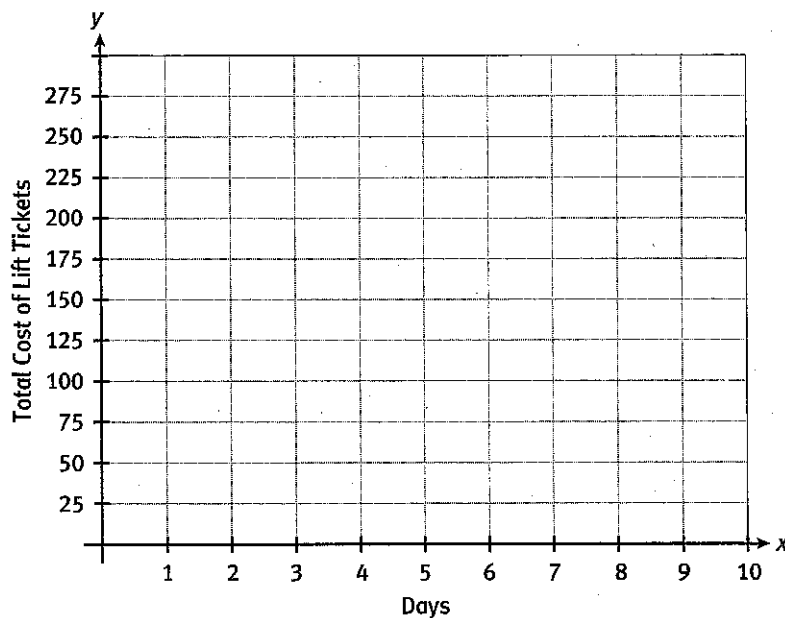
CONNECT AP

The concepts of slope and y-intercept will continue to be developed in later math courses.

My Notes

22. Find the slope and the *y*-intercept of the line that contains the points in the graph for Question 20, and explain how they relate to Misty's situation.

23. Compare and contrast the lines associated with the data for the Daily Lift Tickets in Question 6, and the data for the 10-Day Package.

24. Let *d* represent the number of days Misty plans to ski and let *K* represent Misty's cost. Write an equation for *K* in terms *d* for Misty's cost.

25. Although it seemed like a lot of money, Misty thought about the unlimited season pass for $390.

a. First, she compared the season pass to the daily lift tickets at $30 each. How many times would Misty have to go skiing before she would save money with the $390 season pass? Show your work.

b. Next, Misty compared the price of an unlimited season pass to two 10-Day packages that she would use for 20 days of skiing. Which package would be the best buy? Explain your reasoning.

My Notes

26. If Misty skis the following number of days, which of the three packages should she purchase? Explain why.

   a. 6 days

   b. 8 days

   c. 13 days

   d. 16 days

27. Write a persuasive letter to Misty based on your analysis that makes a recommendation of which package she should purchase. Include multiple representations (graphs, tables, and/or equations) to support your reasoning.

CHECK YOUR UNDERSTANDING

Write your answers on notebook paper. Show your work.

Misty determined that she gets 64 miles on 2 gallons of gas from her car as she drives from her house to go skiing.

1. Create a ratio of Misty's miles per gallon.

2. Using the ratio you found in Question 1, determine how far Misty can go on 1 gallon of gas.

3. How many miles could Misty travel on a full tank of 12 gallons of gas?

4. What is the slope of the line shown?

   a. −4

   b. $-\frac{3}{2}$

   c. $-\frac{2}{3}$

   d. $\frac{3}{2}$

   e. 4
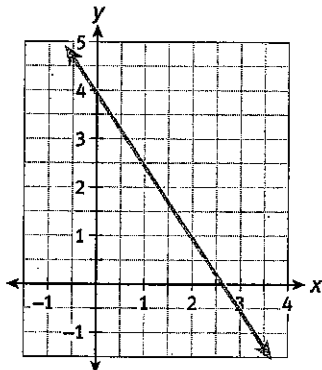
5. Find the slope and y-intercept of the following:
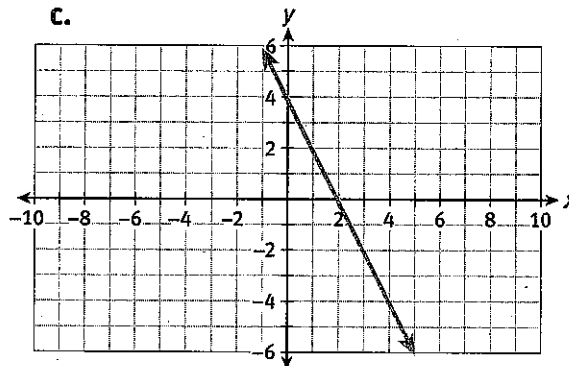
   a.

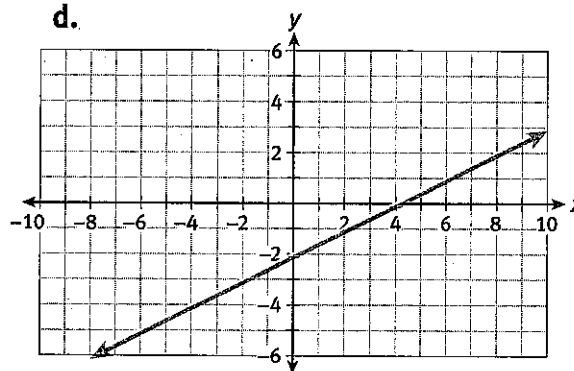 | x | y |
   |---|---|
   | 0 | 1 |
   | 3 | 7 |
   | 6 | 13 |

   b.

x	y
−3	10
0	4
4	−4

c.

d.

6. If a line has a slope of $\frac{3}{4}$, and contains the point (3, 1), then it must also contain which of the following points?

   a. (−2, −2)

   b. (−1, −2)

   c. (0, −3)

   d. (2, 2)

   e. (7, 3)

7. **MATHEMATICAL REFLECTION** How does the steepness of a line affect the slope of the line?