# Geometric Properties of Linear Functions

Chapter 1

Section 5

# Interpreting Parameters of a Linear Function

With time, $t$, in years, the population of four towns $P_A$, $P_B$, $P_C$, and $P_D$ are given by the following formulas: $P_A = 20{,}000 + 1600t$, $P_B = 50{,}000 - 300t$, $P_C = 650t + 45{,}000$, and $P_D = 15{,}000(1.07)^t$.

1) Which populations are represented by linear functions?
2) Describe in words what each linear model tells you about that town's population. Which town starts out with the most people? Which town is growing fastest?

# The Effect of the Parameters

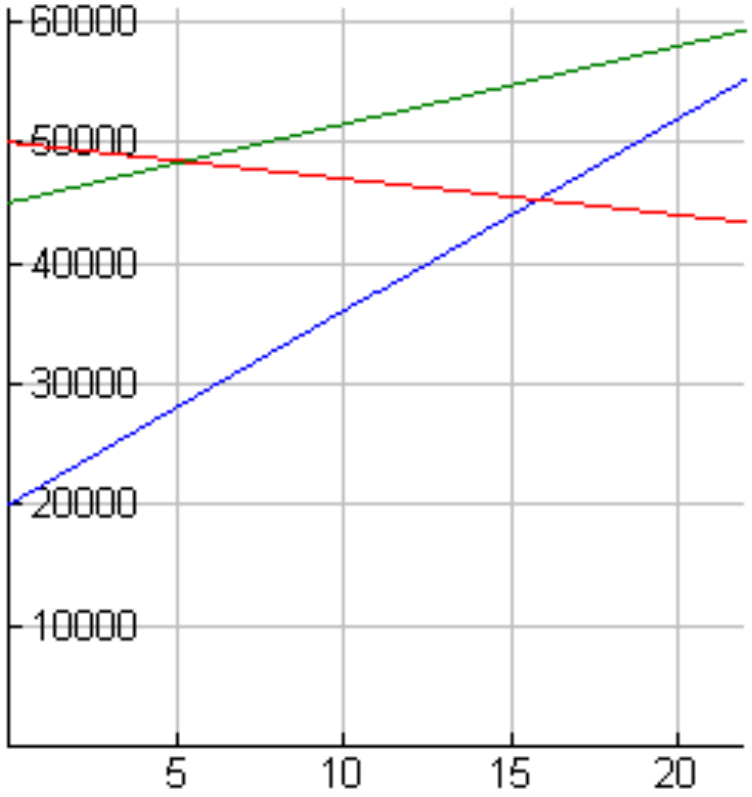
Let $y = b + mx$. Then the graph of $y$ against $x$ is a line.

1) The $y$-intercept, $b$, tells where the line crosses the $y$-axis.
2) If the slope, $m$, is positive, the line climbs from left to right. If the slope, $m$, is negative, the line falls from left to right.
3) The slope, $m$, tells how fast the line is climbing or falling.
4) The larger the magnitude of $m$ (either poisitve or negative), the steeper the graph.

# Using a Graph to Explain Population Data

$P_A = 20{,}000 + 1600t$, $P_B = 50{,}000 - 300t$, $P_C = 650t + 45{,}000$, and $P_D = 15{,}000(1.07)^t$.

1) Graph $P_A$, $P_B$, and $P_C$ and explain how to identify the values of $b$ and $m$ from the graph.
2) Graph $P_D$ and explain how the graph shows that $P_D$ is not a linear function.


60000
50000
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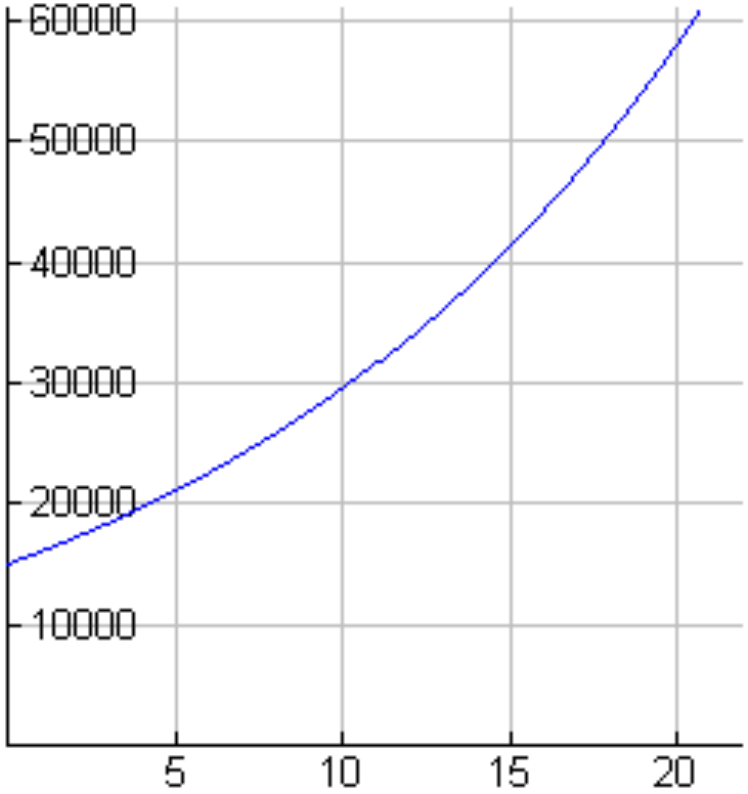
60000
50000
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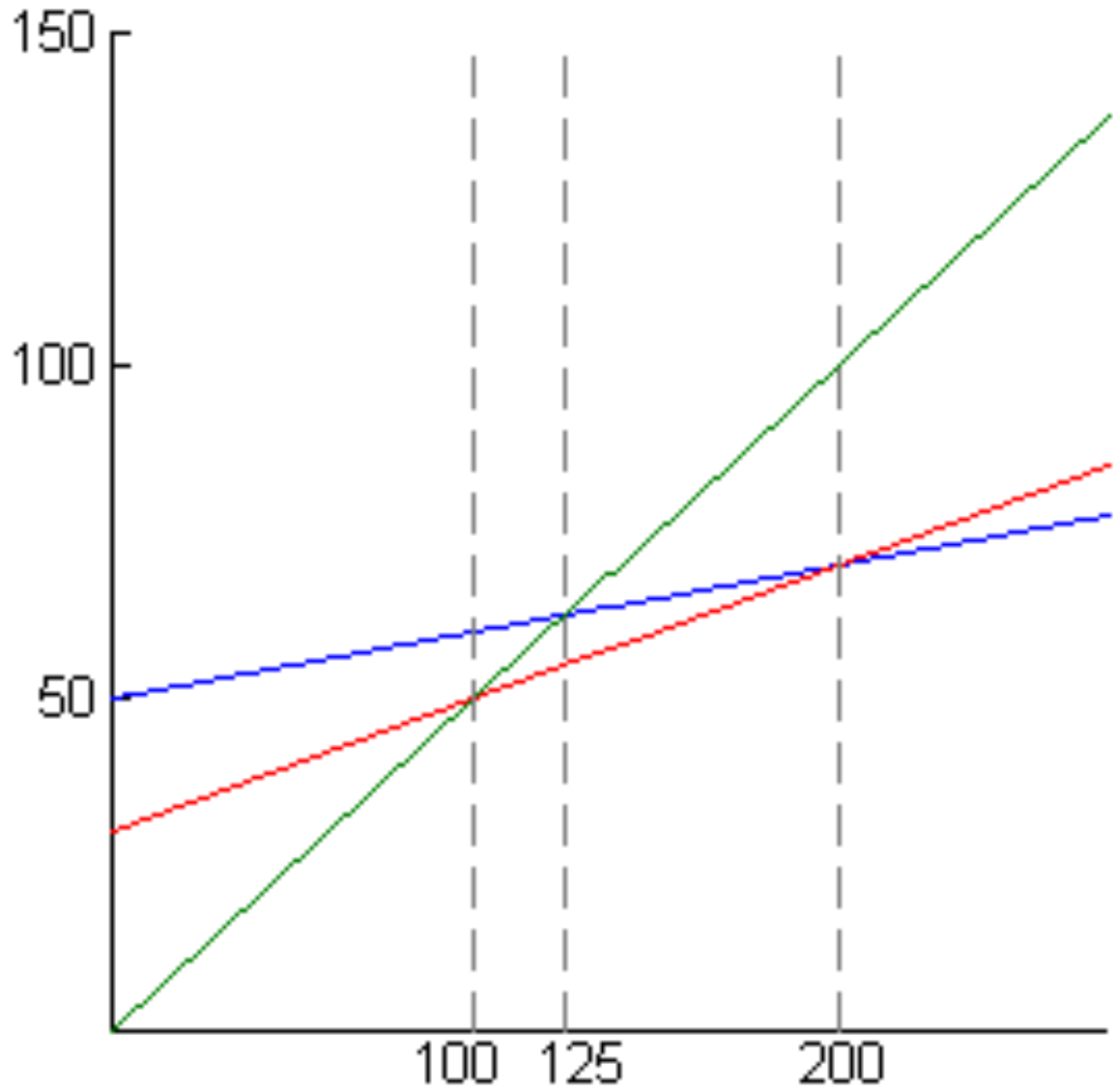
5
10
15
20

# Intersection of Two Lines

The cost in dollars of renting a car for a day from three different rental agencies and driving it $d$ miles is given by the following functions: $C_1 = 50 + 0.10d$, $C_2 = 30 + 0.20d$, and $C_3 = 0.50d$.

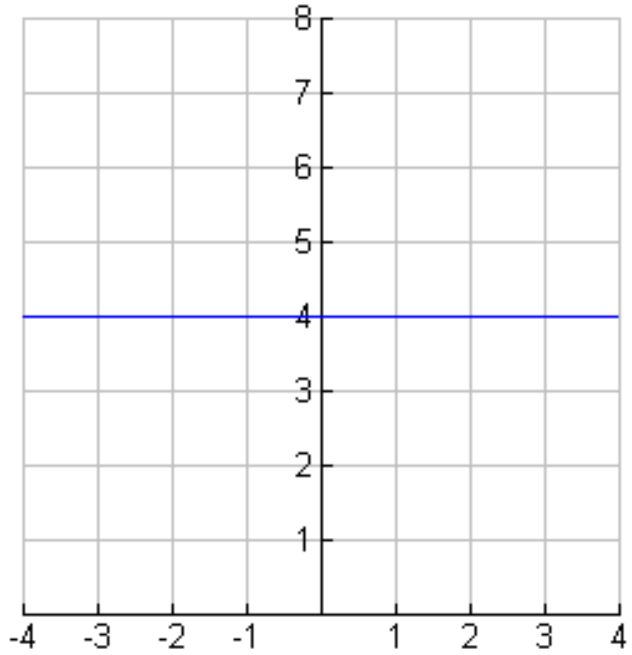
a) Describe in words the daily rental arrangements made by each of these three agencies.

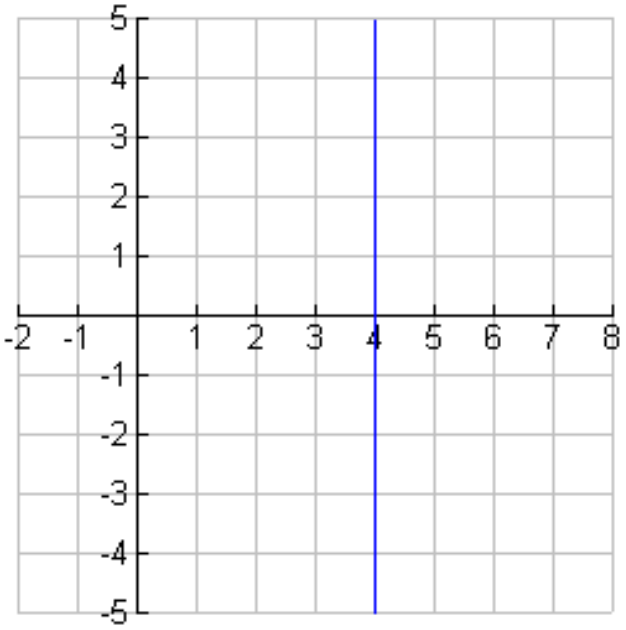
b) Which agency is cheapest?


150
100
50
100
125
200

# Equations of Horizontal and Vertical Lines

Explain why the equation $y = 4$ represents a horizontal line and the equation $x = 4$ represents a vertical line.



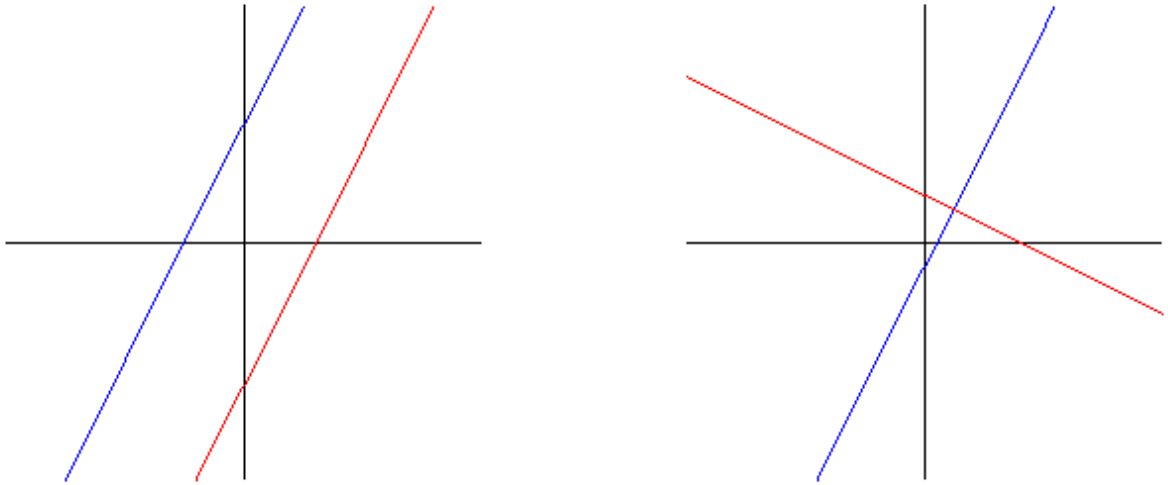



# Horizontal and Vertical Summary

For any constant $k$:

1) The graph of the equation $y = k$ is a horizontal line and its slope is zero.
2) The graph of the equation $x = k$ is a vertical line and its slope is undefined.

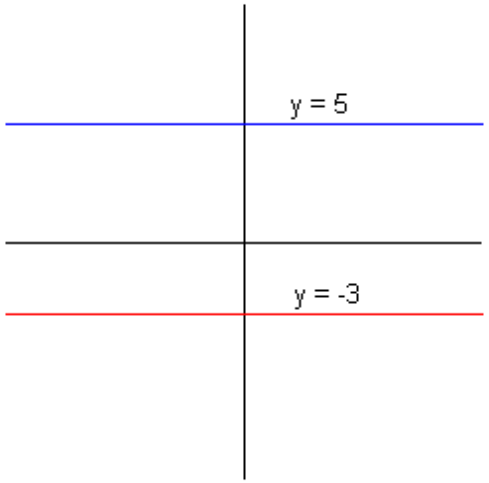
# Slopes of Parallel and Perpendicular Lines



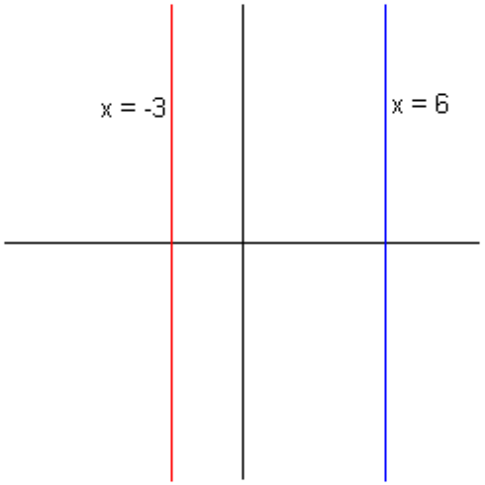
Two lines having slopes $m_1$ and $m_2$.

1) The lines are parallel if and only if $m_1 = m_2$.
2) The lines are perpendicular if and only if $m_1 = -1/m_2$.

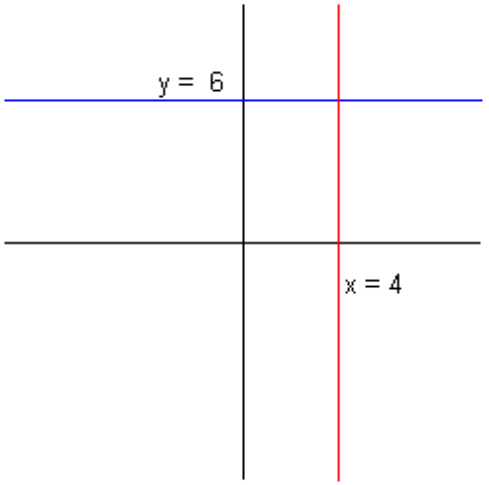
# Some Observations




Any 2 horizontal lines are parallel




Any 2 vertical lines are parallel




Vertical lines are perpendicular to horizontal lines

# Problem #15

Find the equations of the lines parallel to and perpendicular to the line $y + 4x = 7$, and through the point (1, 5).

# Problem #18

Find the equation of the line $l_2$ pictured to the right. Assume that $l_1$ and $l_2$ are perpendicular.