Chapter 1

Linear Equations and Linear Functions

Section 1.1

Using Qualitative Graphs to Describe Situations

Reading a Qualitative Graphs

Reading Qualitative Graphs

Example

Let *p* be the retail price (in dollars) or Air Jordans and *t* be the number of years since 1985.



What does this graph (or curve) tell us? As *t* increases, what happens to *p*?

Identifying Independent and Dependent Variables

Independent and Dependant Variables

Definition

Assume that an authentic situation can be described by using the variables *t* and *p* and that *p* depends on *t*:

- •We call *t* the **independent variable**.
- •We call *p* the **dependent variable**.

Identifying Independent and Dependent Variables

Independent and Dependant Variables

Example

Identify the independent variable and the dependent variable.

You are filling a swimming pool. Let *r* be the rate (in gallons per hour) at which water is added to a swimming pool, and let *t* be the number of hours It takes to fill the pool.

Identifying Independent and Dependent Variables

Independent and Dependant Variables

Solution

- Shorter amount of time to fill the pool, the higher the rate at which water is added to the pool
- Amount of time, *t*, it takes to fill the pool, depends on the rate at which water is added, *r*
- *t* is the dependent variable and *r* is the independent variable.
- The rate at which water is added to the pool does *not* depend on the amount of time it takes to fill the pool.

Reading a Qualitative Graph

Independent and Dependant Variables

Example

Let *A* be the average age (in years) when men first marry, and let *t* be the number of years since 1900. The graph describe the relationship between the variables *t* and *A*.

What does the graph tell us?



Reading a Qualitative Graph

Independent and Dependant Variables

Solution

• Graph tells us that the average age when men first marry decreased each year for a while and then increased each year after than



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Definitions

Independent and Dependant Variables

Definition

An intercept of a curve is any point where the curve and an axis (or axes) intercept.

The shape of the top curve is a *parabola*.

The shape of the bottom curve is a *linear line*.



Sketching a Qualitative Graphs

Sketching Qualitative Graphs

Example

Let *C* be the cost (in dollars) of a 30-second ad during the Super Bowl at *t* years since 1987. For most years the annual increase in cost is more than the previous annual increase in cost. Sketch a qualitative graph that describes the relationship between *C* and *t*.

Sketching a Qualitative Graphs

Sketching Qualitative Graphs

Solution

- Cost of an ad varies according to year
- *C* is the dependent variable
- *t* is the independent variable
- Ads were not free in 1987 (t=0)
- *C*-intercept (or dependent variable intercept) is positive.

Sketching a Qualitative Graphs

Sketching Qualitative Graphs

Solution Continued

- Cost increase, so the curve goes up from left to right
- Most increases are more than the previous year.
- Curve should "bend" upward from left to right.



The shape of this curve is said to be exponential.

Definitions

Sketching Qualitative Graphs

Definition

If a curve goes...

... upwards from left to right it is said to be **increasing**.

... downward from left to right it is said to be **decreasing.**

Increasing Decreasing

Sketching Qualitative Graphs



Which curve is increasing

Which is decreasing?



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Increasing Decreasing

Sketching Qualitative Graphs

Solution

From left to right the first curve is increasing and the second is decreasing.



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Sketching a Qualitative Graph

Sketching Qualitative Graphs

Example

The percentage of flight attendants laid-off by top United States airlines increased from 2001 to 2004 and decreased thereafter.

Let *P* be the percentage of flight attendants laid-off by top United States airlines, and *t* be years since 2001.

Sketch a quantitative graph that describes the relationship between the variable.

Sketching a Qualitative Graph

Sketching Qualitative Graphs

Solution

- The percentage of flight attendants laid off is determined by the time after 2000
- The curve increases then decreases
- *P* is the dependant variable and *t* the independent variable
- Both *P* and *t* are nonnegative.



Quadrants

Sketching Qualitative Graphs



P and *t* are both nonnegative, so the curve is in Quadrant I.

- What quadrant would the curve be in if *P* and *t* were both negative?
- What would the values of *P* and *t* be if the curve was only in Quadrant II, or IV>