4/3/2021

Linear Functions
    Relationships/Sequences
Interpreting Linear Equations
Scatterplots

Linear Sequence vs. Exponential Sequence (vs. Others)

Exponential sequences : the change in the terms is achieved by multiplying one term by a fixed multiplier to get the next term, and so

Linear sequences: the change in terms is achieved by adding a constant to one term to obtain the next term.

The equation of a line in slope-intercept form: $y = mx + b$

$$y = ax + b \qquad y = b_0 + b_1 x$$

The constant is the intercept, and the coefficient of x is the slope

$$y = 35.1x$$

Y is in miles, and x is in gallons of gas, intercept is 0 (no constant in the equation).

Units of the slope are in units of $\frac{y}{x}$.
Recall the slope formula $m = \frac{\Delta y}{\Delta x} = \frac{change\ in\ y}{change\ in\ x} = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$

35.1 has units of miles/gallon

$$35.1 \frac{miles}{gallon} \times 10\ gallons = 351\ miles$$

Interpret the slope: the number has units of y over x:

For each gallon of gas purchases, the car can drive 35.1 miles.
(assume you have one 1 unit off x)

Childhood growth

$$y = 20 + 3x$$

Y is height in inches (after x years), and x is years since birth

Units of slope are inches per year (in/yr)
Interpret the slope: the average growth per year is three inches per year
For each year of age, the child grows three inches

What about the intercept: the value you get when x is zero. When the child is born, the average height is 20 inches.

You can't always interpret the intercept.

$$y = 35.1x - 10.2$$

In an equation like this, the intercept is saying that when x is zero, you can drive negative 10.2 miles: does not make real-world sense.

If the x is in years (2021)…

Sometimes these values result from the trend not starting at x=0, but at some larger value of x.

Scatterplots : see Excel

Review for exam

Conversion:

1100 **square** inches and we want to convert that to **square** centimeters.

Conversion factor for inches to centimeters is 1 in = 2.54 centimeters

$$1100\ in^2\ \times \left(\frac{2.54\ cm}{1\ in}\right)^2 = 1100\ in^2 \times 6.4516 \frac{cm^2}{in^2} = 7096.76\ cm^2$$

Scaling:

10 cubic meters to be scaled up to a model with 400 cubic meters. What is the scaling factor needed?

Volume ratio $\frac{400\ m^3}{10\ m^3} = 40$

Take the cube root of the ratio to make it the linear scaling factor $\sqrt[3]{40} = 40^{\frac{1}{3}} = 3.42$

Both:

10 cubic meters to be scaled to 400 cubic feet.

1 meter = 3.28 feet

$$10\ m^3 \times \left(\frac{3.28\ ft}{m}\right)^3 = 10 \times 35.287552\ ft^3 = 352.87552\ ft^3$$

Volume ratio: $\frac{400\ ft^3}{352.87552\ ft^3} = 1.133544\ldots$

Linear scaling factor is the cube root of this number: $\sqrt[3]{1.133544} = 1.04266\ldots$

Expected value (weighted average).

x	\$20	\$0
Prob(x)	0.51	0.49

20*0.51+0*0.49 = 20*0.51= \$10.2

$$5x^2 + 9x - 22 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$