ALGEBRA & CROSS-TABULATION

Where is she going with this?

- Solving for an unknown quantity
- Variables
- Weighted averages
- Cross-tabulation

Solving for unknown quantity

Problem: $x + 4 = 7$

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Goal: Isolate the unknown variable

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Process: Do the same operation to both sides

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$$x + 4 = 7$$

$$x + 4 - 4 = 7 - 4$$

Solving for unknown quantity

Problem: $x + 4 = 7$

Goal: Isolate the unknown variable

Process: Do the same operation to both sides

$$x + 4 = 7$$

$$x + 4 - 4 = 7 - 4$$

$$\boldsymbol{x = 3}$$

Solving for unknown quantity

Problem: $3x = 12$

Solving for unknown quantity

Problem: $3x = 12$

Goal: Isolate the unknown variable

Process: Do the same operation to both sides

$$3x = 12$$

Solving for unknown quantity

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$$3x = 12$$

$$\frac{3x}{3} = \frac{12}{3}$$

Solving for unknown quantity

Problem: $3x = 12$

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Process: Do the same operation to both sides

$$3x = 12$$

$$\frac{3x}{3} = \frac{12}{3}$$

$$\boldsymbol{x = 4}$$

YOU TRY

1. $x + 5 = 12.7$
2. $\frac{38}{216} = \frac{x}{1{,}000}$
3. $5(3x - 2) = 35$
4. $\frac{3}{x} = 6$
5. $4x^2 = 100$

Variables

- Variable: a quantity that during a calculation is assumed to vary or be capable of varying in value
  - *Often represented as a letter or a symbol*
  - *For example* $x, y, z, a, b, \beta, \alpha, \theta, \ldots$

Function Notation

$$y = 4x - 3$$

$$f(x) = 4x - 3$$

$$g(x) = 2x - 1$$

$$h(x) = 5x - 6$$

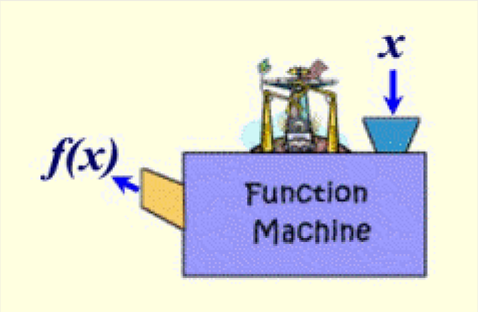

Image: http://www.regentsprep.org/, 2016

Evaluating Algebraic Equations

$$y = 5 + 2x$$

When given values for *x*, obtain *y*

x: {2, 4, 7, 12}

$$y = 5 + 2(2) = 5 + 4 = 9$$

$$y = 5 + 2(4) = 5 + 8 = 13$$

$$y = 5 + 2(7) = 5 + 14 = 19$$

$$y = 5 + 2(12) = 5 + 24 = 29$$

$$f(x) = 5 + 2x$$

When given values for *x*, evaluate the function

x: {2, 4, 7, 12}

$$f(2) = 5 + 2(2) = 5 + 4 = 9$$

$$f(4) = 5 + 2(4) = 5 + 8 = 13$$

$$f(7) = 5 + 2(7) = 5 + 14 = 19$$

$$f(12) = 5 + 2(12) = 5 + 24 = 29$$

YOU TRY

1. Evaluate $y = \frac{2}{3}\alpha + 4\beta$ for $\alpha = 5$ and $\beta = 2$.

2. If $f(x) = x^2 - x + 2$, then $f(5) = ?$

3. Given $f(x) = x^2 - x + 2$, evaluate $f(2a)$.

Average vs. Weighted Average

You're taking a class for which you have received three grades: an 85% on your midterm, a 91% on your project, and a 93% on your final. All count equally toward your final grade. What is your final percentage grade?

$$\frac{85 + 91 + 93}{3} = 89.7$$

Average vs. Weighted Average

You’re taking a class for which you have received three grades: an 85% on your midterm, a 91% on your project, and a 93% on your final. All count equally toward your final grade. What is your final percentage grade?

$$\frac{85 + 91 + 93}{3} = 89.7$$

If instead the midterm and project were worth 30% of your grade and the final was worth 40% of your grade, what would be your final percentage?

Average vs. Weighted Average

Average

$$\frac{85 + 91 + 93}{3} = 89.7$$

Average vs. Weighted Average

Average

$$\frac{85 + 91 + 93}{3} = 89.7$$

$$\left(\frac{1}{3}\right)85 + \left(\frac{1}{3}\right)91 + \left(\frac{1}{3}\right)93 = 89.7$$

Average vs. Weighted Average

Average

$$\frac{85 + 91 + 93}{3} = 89.7$$

$$\left(\frac{1}{3}\right)85 + \left(\frac{1}{3}\right)91 + \left(\frac{1}{3}\right)93 = 89.7$$

Weighted Average

$$\left(\frac{3}{10}\right)85 + \left(\frac{3}{10}\right)91 + \left(\frac{4}{10}\right)93 = 90$$

Average vs. Weighted Average

Average

$$\frac{85 + 91 + 93}{3} = 89.7$$

$$\left(\frac{1}{3}\right)85 + \left(\frac{1}{3}\right)91 + \left(\frac{1}{3}\right)93 = 89.7$$

$$(0.33)85 + (0.33)91 + (0.33)93 = 88.8$$

Weighted Average

$$\left(\frac{3}{10}\right)85 + \left(\frac{3}{10}\right)91 + \left(\frac{4}{10}\right)93 = 90$$

$$(0.3)85 + (0.3)91 + (0.4)93 = 90$$

Average vs. Weighted Average

Average

$$\frac{85 + 91 + 93}{3} = 89.7$$

$$\left(\frac{1}{3}\right)85 + \left(\frac{1}{3}\right)91 + \left(\frac{1}{3}\right)93 = 89.7$$

$$(0.33)85 + (0.33)91 + (0.33)93 = 88.8$$

Weighted Average

$$\left(\frac{3}{10}\right)85 + \left(\frac{3}{10}\right)91 + \left(\frac{4}{10}\right)93 = 90$$

$$(0.3)85 + (0.3)91 + (0.4)93 = 90$$

YOU TRY

For a particular disease, 80% of cases are among children <10-years-old. Among these children, the risk of experiencing serious sequelae is 15%. In older children and adults, the risk of serious sequelae is only 5%. What is the risk of serious sequelae overall for all ages?

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Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

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Other names: frequency table, contingency table

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2×2 table

	Breast cancer	No breast cancer
Gene variant A	5	10
Gene variant B	7	30

Cross-tabulation

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2 × 2 table

	Breast cancer	No breast cancer
Gene variant A	5	10
Gene variant B	7	30

cell

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2×2 table

	Breast cancer	No breast cancer	
Gene variant A	5	10	15
Gene variant B	7	30	37
	12	40	

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2 × 2 table

	Breast cancer	No breast cancer	
Gene variant A	5	10	15
Gene variant B	7	30	37
	12	40	

margins

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2 × 2 table

	Breast cancer	No breast cancer	
Gene variant A	5	10	15
Gene variant B	7	30	37
	12	40	52

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2 × 2 table

	Breast cancer	No breast cancer	
Gene variant A	5 (5/52)	10	15
Gene variant B	7	30	37
	12	40	52

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2 × 2 table

	Breast cancer	No breast cancer	
Gene variant A	5 (0.096)	10	15
Gene variant B	7	30	37
	12	40	52

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2×2 table

	Breast cancer	No breast cancer	
Gene variant A	5 (9.6%)	10	15
Gene variant B	7	30	37
	12	40	52

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2 × 2 table

	Breast cancer	No breast cancer	
Gene variant A	5 (9.6%)	10 (19.2%)	15
Gene variant B	7 (13.5%)	30 (57.7%)	37
	12	40	52

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2 × 2 table

	Breast cancer	No breast cancer	
Gene variant A	5 (9.6%)	10 (19.2%)	15 (28.8%)
Gene variant B	7 (13.5%)	30 (57.7%)	37 (71.2%)
	12 (23.1%)	40 (76.9%)	52

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2 × 2 table

	Breast cancer	No breast cancer	
Gene variant A	5 (9.6%)	10 (19.2%)	15 (28.8%)
Gene variant B	7 (13.5%)	30 (57.7%)	37 (71.2%)
	12 (23.1%)	40 (76.9%)	52 (100%)

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2 × 2 table

	Breast cancer	No breast cancer	
Gene variant A	5 (5/12)	10	15
Gene variant B	7 (7/12)	30	37
	12	40	52

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2 × 2 table

	Breast cancer	No breast cancer	
Gene variant A	5 (41.7%)	10	15
Gene variant B	7 (58.3%)	30	37
	12	40	52

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2 × 2 table

	Breast cancer	No breast cancer	
Gene variant A	5 (41.7%)	10	15
Gene variant B	7 (58.3%)	30	37
	12 (100%)	40	52

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2 × 2 table

	Breast cancer	No breast cancer	
Gene variant A	5 (41.7%)	10 (25%)	15 (28.8%)
Gene variant B	7 (58.3%)	30 (75%)	37 (71.2%)
	12 (100%)	40 (100%)	52 (100%)

Cross-tabulation

a tool that allows you analyze the relationship between two or more categorical variables

2 × 2 table

	Breast cancer	No breast cancer	
Gene variant A	5 (33.3%)	10 (66.7%)	15 (100%)
Gene variant B	7 (18.9%)	30 (81.1%)	37 (100%)
	12 (23.1%)	40 (76.9%)	52 (100%)

YOU TRY

In a particular class, 12 of 27 people with a height greater than 66 inches prefer pizza. Of the 49 students in the class, 10 have a height less than or equal 66 inches and prefer soup.

Construct a frequency table describing the relationship between food preference and height. Use the table to answer these questions. Given that a person prefers soup, is the person more likely to be taller or shorter than 66 inches? Does it seem like pizza/soup preference is related to height?

Cross-tabulation

- Helps us understand the relationship between categorical variables (or those that can be made categorical)
- Good way to summarize data
- Can be useful in organizing diverse pieces of data about the same population