

Vertical Progression:

<p>6th Grade</p>	<p>ELG 6.5 Apply and extend previous understandings of arithmetic to algebraic expressions.</p> <ul style="list-style-type: none"> ○ 6.EE.A.2 Write, read, and evaluate expressions in which letters stand for numbers. <p>ELG 6.1 Understand ratio concepts and use ratio reasoning to solve problems.</p> <ul style="list-style-type: none"> ○ 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
<p>7th Grade</p>	<p>ELG 7.1 Analyze proportional relationships and use them to solve real-world and mathematical problems.</p> <ul style="list-style-type: none"> ○ 7.RP.A.2 Recognize and represent proportional relationships between quantities. ○ 7.RP.A.2.a Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. ○ 7.RP.A.2.b Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. ○ 7.RP.A.2.c Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as $t = pn$. ○ 7.RP.A.2.d Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$ where r is the unit rate.
<p>8th Grade</p>	<p>ELG 8.6 Use functions to model relationships between quantities.</p> <ul style="list-style-type: none"> ○ 8.F.B.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. ○ 8.F.B.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. <p>Note: Functions may include linear, quadratic, exponential, polynomial (quadratic or cubic), square root, cube root, and piecewise-defined functions (including step and absolute value).</p>
<p>Algebra 1</p>	<p>ELG.MA.HS.F.2 Interpret functions that arise in applications in terms of the context</p> <ul style="list-style-type: none"> ○ F-IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*</i> ○ F-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*</i> ○ F-IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*

Students will demonstrate command of the ELG by:

- Constructing a function to model a linear relationship using different forms (tables, graphs, equations).
- Determining the rate of change and the initial value of a linear function from a graph or a table.
- Explaining the meaning of the rate of change and initial value of a linear function based on the context.
- Drawing a graph based on a description of the relationship between two quantities.
- Analyzing the relationship between two quantities shown on a graph.

Vocabulary:

- constant
- coordinate plane
- decreasing
- equation
- function
- graph
- increasing
- initial value
- linear
- non-linear
- ordered pair
- rate of change
- slope-intercept form
- table
- x-intercept
- y-intercept

Sample Instructional/Assessment Tasks:

1) Standard(s): 8.F.B.4

Source: <https://www.illustrativemathematics.org/content-standards/8/F/B/4/tasks/383>

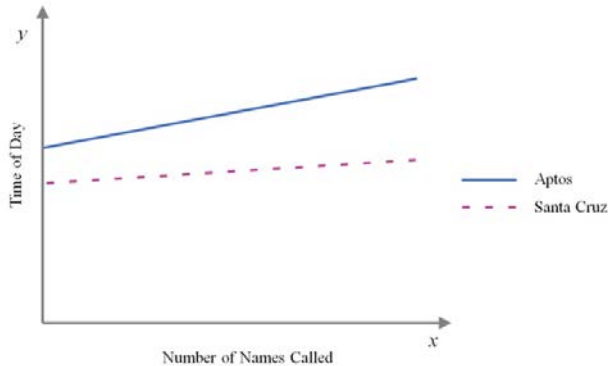
Item Prompt:

The SLV High School graduation started at 1:00PM. After some speeches, the principal started reading off the names of the students, alphabetically by last name. When he finishes, the graduation will end.

a. Use the bulletin shown below to estimate when the graduation will end.

San Lorenzo Valley High School Class of 2011		San Lorenzo Valley High School Class of 2011	
Micah Stephen Adams	Amber Anne Chaso	Nicholas Gregory Hargraves	Matthew Alexander Lipperd
Xavier Josue Alvin	Piye Elise Chavez	Alexander Samuel Hammett	Madeline Elizabeth Lopez
Connor James Anttila	David Thomas Augustus	David Michael Hart	Emily Marie Madison
David Zachary Baker	Joe Darlene Chinn	Melissa Lorraine Harvey	Rebecca Lynn Makita
Bradley Garrett Barnard	Emily Elizabeth Clements	Olivia Louise Herrera	Savanna San Mangelsen
Joseph Barnes	Claire Elizabeth Cloud	Kasia Adair Hill	Zane Michael Markham
James Alexander Barnes	Steven Dennis Connelly	Ludmila Eliana Hipsley	Alfredo Martinez
Michael Barton	Conor Thomas D'Amato	Jazelle Gina Hooper	Tyler Cameron Mattson
Sarah Raiha Beasley	Cassandra Suzanne Davis	Mariah Donna May Hopkins	Wayne Thomas McCarthy
Alison Rose Beasley	Lauren Marie Dempewolf	Lindsay Marie Hoppin	Theo Christopher McClash
Emily Anne Bechle	Blake Bradley Dennis	Bryn Kathryn Horton	Annelise Marie McFarland
Brandon Scott Bevers	Jake Madison Debreuil	Thomas John Housek	Alexander Michael McIntosh
Patrick Fereva Belardi	Shannon Elaine Eisner	Ellen Joanne Irwin	Dominique Sharee McIntosh
Katlyn Elia Benson	Emily Anne Engel	Jordan Isaacson	Victoria McKenzie
Jordan Starr Thomas Bereman	Dominique Ferguson	Joseph Clifford Jansen	Violet Josette McNally
Taylor Reneae Foster Bernitto	Samantha Marie Jones	Allison Kristine Jarus	Kendra Dee Messimer
Ashley Michelle Ann Billington	Christina Marie Freitas	Nettie Pearl Mitchell Johnson	Marissa Grace Brundick
Morgen King Biswa	Anju Friend	Lacey Marie Johnson	Sage Nicole Monick
Jaclyn Kate Black	Nathaniel Justin Fruzza	Felipe Johnson	Thomas Ocean Moreno
Xitlali Borreson	Mariah Nichole Gaimez	Shelby Danielle Johnson	Rainbow Roxanne Muchamael
Chere Nicole Brandon	Robin Lavender Garcia	Zachary David Johnson	Nicholas Jeffrey Newberry
Sydney Lauren Garcia Breil	Ronja Andrea Garcia	Dakota Shea Jones	George Austin Norfleet
Curtis Martin Brewer	Mason Garrett	Tanner William Jones	Travis James Nugent
Katherine Evelyn Brown	Kylee Anne Genis	Clara Joy Kemau	Joseph Carl Olson
Annika Bruce	Melanie Lauren Geim	Mia Anne Kellogg	Lacie Marie Orlando
Amanda Lynn Bruce	Andrea Serena Godbout	Maxine Elaine Kelly	Mary Elaine Ivy Orr
David Michael Burge	Angela Gonzales	Ryan Scott Kennedy	Austin Leonard Overton
Jordan Donovan Burk	Angela Marie Gougeon	Jenny Rae Kersten	Haley Lauren Pace
Nicholas Ryan Burks	Dakota Makua Gorman	Andrew Benjamin King	James Evan Paolini
Joseph Thomas Burton	Donna Jeanette Gorman	Russell Theodore Klair	Timothy William Parker
McLean Avery Cernacho	Michael Marie Grindy	Zachariah Wiyia Toghil Klaus	Carson Taylor Painter
Alexander Austin Campbell	Erin Cassidy Groszard	Christina Rose Knoll	Zachary Alan Peabody
Jason William McGregor	Krista Marie Grunberger	Jessica Danielle Kraft	Katrina May Pearce
Taylor James Casey	Tyler Alan Hagen	Jessica Ann Lacy	Samuel Jackson Phippley
Kory Daniel Chadwick	Hazel Gladys Jane Haikkila	Joseph Allan Landry	Chandler Elizabeth Perazzo
Audrey Elizabeth Chapin	Marcus Taylor Halverson	Abbie Mae Leveque	Sebastian Thomas Peterson
			Hannah Mae Petras
			Rachael Danielle Pfister
			Jesse Dean Phillips
			Saree Iris Potter
			Kirstin Jane Prather
			Haley Brooke Prunella
			Brittany Lynette Ramirez
			Sondra Marie Raymond
			Nathan Daves Reader
			Kristy Marie Reक्टर
			Sergio Aldo Ringelman
			Christopher Ross Rivket
			Joshua David Roberts
			Lara Elaine Rodriguez
			Brandon Douchard Ruiz
			Kaiya Irene Salangasing
			Erik Mark Sanchez
			Fiona Darlene Sans
			James Trevor Sawyer
			Jared Warrior Schell
			Lial Melissa Schrell
			Jessica Marie Simonick
			Megan Danielle Sirabak
			David Thyaman Stadwick
			Logan James Smith
			Elizabeth Smith
			Dillon Sean Sohooza
			Nicolas Aaron Sovolewski
			Miles Random Staggs
			Bruce Louis Steinberg
			Matthew McGree Stewart
			Kelsey Anne Stillier
			Daniel Todd Sutton
			Deanna Marie Tindell
			Antoinette Jordan Townsend
			Joseph Ryan Turnbale
			Rachel Ana Unli
			Natalie Vernazza
			Rochelle Whitney Viola
			Carson Alexander Walker
			Daniel Herrera Wetherhorn
			Quillen Arthur White
			Jessica Lynn Whitehall
			Stephanie Anne Wildman
			Jessica Kayla Wood
			Alajha Kathleen Wyllie
			Peter Francis Zavaroni
			Graduation coordinators:
			Class President - Hazel Haikkila
			Vice President - Lindsey Hoagan
			Secretary - Morgan Biswa
			Treasurer - Bradley Barnard
			Principal - Michael Billings
			Assistant Principal - Kent Arredondo
			Counselors - Leslie Ebbage
			Noreen Floden
			Annabel Nolan
			Jeff Burns
			Board of Trustees - Kip Dakota, President
			Les Tellez, Clerk
			Laura Ritchie, Trustee
			Kathy Wylie, Trustee
			George Dolson, Trustee
			Superintendent - Julie Belardi
			Director Student Activities - Leslie Ebbage
			Program cover artwork - Shannon Hall '11

- b. Estimate how long the speeches took. How do you know?
- c. Write an equation that the parents could use to find the approximate time the principal will call their child's name given the child's position in the list in the graduation program.
- d. Aptos High School and Santa Cruz High School started their graduations at the same time. The graphs shown below show the time of day as a function of the number of names the principal has read at each school. Write down as many differences between the two graduations as you can based on differences in the two graphs. Give your reasons for each.



Correct Answer(s)

- a. The principal had read 40 names by 1:28 and 65 names by 1:33. That yields a differential of 25 names in 5 minutes or 5 names per minute. There are 126 names remaining to be called.

$$\frac{126 \text{ names}}{5 \text{ names}} = 25.2 \text{ minutes}$$

The graduation will last approximately 25 minutes after 1:33. If it takes exactly 25 more minutes, the graduation will end at 1:58. It is reasonable to say that the graduation ceremony will end close to 2:00 p.m.

- b. Assuming the principal read 5 names per minute, the initial 40 names took $40 \text{ names} \cdot \frac{1 \text{ minute}}{5 \text{ names}}$ or 8 minutes to read. We know the 40th name was read at 1:28, which means the principal began reading names at 1:20 or so. Since the graduation itself started at 1:00, the speeches took about 20 minutes.

- c. The principal began reading names at 20 minutes past 1:00. Let n be the child's position in the list in the graduation bulletin and t be the number of minutes past 1:00 the child's name will be called. Assuming each name requires $1/5$ minutes, then one equation would be:

$$t = \frac{n}{5} + 20$$

We can emphasize the fact that t , the number of minutes after 1:00 is a function of n , the position in the graduation list by writing the answer using function notation:

$$t(n) = \frac{n}{5} + 20$$

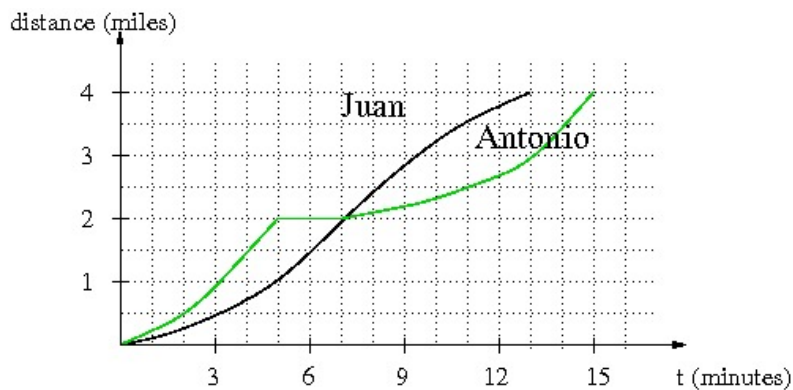
- d. Aptos started calling names later because its y-intercept is greater; in other words, more time has passed before Aptos started calling names. The principal at Aptos calls out names more slowly because the slope, which corresponds to the number of "minutes per name," is greater. In other words, it takes the principal a greater number of minutes per name to read the list.

2) Standard(s): 8.F.B.5

Source: <https://www.illustrativemathematics.org/content-standards/8/F/B/5/tasks/633>

Item Prompt:

Antonio and Juan are in a 4-mile bike race. The graph below shows the distance of each racer (in miles) as a function of time (in minutes).



- Who wins the race? How do you know?
- Imagine you were watching the race and had to announce it over the radio, write a little story describing the race.

Correct Answer:

- Juan wins the race. He will have finished the race in 13 minutes while Antonio takes 15 minutes to ride the same distance.

- Answers may vary. Here is one example:

Juan and Antonio are off for a 4-mile bike race. Antonio has the early lead. He is picking up speed, pulling away from Juan who seems to have some trouble finding his stride.

Antonio looks like the clear favorite 4 minutes into the race. But wait, he is in trouble now – oh no, he ran off the road and fell off his bike. He seems a bit dazed sitting at the side of the road. Okay, he is getting up and checking that all limbs are still working. He lost two minutes getting up and dragging his bike out of the ditch, but now he is back on the bike.

Juan had a slow start but he was picking up speed and now is virtually flying by Antonio, just as he is getting back on this bike. Can Juan keep up his newfound speed or will Antonio catch up again? Juan passed Antonio 7 minutes into the race and with 2 miles to go. He is pulling ahead now of Antonio who looks like he is hurting a little bit after his fall and has trouble finding his old speed.

Oh no, Juan is losing steam and slowing down. Is his advantage big enough to get him over the finish line ahead of Antonio? Yes! He has won the race in 13 minutes and is collapsing into the grass trying to catch his breath after his epic win. Where is Antonio? Ah, here he is coming now, he is speeding up, going really fast as he crosses the finish line at the 15-minute mark, but too late to make a difference in the race.