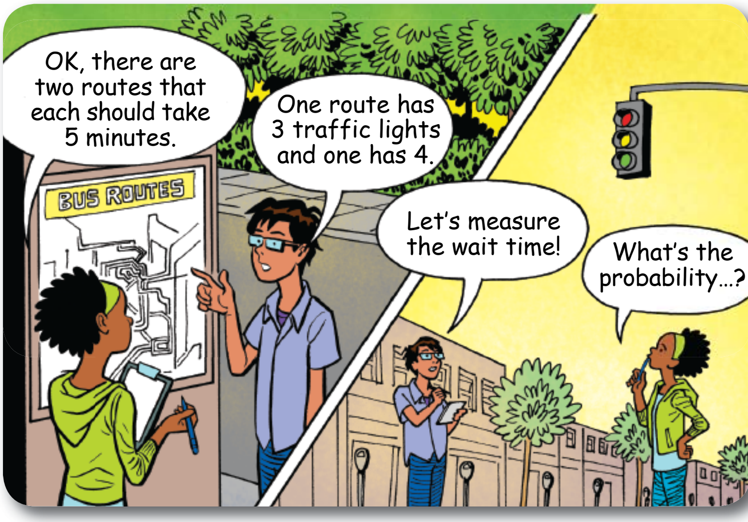
The Case of the Tardy Transportation

Athena and Rick have received an e-mail from the school's transportation director. One of the school's buses is almost always late and she needs to find a solution. "Can you help?"



There are two possible routes the bus can take. If there were no traffic lights, either route would take five minutes. The bus currently takes Elm Street, which has three traffic lights. An alternate route using Washington Road has four lights. "Three lights must be faster than four," suggests the director, but Rick and Athena want to investigate.

Rick first goes to each intersection and measures how long each red light stayed red. Athena then uses the average lengths of the red and green lights to determine the probability of each light being red or green and the average wait time at a red light. Here are their findings:

Elm Street Route		
Intersection	**Average Wait Time for a Red Light**	**Probability of a Red Light**
Main Street	2 minutes	1/2
Post Road	2 minutes	1/2
Fairview Avenue	2 minutes	1/2

Washington Road Route		
Intersection	**Average Wait Time for a Red Light**	**Probability of a Red Light**
Village Road	1 minute	1/10
Prospect Road	1 minute	1/10
Broad Street	1 minute	1/10
Market Street	1 minute	1/10

Athena knows that to find the total time each route would typically take, she needs to multiply the probability of a red light at each intersection by the average wait time at a red light. She then decides to add those times to the length of time it would take the bus to complete each route with no red lights.

WORK THE MATH

Show your work—use separate paper as needed.

1 **How long will it typically take to complete the Elm Street route? The Washington Road route?**

2 **On the Washington Road route, what is the probability of having the Village Road and Prospect Road lights both be green?**

3 **What is the probability of having all four lights be green on the Washington Road route?**

HINTS:

- To find the probability of more than one event happening, multiply the individual probabilities.
- The probability that a light will be red or green is 100%, or 1.0, expressed as a decimal. The probability of a light being green is 1 – the probability of it being red.

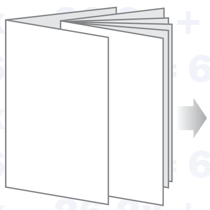
Bonus Worksheets & Take-Home Activities

Expect the Unexpected With Math®

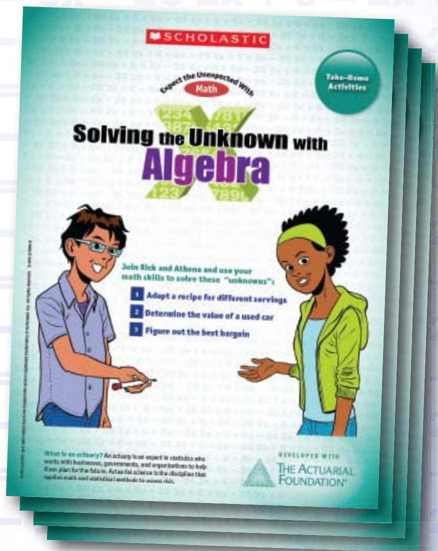
Solving the Unknown with Algebra

INSIDE:

3 Bonus Worksheets
(remove cover of booklet)



31 Take-Home Activity Booklets
(one for each student)



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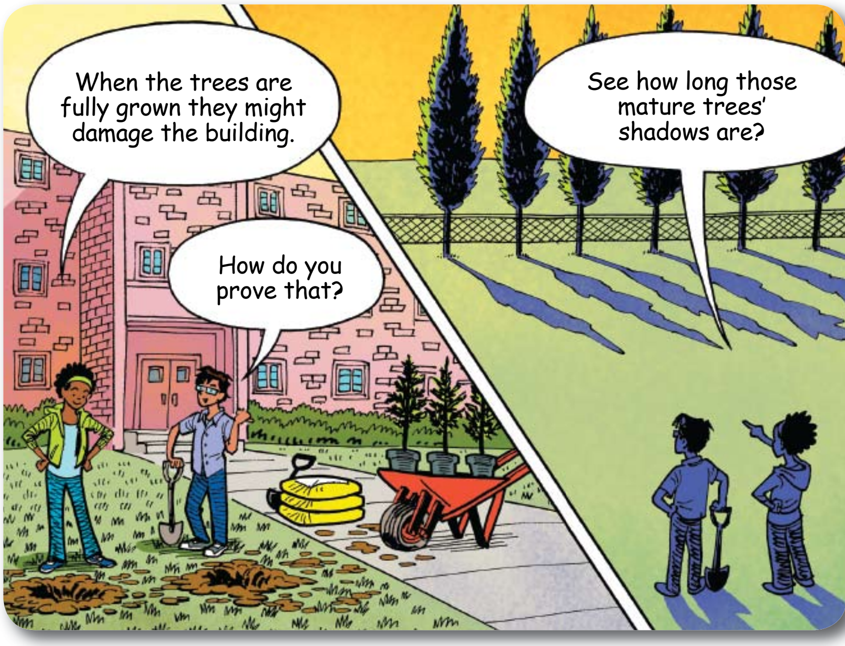
The Case of the Perilous Planting

Athena and Rick have been asked to inspect the planting of some Scots pine trees at school. Athena notices that holes have been dug for the young trees (now 3 feet tall) and that the holes are about 60 feet from the school. "If the trees are too close," she says, "they could damage the building in a severe windstorm when they're fully grown."



"How do you prove that?" asks Rick. Athena notices some mature Scots pine trees with shadows about 30 feet long. She then measures a young tree's shadow and finds it to be one foot. "New holes need to be dug!" exclaims Athena. "The trees are too close to the school!"

WORK THE MATH

Show your work—use separate paper as needed.

1 **Why is Athena so sure that the young trees are being planted too close to the school building? Hint: Think about setting up a proportion as you did when you compared the distance on a map to the distance in the real world.**

2 **Just before sunset, the young trees cast a six-foot shadow. Using the height of a mature tree calculated in problem 1, how long are the mature trees' shadows just before sunset?**

NOW TRY THIS:

The school building is 45 feet tall. How long a shadow would the building cast if measured at the time of the tree-planting?

The Case of the Smelly Sandwich

Sometimes Athena and Rick receive non-serious requests. One such e-mail reported that a rotting sandwich had been removed (with tongs) from a school locker and was swarming with the bacteria *malodorous fictitious*. The e-mail also claimed:

- This particular bacteria is found in food at a concentration of 10 bacteria per cubic centimeter.
- There were 1,000 of the bacteria per cubic centimeter in the sandwich.
- The bacteria reproduces rapidly, doubling every week.

The e-mail challenged the duo to figure out how long the sandwich had been in the locker. Rick and Athena got to work. "Maybe we could use the growth formula," Rick suggested. "The growth formula works like the formula for compound interest: $y = a(1 + r)^n$, where y = the ending number of bacteria, a = the starting number of bacteria, r = the growth rate, and n = the number of time periods." Since the number of bacteria doubles every week, Rick further determined that the growth rate was 100% per week. Expressed as a decimal, Rick determined that r would equal 1.

WORK THE MATH

Show your work—use separate paper as needed.

1 **What is the growth rate (r) of the bacteria?**

2 **What is the starting number of bacteria?**

3 **What is the ending number of bacteria?**

4 **In what unit of time (days, weeks, months, etc.) is the growth rate recorded?**

5 **Was the sandwich in the locker at least a month? How do you know?**

6 **Approximately how long was the sandwich in the locker?**