

THE HARDEST MATH PROBLEM

GRADE 8

There's a new club at Monroe Middle School thanks to three persuasive students—Vishal, Maria, and Jade. When the principal read their proposal for EARTH Club, she smiled and said, "Environmentally **Aware** and **Ready to Help!** What a great title! Now what activities do you have planned?"

"First, we'll study the declining population of bees," said Vishal.

"Bees are vital to our ecosystem," Maria explained.

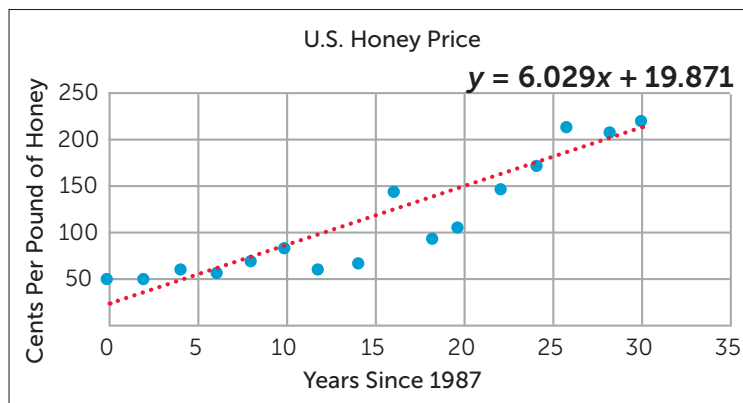
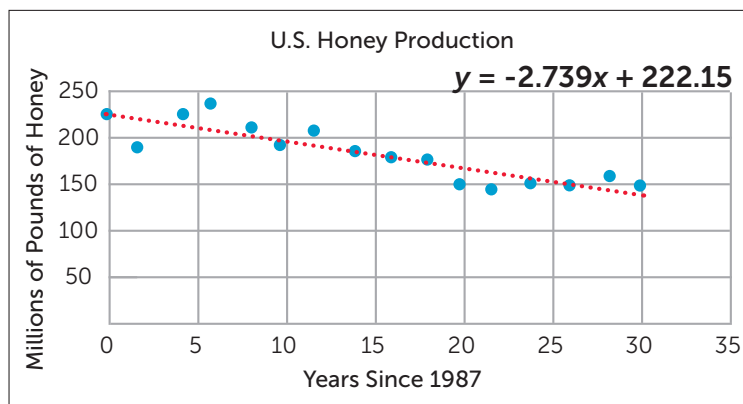
"Did you know that when they transfer pollen, they start the process of reproduction in about 80 percent of plants? That includes fruits, vegetables, flowers, and seeds."

"It also includes around 90 different types of food, like apples and pumpkins," Jade added.

"Wow," said the principal. "The EARTH Club is officially approved!"

Solve the Problem

Jade read that honey is in high demand at stores right now because more and more people want natural sweeteners. She was interested in looking at the relationship between honey production and the cost of honey over the same set of years. She considered the graphs below:



For the **25-year** period from 1992 to 2017, **find the percent change in honey production and the percent change in honey price**. Include the complete decimal in the trend line equations. For example, use 6.029 and 19.871 (all digits to the thousandths place) in the production equation. Round only at the end of all your calculations, and round each of the final two answers to the nearest whole number percent.

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CHALLENGE 1 ANSWER KEY — GRADE 8

Although each problem does have a correct numeric solution, there are multiple pathways students can take to arrive at the answer. Teachers, if your students answered Challenge 1 correctly, they are invited to enter Challenge 2! Get the Challenge 2 materials at scholastic.com/hardestmathcontest.

Calculating Changes in Production and Price

Step 1: The first thing I need to do is really look closely at the graphs. For both graphs, the x-axis is labeled “Years Since 1987.” For the production graph, the y-axis is labeled “Millions of Pounds,” and for the price graph, the y-axis is labeled “Cents Per Pound.”

Step 2: Next, I will label my trend line equations so I remember what the variables represent.

<p>Honey production</p> $y = -2.739x + 222.15$ <p>↑ Millions of pounds of honey</p> <p>↑ Number of years since 1987</p>	<p>Honey price</p> $y = 6.029x + 19.871$ <p>↑ Price of honey in cents per pound</p> <p>↑ Number of years since 1987</p>
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Step 3: I will start with honey production and use that equation to find the value y , millions of pounds of honey, for each of the two years.

$$\begin{aligned}
 1992 - 1987 &= 5 \text{ years, so} \\
 x &= 5 \\
 y &= -2.739x + 222.15 \\
 y &= -2.739(5) + 222.15 \\
 y &= -13.695 + 222.15 \\
 y &= 208.455
 \end{aligned}$$

$$\begin{aligned}
 2017 - 1987 &= 30 \text{ years, so} \\
 x &= 30 \\
 y &= -2.739x + 222.15 \\
 y &= -2.739(30) + 222.15 \\
 y &= -82.17 + 222.15 \\
 y &= 139.98
 \end{aligned}$$

In 1992, honey production was 208.455 million pounds (which is a shorter way of writing 208,455,000 pounds), and in 2017, it was 139.98 million pounds (139,980,000 pounds).

Step 4: To find percent change in honey production between these two years, I use the percent change formula:

$$\begin{aligned}
 \% \text{ of change} &= \frac{\text{amount of change}}{\text{original value}} \\
 &= \frac{(208.455 \text{ million} - 139.98 \text{ million})}{208.455 \text{ million}} \\
 &= \frac{(208.455 \text{ million} - 139.98 \text{ million})}{208.455 \text{ million}} = \frac{68.475 \text{ million}}{208.455 \text{ million}} = 0.328488163... \approx 33\%
 \end{aligned}$$

Since honey production went down from 1992 to 2017, this is a 33% decrease in honey production. I could also report this as a change of -33%.

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Step 5: Now I will use the equation for honey price and do similar substitutions.

In 1992

$$y = 6.029x + 19.871$$

$$y = 6.029(5) + 19.871$$

$$y = 30.145 + 19.871$$

$$y = 50.016$$

In 2017

$$y = 6.029x + 19.871$$

$$y = 6.029(30) + 19.871$$

$$y = 180.87 + 19.871$$

$$y = 200.741$$

In 1992, the price of honey was 50.016 cents per pound, and in 2017 it was 200.741 cents per pound.

Step 6: To find percent change in honey price between these 2 years, I use the percent change formula:

$$\begin{aligned} \% \text{ of change} &= \frac{\text{amount of change}}{\text{original value}} \\ &= \frac{(200.741 - 50.016)}{50.016} \\ &= \frac{150.725}{50.016} \approx 3.013535668... \approx 301\% \end{aligned}$$

Since the value went up from 1992 to 2017, this is a 301% increase in honey price.

Final answers: For the 25-year period from 1992 to 2017, the percent change in honey production was a **33% decrease (or -33%)**, and the percent change in honey price was a **301% increase**.