October 26th Puzzle

Math History-Mystery Puzzle

President Truman Nearly Doubles the Minimum Wage

by David B. Spangler
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Print & Digital

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October 26: President Truman Nearly Doubles the Minimum Wage

On **October 26** of the *Mystery Year*, **President Harry S. Truman proposed legislation requiring the federal minimum wage increase from $0.40 per hour to $0.75 per hour** — almost doubling it. The law went into effect 90 days later (on January 24), and it was one of President Truman's actions taken to deliver on his **Fair Deal.** His Fair Deal recommended that all Americans have health insurance, that the minimum wage (the least amount of money per hour that someone can be paid) be increased, and that, by law, all Americans be guaranteed equal rights.

President Harry S. Truman,
33rd U.S. President

Mystery Year

Use the clues on the next page to find the *Mystery Year*.

____	____	____	____
Thousands	Hundreds	Tens	Ones

October 26 CLUES

Use these clues to find the *Mystery Year:*

- **What was the *percent of increase — as a decimal* — in the minimum wage when it increased from \$0.40 per hour to \$0.75 per hour? Round to the nearest tenths place.** (Percent of Increase = $\frac{\text{amount of increase}}{\text{original number}}$)

  The digit in the tenths place is the ones digit of the *Mystery Year.*

- **\$0.75 per hour during the *Mystery Year* is worth about 1,045% more in today's dollars (due to inflation). What is the equivalent of \$0.75 per hour in today's dollars, rounded to the nearest cent?**

  The digit in the hundredths place is the tens digit of the *Mystery Year.*

- **Tara and Tonya each started a job earning their state's minimum wage. Tara works at Store A, making \$11/hour with a bonus of \$36 for agreeing to work night shifts. Tonya works at Store B earning \$15/hour.**

  After how many hours must each work before they will have earned the same amount?

  The number of hours is the hundreds digit of the *Mystery Year.*

- **Evaluate the expression below to find the year when Truman's proposal *went into law.* Use that result to check the *Mystery Year.***

$$2020 - 3^2 - 4^2 - 5^2 - 2 \div 0.1$$

October 26: President Truman Nearly Doubles the Minimum Wage

President* *Harry S. Truman,
33rd U.S. President

On **October 26** of the *Mystery Year*, **President Harry S. Truman proposed legislation requiring the federal minimum wage increase from $0.40 per hour to $0.75 per hour** — almost doubling it. The law went into effect 90 days later (on January 24), and it was one of President Truman's actions taken to deliver on his **Fair Deal.** His Fair Deal recommended that all Americans have health insurance, that the minimum wage (the least amount of money per hour that someone can be paid) be increased, and that, by law, all Americans be guaranteed equal rights.

As of 2020, the federally-mandated minimum wage is $7.25/hour, a rate that has not increased since 2009. However, a push to raise this to a "living wage" of $15/hour is gaining momentum, having now been enacted in 8 states to be phased in by 2025.

Use these clues to find the *Mystery Year:*

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______	______	______	______
Thousands	Hundreds	Tens	Ones

How to Use
Math History-Mystery Puzzles
Warm-up Activities for Middle School

Each puzzle begins with historical information about a particular person or event. The topics selected reflect the diverse nature of our society. Students use the clues that follow to determine the *Mystery Year* when the event occurred. In some cases, data needed to solve a clue is contained within the historical information. This reinforces what students experience in the real world: The data needed to solve a problem may not all appear in the same place.

The math content of the warm-ups is based on a ***spiral review of skills***. During the early months of the school year, they provide important math review skills drawn from Grades 5 and 6. As the year progresses, the skills advance to those of Grades 6 and 7 — with an abundance of real-world connections related to the contexts of the events. Towards the end of the school year, math skills from Grade 8 are included that can also be handled intuitively by students in earlier grades. It should be noted that many **high-school teachers** are using the puzzles with success to provide students with important skills review in context.

Students focus on a number of different math skills and concepts in the same warm-up. The spiral review is intended to help students keep their skills sharp. Also, the clues are intended to provide day-to-day mathematical variety. So, while students may be studying in unit, on, say, percent, they may be solving clues that review fractions or measurement.

Each clue produces a *digit* of the *Mystery Year.* As the clue is solved, students record the digit in the box to the right of the clue and into the place-value chart for the *Mystery Year* at the bottom of the first page of the puzzle. **The final clue with each puzzle provides a "check" for determining the correct *Mystery Year.***

Provided with each puzzle are extensive **Teacher Notes with Sample Solution Strategies** that include valuable teacher information that address the following:

- The specific **Common Core State Standards for Mathematical Content** that are addressed in the clues. When a clue employs skills that are not directly addressed by a Standard for Mathematical Content, one or more **Standards for Mathematical Practice** are cited.
- **Step-by-step solutions** designed so thoroughly that parents working with students at home are equipped to help their child. *Alternative solution strategies* are detailed to illustrate various paths to the solution.
- **Math Notes** that provide additional **mathematical background** for the teacher. This includes various pedagogical insights that include an analysis of related ***common student misconceptions*** **with *intervention suggestions.***
- **Extensions** that allow advanced students to take the content to the next level.
- **Multicultural Notes** to bring to light the contributions from various cultures related to the discovery / development of the content of the puzzle.
- **Historical Notes** to provide further context for the theme of the puzzle. Often these notes delve into **social justice issues** related to the theme of the puzzle. Included are links to **video clips** and uplifting **quotes**.

Even though we do not provide a separate puzzle for each day of a given week, we view the puzzles as being ***daily puzzles*** because of the extensive activities and extensions that are provided with the Teacher Notes that may be used during the other days of the week.

To download a FREE, more extensive document describing **How to Use** the puzzles, go to https://www.teacherspayteachers.com/Product/FREE-How-to-Use-Math-History-Mystery-Puzzles-for-Middle-School-manual-7037642

Teacher Notes and Sample Solution Strategies for October 26

October 26: President Truman Nearly Doubles the Minimum Wage

CCSS: 5.NBT.7, 6.RP.3, 7.RP.3, MP2 (Reason Abstractly and Quantitatively), 7.EE.3, 6.EE.1, MP6 (Attend to Precision).

Mystery Year: **1949**

- Percent of change, or percent increase as in this case, is the ratio or comparison of the amount of the change to the original number. The minimum wage increased from \$0.40/hour to \$0.75/hour, a change or difference of \$0.35. To find the percent increase, divide 0.35 (the growth amount) by 0.40 (the original number): $0.35 \div 0.40 = 0.875$. When rounded to the nearest tenth, the result is 0.9. The digit in the tenths place is 9, so the ones digit of the *Mystery Year* is 9.

  Math Notes: Be sure to mention that 0.9 = 90%, which is close to 100%. As the title of the puzzle indicates, President Truman's proposal "nearly doubled" the then minimum wage of \$0.40/hour. Ask: *How much of an increase would have doubled the minimum wage of \$0.40?* (Doubling \$0.40 would be an increase of \$0.40 per hour, resulting in a new minimum wage of \$0.80/hour.)

  Financial Literacy Extensions: Pose this problem:

  Suppose \$0.40 is increased by 200%. What is the new result? Explain.

  Sample Solution: Each increase of 100% increases the original number (the base) by \$0.40. So, a 100% increase brings the result from the base of \$0.40 to \$0.80. A 200% increases doubles that increase of \$0.40 to an increase of \$0.80. So, the new result is \$0.40 + \$0.80, or \$1.20.

  Pose this problem: *Suppose the price of an item goes from \$2 to \$8. What is the percent of increase? Explain.*

  Sample Solution: Each increase of \$2 represents a 100% increase from \$2 (the base). So, going from \$2 to \$4 represents a 100% increase. Going from \$2 to \$6 represents a 100% + 100%, or a 200% increase. Finally, going from \$2 to \$8 represents a 100% + 100% + 100%, or a 300% increase.) A **common misconception** is that some students believe the increase is 400% because $8 \div 2 = 4$. Point out that we began with a price of \$2, so the amount of increase is \$6, not \$8.

- To convert the \$0.75/hour minimum wage to an equivalent wage in today's dollars, the cumulative inflation rate of 1,045% must be applied. (Mention that *inflation* is the general increase in prices over a period of time.) To find 1,045% *of* \$0.75, multiply 10.45 (the decimal form of 1,045%) and 0.75: $10.45 \times \$0.75 = \$7.8375$. Rounded to the nearest cent, the result is \$7.84. This means that the minimum wage of \$0.75/hour in President Truman's legislation would be equivalent to an hourly wage today of about \$7.84. Because the hundredths digit in \$7.84 is 4, the tens digit of the *Mystery Year* is 4.

  Math Notes: Some students have difficulty writing the decimal equivalent for a percent greater than 100%. Some students have the **misconception** that all percents are numbers that are less than or equal to 1 (perhaps confusing a percent with a probability). Remind students that *percent* means "per 100." You may need to point out words that have "cent" in them such as century (100 years), cent (100 cents = 1 dollar), and centimeter (100 centimeters = 1 meter). Mention that percent is a ratio of a number to 100. So, 39% can be expressed as the ratio $\frac{39}{100}$, which has the decimal equivalent, 0.39. Thus, 1,045% can be expressed as the ratio $\frac{1{,}045}{100}$, which has the decimal equivalent, 1,045 ÷ 100, or 10.45.

Some students may need additional support in comprehending percents that are greater than 100%. Provide scaffolding such as this: *Suppose your goal is to practice the violin for 30 minutes, and you practice all 30 minutes. What percent of your goal did you accomplish?* (100%) *Suppose you set a new goal to practice 45 minutes. How many extra minutes is that?* (15 minutes) *What percent of the original 30 minutes is 15 minutes?* (15 minutes is half of 30, so it is 50% of 30 minutes.) *So, if 45 minutes is 50% longer than 30 minutes, then 45 minutes represents what percent of 30 minutes?* (100% + 50%, or 150%)

Financial Literacy Extensions: Pose additional situations involving percents greater than 100%: *If an original investment in a stock of $20 is now worth 500% of the original value, how much is the stock now worth?* (It is now worth 5 times as much as the original value, or $100 because 500% represents 5 groups of 100%) *Suppose the $20 stock is now worth 1,000% of its original investment?* (It is now worth 10 times as much, or $200 because 1,000% represents 10 groups of 100%.) *How does the situation of a stock price of $20* increasing to *500% of its value different from a stock price of $20 increasing* by *500%?* (A $20-stock that is *now worth 500% of its original value* is now worth 5 times its original price. So, it is now worth 5 × $20, or $100. A $20-stock *whose value increases by 500%* is now worth 5 groups of 100% *more* than its original $20. So, it is now worth $20 + 5 × $20, or $120.)

For reference and further exploration, have students analyze the Federal Reserve Economic Data (FRED) Graph provided at the end of these notes.

- Using reasoning and the strategy, *guess, test, and revise,* students may test different numbers of hours Tara and Tonya would need to work before each will have earned the same amount. Students may randomly test different numbers, but organizing their work in a table may help them visualize patterns and reasonable numbers to test, as shown below:

Number of Hours Worked	**Tara** **$11/hour + $36 bonus**	**Tonya** **$15/hour**	**Check:** ***Are they the same?***
1	1 × $11 + 36 = $47	1 × $15 = $15	No, Tara is earning more than Tonya.
5	5 × $11 + $36 = $91	5 × $15 = $75	No, Tara is still earning more, but they are getting closer!
10	10 × $11 + $36 = $146	10 × $15= $150	No, but now Tonya is earning more!
9	**9** × $11 + 36 = $135	**9** × $15 = $135	Yes! When they both have worked **9** hours, they will have earned the same amount!

Because 9 is the number of hours that Tara and Tonya must work before they will have earned the same as each other, the hundreds digit of the *Mystery Year* is 9.

Math Notes: For more advanced students or students familiar with solving multi-step equations, they may opt to translate this scenario into an equation and solve algebraically, as shown below:

- Let $\boldsymbol{x}$ represent the number of hours Tara and Tonya must each work before they will have earned the same amount.
- Then the amount Tara would earn in that many hours is represented by $11x + 36$, and Tonya's amount earned is represented by $15x$.
- The equation representing "the number of hours they would need to work before each will have earned the same amount" is:

$$11x + 36 = 15x.$$

- Solve for x:

$11x + 36 = 15x$

$11x - 11x + 36 = 15x - 11x$ Subtract $11x$ from each side of the equation.

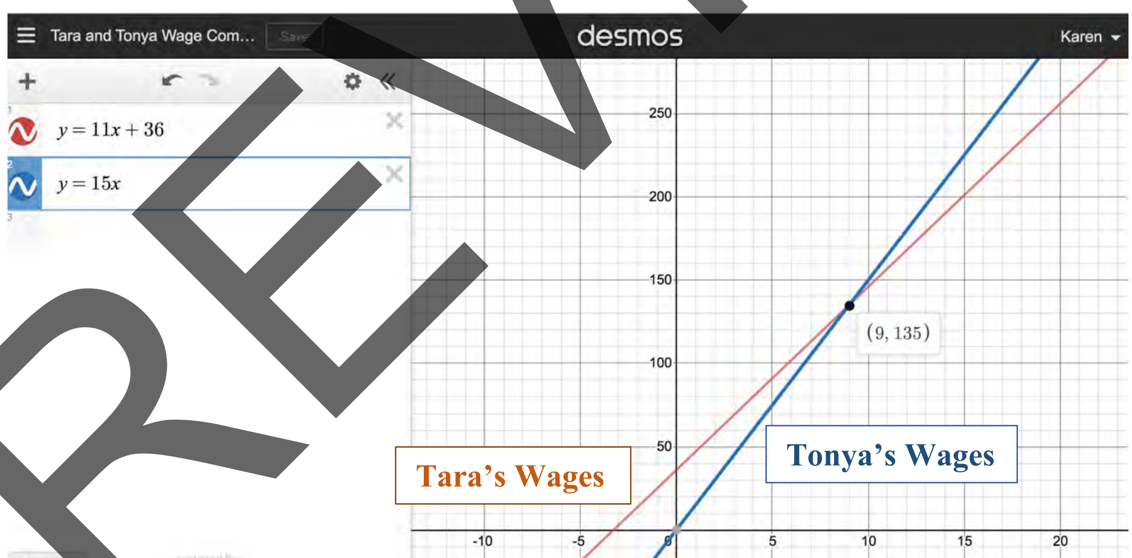
$36 = 4x$ Combine like terms.

$\frac{36}{4} = \frac{4x}{4}$ Divide each side by 4 to isolate the variable.

$9 = x$ Simplify each side.

So, after each has worked 9 hours, they will have earned the same amount. Thus, the digit in the hundreds place of the *Mystery Year* is 9.

Students may also solve the problem graphically, as shown by the system of two equations, $y = 11x + 36$ and $y = 15x$, graphed below using Desmos software.



Have students note where the two lines intersect (cross). Ask: *What information does the point of intersection tell us?* (The point of intersection (9, 135) shows when Tara and Tonya will have earned the same amount — namely, after 9 hours. It also shows that after 9 hours, each will have earned \$135.

Extension: Have students write their own math problems based on *state minimum wage rates.* This URL provides current state minimum wage rates:
< https://www.ncsl.org/research/labor-and-employment/state-minimum-wage-chart.aspx >

When this puzzle was written in August 2021, the state minimum wage rates ranged from \$15.00 in the District of Columbia to just \$7.25 in many states. (The Federal minimum wage rate in August 2021 was also \$7.25.) Encourage students to write problems involving the mean, median, mode, percents, and more. Students should then solve problems written by other students.

- Evaluate the expression:

$2020 - 3^2 - 4^2 - 5^2 - 2 \div 0.1 =$	
$2020 - 9 - 16 - 25 - 2 \div 0.1 =$	According to the order of operations, first evaluate the exponents: $3^2 = 9$, 4^2 16, $5^2 = 25$.
$2020 - 9 - 16 - 25 - 20 =$	Next, divide: $2 \div 0.1 = 20$.
1950	Finally, subtract from left to right.

Attention to detail is called for here, as the *Mystery Year* is the year the new federal minimum wage was *proposed* — not when it went it became law (in 1950). The introduction text provides the needed information to solve this clue: "The law went into effect 90 days later (on January 24)." Therefore, the *Mystery Year* occurred the year *prior to* 1950, namely, 1949. The digits of the *Mystery Year* determined so far are __ 9 4 9, so it is confirmed that the *Mystery Year* is 1949.

Historical Notes: President Truman's Fair Deal was an ambitious set of proposals, consisting of 21 points — mostly which were opposed by Congress. The increase in the minimum wage from \$0.40 to \$0.75 per hour, however, was viewed as less controversial, and it passed through Congress to become law in 1950.

The movement for minimum wages was first motivated as a way to stop the exploitation of workers in sweatshops, by employers who were thought to have unfair bargaining power over them. Over time, minimum wages came to be seen as a way to help lower-income families come closer to having a **"living wage"** — a wage that is great enough to sustain a normal standard of living for oneself and one's family. This includes the ability for one to pay for current necessities — which includes food, healthcare, and rent, along with a reasonable amount of leisure time.

There are pros and cons to a minimum wage. The cons include the possible fallout from employers who are challenged to meet this minimum and may have to reduce their work force/hours and/or raise prices for products/services to comply. The pros include increased work productivity, morale, and spending — along with the fact that their workers will now be closer to earning a "living wage."

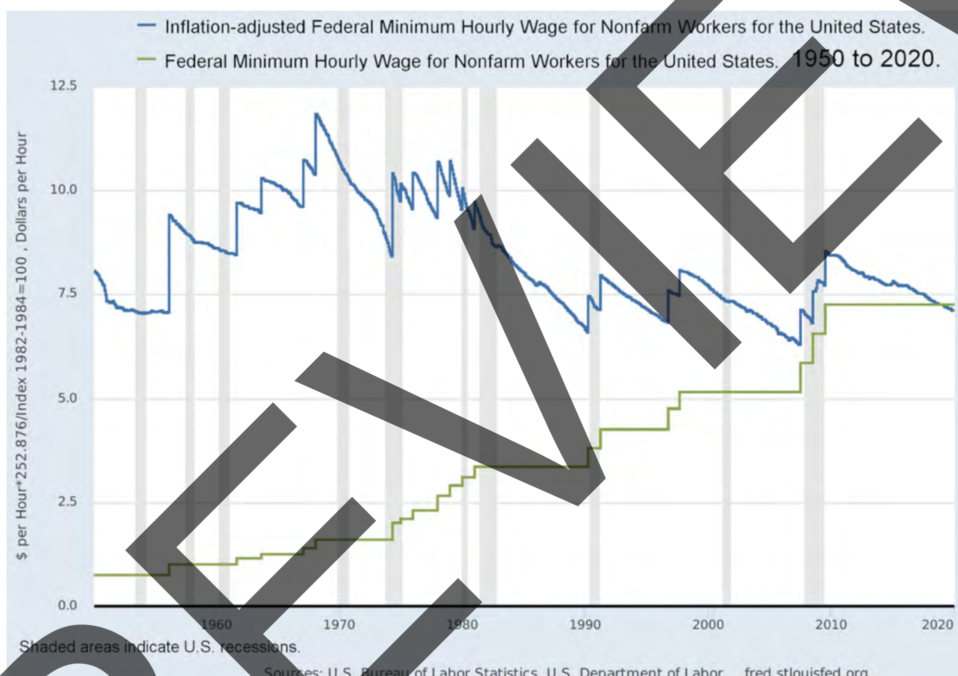
As of January 2020, there were 29 states and Washington, D.C. with a minimum wage greater than the federal minimum of \$7.25. This accounts for about 90% of all minimum-wage earners. The mean wage for all minimum-wage earners is \$11.80. The current push for raising the minimum wage to \$15/hour is gaining momentum and, as of 2020, has been adopted by the following states to be phased in by 2025: Connecticut, California, Illinois, Maryland, District of Columbia, Massachusetts, New Jersey, and New York.
Source: https://en.wikipedia.org/wiki/Minimum_wage_in_the_United_States

Many corporations have already enacted internal raises from the federal minimum wage of \$7.25. As of August 2021, those corporations included Costco (\$16/hr), Amazon (\$15/hr), Target (\$15/hr), Chipotle (\$15/hr), Under Armour (\$15), MacDonald's (range of \$11 to \$17/hr), and many more.
Source: https://www.fool.com/the-ascent/banks/articles/these-8-companies-are-increasing-wages-to-attract-more-employees/

Financial Literacy Extension: The graph below shows the history of the federal minimum wage from 1950 to 2020. The top line (in blue) is inflation-adjusted to 2020 dollars. You may want to pose questions such as the following to help students analyze the graph.

- *When did the overall **inflation-adjusted** federal hourly wages have close to a 30-year decline?* (from about 1980 to 2008)
- *When did the overall **inflation-adjusted** federal hourly wages have about a 6-year improvement?* (from about 1962 to 1968)
- *During which year did those earning the minimum wage have their best buying power?* (about 1967 or 1968)
- *During which year were the **inflation-adjusted** federal hourly wages lower than the federal minimum wage?* (2020)

Federal Reserve Economic Data (FRED) Graph



Source:
https://upload.wikimedia.org/wikipedia/commons/3/30/Timeline_of_federal_minimum_hourly_wage_for_nonfarm_workers_for_the_United_States._And_inflation-adjusted.gif

Read, "Minimum Wage: Facts and Analysis" (from the Employment Policies Institute, a non-profit research organization dedicated to studying public policy issues surrounding employment growth): https://bit.ly/3sNbtpF

Watch "Harry Truman, President of the United States" (21:17):
https://www.youtube.com/watch?v=lzSS_ZcWZsw

"It is a measure dictated by social justice. It adds to our economic strength. It is founded on the belief that full human dignity requires at least a minimum level of economic sufficiency and security."
—***President Harry S. Truman*** *(1884–1972), on his minimum wage legislation*