Percent Increase and Percent Decrease

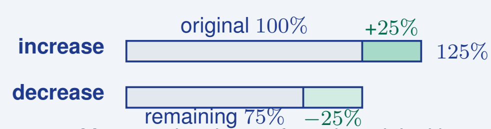
Name: ______________	Date: ____________	Score: _____ / 17

Percent increase and percent decrease tell you *how much* something changed *compared with where it started*—and that last part is the key! The percent is always based on the **original** amount, not the new amount, which is why a 20% increase and a 20% decrease are not exact opposites unless the starting values match. Once you get this idea, you can make sense of rising prices, shrinking populations, and changing data with confidence. This is one of those skills you will use in the news, at the store, and in science class!

Key Concepts & Quick Review

$\%$ Change $= \dfrac{\text{New} - \text{Original}}{\text{Original}} \times 100$. Positive $\Rightarrow$ increase. Negative $\Rightarrow$ decrease.

New value from % change: Increase: New $=$ Original $\times(1+r)$. Decrease: New $=$ Original $\times(1-r)$. (r = rate as a decimal)



Measure the change from the original bar.

Examples

① A price rose from $\$40$ to $\$52$. Find the percent increase. Then find the new price if it later decreases by 15%.

Think It Through: % increase: $\dfrac{52-40}{40} \times 100 = \dfrac{12}{40} \times 100 = 30\%$. After 15% decrease: $52 \times (1 - 0.15) = 52 \times 0.85 = \$44.20$.

Answer: 30% *increase; new price after decrease:* $\$44.20$

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② A town's population dropped from $18{,}500$ to $16{,}280$. Find the percent decrease to the nearest tenth of a percent. If the population then grows by 8%, what is the new population?

Think It Through: % decrease: $\dfrac{18{,}500 - 16{,}280}{18{,}500} \times 100 = \dfrac{2{,}220}{18{,}500} \times 100 \approx 12.0\%$. After 8% growth: $16{,}280 \times 1.08 \approx 17{,}582$ people.

Answer: $\approx 12.0\%$ *decrease; new population* $\approx 17{,}582$

Practice Problems

Find the percent increase or decrease, or find the new value after the given change.

1. A value changes from 20 to 28. Find the percent increase or decrease. ______
2. A value changes from 50 to 35. Find the percent increase or decrease. ______
3. A value changes from 80 to 100. Find the percent increase or decrease. ______
4. A value changes from 60 to 45. Find the percent increase or decrease. ______
5. A value changes from 120 to 150. Find the percent increase or decrease. ______
6. A value changes from 200 to 160. Find the percent increase or decrease. ______
7. A value changes from 45 to 54. Find the percent increase or decrease. ______
8. A value changes from 75 to 60. Find the percent increase or decrease. ______
9. A value changes from 90 to 108. Find the percent increase or decrease. ______
10. A value changes from 25 to 20. Find the percent increase or decrease. ______
11. Find the new value after increasing 60 by 20%. ______
12. Find the new value after decreasing 80 by 15%. ______
13. Find the new value after increasing 150 by 30%. ______
14. Find the new value after decreasing 240 by 25%. ______
15. Find the new value after increasing 500 by 8%. ______

Study Tips

- ☞ Always divide by the **original** value — never the new value. The original is the starting reference point.
- ☞ Shortcut for new value: instead of finding the change separately, multiply directly by $(1 + r)$ for increases or $(1 - r)$ for decreases.
- ☞ A 50% decrease followed by a 50% increase does **not** return to the original. Try it: $100 \to 50 \to 75$.

✍ Word Problems

16. A store's monthly revenue was $\$84{,}000$ in January. In February it rose to $\$96{,}600$ and in March it dropped to $\$89{,}000$. Find the percent increase from January to February and the percent decrease from February to March. Round to the nearest tenth of a percent. ______

17. A student's test score improved from 64 points to 80 points. Find the percent increase. If the same percent increase applies to a second student whose original score was 75 points, what is their new score? Round to the nearest whole point. ______

Answer Keys

1) 40% increase	**10)** 20% decrease
2) 30% decrease	**11)** 72
3) 25% increase	**12)** 68
4) 25% decrease	**13)** 195
5) 25% increase	**14)** 180
6) 20% decrease	**15)** 540
7) 20% increase	**16)** Jan→Feb: 15% increase; Feb→Mar: $\approx 7.9\%$ decrease.
8) 20% decrease	**17)** 25% increase; new score about 94
9) 20% increase	

Step-by-Step Explanations

Strategy: For Proportional vs. Non-Proportional Relationships, check whether the relationship has one constant multiplier and passes through the origin when graphed. For proportionality, test more than one pair so the constant is not just a coincidence.

Practice 1:

x	2	4	6
y	6	12	18

Answer: P

In the opening example, compare each y/x value; the table stays proportional only if the ratio never changes.

Practice 10:

x	6	9	12
y	2	3	4

Answer: P

For the end-of-set item, check all three ordered pairs against the same constant, not just the first two.

Word-problem notes:

11. Answer: Plan A is proportional ($y/x = 0.10$ always); Plan B is non-proportional (flat fee).
Plan A follows the rule $y = 0.10x$, so its costs are 1.00, 2.00, 3.00, and 4.00 for 10, 20, 30, and 40 texts. The ratio $\frac{y}{x}$ stays 0.10, so Plan A is proportional. Plan B follows $y = 0.05x + 5$, so the flat fee adds a starting amount before any texts are sent. Because of that extra 5, the ratios change, and the relationship is non-proportional.

12. Answer: Pool 1: $y = 200x$ (proportional); Pool 2: $y = 150x + 500$ (non-proportional).
Pool 1 starts empty, so its volume after x hours is just rate times time: $y = 200x$. Because it begins at 0, it passes through $(0, 0)$, so it is proportional. Pool 2 already has $500\,gal$, so its equation is $y = 150x + 500$. When $x = 0$, the volume is 500, not 0, so it does not pass through the origin. That is why Pool 2 is non-proportional.

13. Answer: Graph A is proportional (line through origin); $k = 2$. Graph B is not (does not pass through the origin).
Graph A passes through $(0, 0)$ and is a straight line, so it is proportional. Pick a clean point on it, such as $(1, 2)$ or $(3, 6)$, and divide y by x: $\frac{2}{1} = 2$ or $\frac{6}{3} = 2$, so $k = 2$. Graph B is also a straight line, but it crosses the y-axis at 2, not at the origin. Because it does not pass through $(0, 0)$, it is non-proportional even though it is linear.