Percent Error: How Close Are Your Estimates?

Name: _____	Date: _____	Score: _____ / 17

How close is "close enough"? That is exactly what **percent error** tells you! Instead of just looking at the size of a mistake, it compares the mistake to the *true value*—so the result is fair no matter how big or small the numbers are. A 2-unit difference can be tiny in one situation and huge in another, and percent error captures that perfectly. You will use this in science experiments, engineering projects, and anywhere accuracy matters.

Key Concepts & Quick Review

$$\% \text{ Error} = \frac{|\text{Estimated} - \text{Actual}|}{|\text{Actual}|} \times 100$$

The **actual** (exact/accepted) value is in the denominator. A small percent error means high accuracy. A 0% error means a perfect estimate. Percent error ≥ 0 always.

Examples

① A student estimates a classroom is 35 feet long. The actual length is 32 feet. Find the percent error. Round to the nearest tenth.

Think It Through: $\% \text{ Error} = \frac{|35 - 32|}{32} \times 100 = \frac{3}{32} \times 100 = 9.375 \approx 9.4\%$.

Answer: $\approx 9.4\%$ *error*

② A lab experiment measured a reaction time as $4.8\ s$. The accepted value is $5.0\ s$. Find the percent error and determine whether the measurement was an overestimate or underestimate.

Think It Through: $\% \text{ Error} = \frac{|4.8 - 5.0|}{5.0} \times 100 = \frac{0.2}{5.0} \times 100 = 4\%$. Since $4.8 < 5.0$, the measurement was an **underestimate**.

Answer: 4% *error; underestimate*

Practice Problems

Find the percent error for each estimate. Round to the nearest tenth of a percent.

1. An estimate is 50 and the actual value is 40. Find the percent error. _____
2. An estimate is 90 and the actual value is 100. Find the percent error. _____
3. An estimate is 12 and the actual value is 15. Find the percent error. _____
4. An estimate is 28 and the actual value is 25. Find the percent error. _____
5. An estimate is 76 and the actual value is 80. Find the percent error. _____
6. An estimate is 144 and the actual value is 150. Find the percent error. _____
7. An estimate is 9.5 and the actual value is 10. Find the percent error. _____
8. An estimate is 33 and the actual value is 30. Find the percent error. _____

9. An estimate is 200 and the actual value is 250. Find the percent error.

10. An estimate is 58 and the actual value is 60. Find the percent error.

11. An estimate is 4.8 and the actual value is 5.0. Find the percent error.

12. An estimate is 320 and the actual value is 300. Find the percent error.

13. An estimate is 18 and the actual value is 20. Find the percent error.

14. An estimate is 110 and the actual value is 120. Find the percent error.

15. An estimate is 7 and the actual value is 8. Find the percent error.

Study Tips

- Always divide by the **actual (accepted) value** — not the estimate. The actual value is the reference standard.
- Use absolute value bars so the result is **always positive**, regardless of whether the estimate is too high or too low.
- A smaller percent error means a **more accurate** estimate. In science, errors under 5% are generally considered acceptable.

Word Problems

16. A meteorologist predicted 3.2 inches of rain for the month. The actual rainfall was 4.5 inches. Find the percent error. Was it an overestimate or underestimate? If the following month the meteorologist predicted 5.8 inches and the actual was 5.5 inches, which month's prediction was more accurate?

17. Three students each estimate the mass of a rock. Student A estimates $\mathbf{148}\ g$, Student B estimates $\mathbf{135}\ g$, and Student C estimates $\mathbf{162}\ g$. The actual mass is $\mathbf{150}\ g$. Calculate each student's percent error and rank the estimates from most to least accurate.

Answer Keys

1) 25%
2) 10%
3) 20%
4) 12%
5) 5%
6) 4%
7) 5%
8) 10%
9) 20%
10) 3.33%
11) 4%
12) 6.67%
13) 10%
14) 8.33%
15) 12.5%
16) Month 1: $\approx 28.9\%$ (underestimate); Month 2: $\approx 5.5\%$ (overestimate); Month 2 more accurate.
17) A: $\approx 1.3\%$; B: 10%; C: 8%. Rank: A, C, B.

Step-by-Step Explanations

Strategy: For Writing Equations for Proportional Relationships, find the constant rate first, then put it into $y = kx$ so the equation can answer any input. For proportional equations, identify what y represents and what x represents before writing the rule.

Practice 1: Write the equation $y = kx$ when $k = 4$, then find y for $x = 6$. **Answer:** 24
For the first worked item, write the rule first, then substitute $x = 6$ so the equation does the organizing.

Practice 15: Use the equation $y = 1.2x$ to find y when $x = 15$. **Answer:** 18
Near the end of this topic, the equation already gives the rate, so substitute and multiply.

Word-problem notes:

16. Answer: $k = 2400$ pages/hr; $y = 2400x$; $7.5\,hr$: $18{,}000$ pages; 600 pages: $15\,min$.
Find the printing rate by dividing pages by hours: $1800 \div \frac{3}{4} = 1800 \times \frac{4}{3} = 2400$ pages per hour. So the equation is $y = 2400x$. For a 7.5-hour shift, $y = 2400 \times 7.5 = 18{,}000$ pages. To find how long it takes to print 600 pages, solve $600 = 2400x$. That gives $x = \frac{600}{2400} = 0.25$ hour, which is $15\,min$. The equation lets you work both forward and backward.

17. Answer: Amir: $y = 8x$; Bea: $y = 12x$; Bea fastest, Amir slowest; $2\,hr$: 16, 24, $22\,mi$.
First find each runner's constant speed. Amir's speed is $2 \div \frac{1}{4} = 8\,mi$ per hour, so his equation is $y = 8x$. Bea's speed is $9 \div \frac{3}{4} = 12\,mi$ per hour, so her equation is $y = 12x$. Carlos already has the equation $y = 11x$, so his speed is $11\,mi$ per hour. Comparing 8, 11, and 12 shows that Bea is fastest and Amir is slowest. After 2 hours, they run 16, 24, and $22\,mi$ respectively.

18. Answer: $k = 2$; $y = 2x$; $9\,lb$ costs \$18.
The line passes through the origin and through $(4, 8)$, so the relationship is proportional. Find k from the marked point: $k = \frac{8}{4} = 2$. The equation is $y = 2x$ (where y is dollars and x is pounds). For 9 pounds, substitute: $y = 2 \times 9 = 18$, so the cost is \$18.

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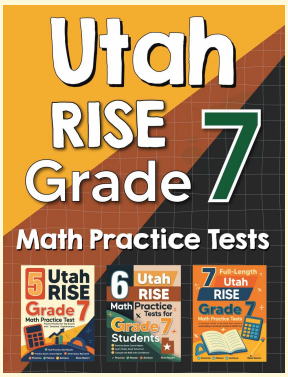

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