Name: _____ **Date:** _____

UNIT 1

1.1.10 — Percentages of Quantities

Percent as "per hundred" • Benchmark strategies • Multipliers • Estimation • Reverse percentages

A. PERCENT MEANS "PER HUNDRED"

Complete the equivalent fraction and decimal. Simplify the fraction where appropriate.

> Example: $35\% = \frac{35}{100} = 0.35$

Percentage	Fraction out of 100	Simplified fraction	Decimal
8%	_____	_____	_____
25%	_____	_____	_____
62%	_____	_____	_____
125%	_____	_____	_____
0.6%	_____	_____	_____

B. BUILD PERCENTAGES FROM BENCHMARKS

Use 10%, 5%, 1%, 20%, 25% or combinations of them. Show one efficient mental step for each.

1. 10% of 350 = _____
2. 5% of 240 = _____
3. 25% of 84 = _____
4. 15% of 120 = _____ Strategy: _____
5. 35% of 160 = _____ Strategy: _____
6. 2.5% of 320 = _____ Strategy: _____
7. 65% of 40 = _____

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UNIT 1

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C. DECIMAL MULTIPLIERS AND ESTIMATION

Estimate first, then calculate exactly. Include a short check that your exact answer is reasonable.

> General rule: $p\%$ of $Q = \frac{p}{100} \times Q$ Example: $0.35 \times 240 = 84$

Calculation	Reasonable estimate	Exact value
48% of 198		
37% of 460		
12.5% of 72		
6.4% of 375		

D. REAL-WORLD PERCENTAGE PROBLEMS

Choose a benchmark, multiplier or diagram. Give units and interpret the answer.

1. A jacket costs $68 and is reduced by 25%. Find the discount and the sale price.

2. A laptop battery stores 60 Wh when fully charged. The display shows 97%. How much energy is stored?

3. 40% of 30 students chose the bus for a field trip. How many students chose the bus? Explain why your answer must be a whole number.

4. A school sold 72% of 450 tickets before an event. How many tickets were sold, and how many remained?

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UNIT 1

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E. REVERSE A PERCENTAGE RELATIONSHIP

The given amount is a part of an unknown whole. Find the whole and check by multiplying.

> Model example: $0.30N = 18 \Rightarrow N = \frac{18}{0.30} = 60$

1. 35% of N is 28. Find N. _____
2. 12% of a number is 54. Find the number. _____
3. 62.5% of a quantity is 45. Find the whole quantity.

   _____
4. After a 25% discount, a backpack costs $63. Find the original price.

F. REASONING, ERRORS AND COMPARISON

Communicate mathematically: identify the faulty idea, provide a counterexample where useful, and justify your conclusion.

1. A student says, "20% of 50 is 50 ÷ 20 = 2.5." Explain the error and give the correct calculation.
2. Classify the claim as **always, sometimes or never true**: "A larger percentage produces a larger amount." Use 60% of 50 and 40% of 100 in your explanation.
3. Without a calculator, decide which is larger: 49% of 202 or 51% of 198. Explain your reasoning before calculating exactly.

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UNIT 1

1.1.10 — Percentages of Quantities

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G. EXTENDED / IB-STYLE CHALLENGE

These problems combine percentage ideas. Show a clear sequence of steps and state what each result represents.

1. A store reduces a $250 bicycle by 20%, then gives an additional 15% off the reduced price.

   (a) Find the final price. (b) Find the overall percentage discount. (c) Explain why the two discounts do not make a 35% discount.

2. A charity has raised 35% of its target. After receiving a further $3,900, it has raised 61% of the target. Find the fundraising target.

3. A school survey has 640 responses. 62.5% are from students. Of the student responses, 40% are from Year 1. How many Year 1 student responses are there? What percentage of all responses is this?

H. MODEL AND COMMUNICATE

Use the percentage as a multiplier or reverse the relationship. Include a sentence interpreting each answer.

1. A device has a 72 Wh battery. After several hours, 45 Wh remain. What percentage of the full battery remains? Give the answer to one decimal place.

2. A phone battery is at 80%. After using 18 percentage points of its full capacity, it contains 37.2 Wh. What is the phone battery's full capacity?

3. Create your own example showing that the same percentage applied to two different wholes gives proportional but different amounts. State the percentage, both wholes and both resulting parts.

ANSWER KEY

Name: _____ Date: _____

UNIT 1

ANSWER KEY — 1.1.10 Percentages of Quantities

Sections A–C

A. PERCENT MEANS "PER HUNDRED"

Percentage	Fraction out of 100	Simplified fraction	Decimal
8%	**8/100**	**2/25**	**0.08**
25%	**25/100**	**1/4**	**0.25**
62%	**62/100**	**31/50**	**0.62**
125%	**125/100**	**5/4**	**1.25**
0.6%	**0.6/100**	**3/500**	**0.006**

B. BENCHMARK PERCENTAGES

1. 35
2. 12
3. 21
4. 18; for example, 10% = 12 and 5% = 6, so 15% = 18.
5. 56; for example, 25% = 40 and 10% = 16, so 35% = 56.
6. 8; 5% of 320 = 16, then halve to get 2.5% = 8.
7. 26

C. DECIMAL MULTIPLIERS AND ESTIMATION

Calculation	Reasonable estimate	Exact value
48% of 198	50% of 200 ≈ 100	**95.04**
37% of 460	40% of 450 ≈ 180	**170.2**
12.5% of 72	1/8 of 72 = 9	**9**
6.4% of 375	6% of 400 ≈ 24	**24**

Name: _____ Date: _____

UNIT 1

ANSWER KEY — 1.1.10 Percentages of Quantities

Sections D–F

D. REAL-WORLD PERCENTAGE PROBLEMS

1. Discount = **25% of $68 = $17**; sale price = **$51**. $0.25 \times 68 = 17 \quad \Rightarrow \quad 68 - 17 = 51$
2. $0.97 \times 60 = 58.2$ Wh Therefore, **58.2 Wh** is stored.
3. 0.40 × 30 = **12 students**. A student count must be a whole number because students are discrete.
4. 0.72 × 450 = **324 tickets sold**; 450 - 324 = **126 tickets remaining**.

E. REVERSE A PERCENTAGE RELATIONSHIP

1. 0.35N = 28, so **N = 80**.
2. 0.12N = 54, so **N = 450**.
3. 0.625N = 45, so **N = 72**.
4. The sale price is 75% of the original: 0.75N = 63, so **N = $84**.

F. REASONING, ERRORS AND COMPARISON

1. 20% means 0.20 (or 1/5), so the student should multiply by 0.20 or divide by 5: **20% of 50 = 10**.
2. **Sometimes true.** For the same positive whole, a larger percentage gives a larger amount. With different wholes it may not: 60% of 50 = 30, while 40% of 100 = 40.
3. Both are close to 50% of 200 = 100. Exact values: 0.49 × 202 = **98.98**; 0.51 × 198 = **100.98**. Therefore 51% of 198 is larger by 2.

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UNIT 1

ANSWER KEY — 1.1.10 Percentages of Quantities

Sections G–H

G. EXTENDED / IB-STYLE CHALLENGE

1. After 20% off: \$250 × 0.80 = \$200. Then \$200 × 0.85 = **\$170**. Overall multiplier: $0.80 \times 0.85 = 0.68$ so the final price is 68% of the original; the overall discount is **32%**, not 35%, because the second discount is applied to the already-reduced price.
2. The extra \$3,900 moves the charity from 35% to 61%, a change of 26% of the target. Thus 0.26T = 3900, so **T = \$15,000**.
3. Student responses: 0.625 × 640 = 400. Year 1 student responses: 0.40 × 400 = **160**. As a percentage of all responses: 160/640 = **25%**.

H. MODEL AND COMMUNICATE

1. $\frac{45}{72} \times 100 = 62.5\%$ So **62.5%** of the battery remains.
2. 80% - 18 percentage points = 62%. Therefore 0.62C = 37.2, so **C = 60 Wh**.
3. Answers vary. Example: choose 30%. For wholes 50 and 120, the parts are 15 and 36. The whole is multiplied by 2.4 (50 → 120), and the part is also multiplied by 2.4 (15 → 36), showing proportionality.

TEACHER NOTE — ACCEPTABLE METHODS

Equivalent benchmark, fraction, bar-model, ratio-table and decimal-multiplier methods are all valid when the reasoning is mathematically correct and clearly communicated. For estimation questions, accept sensible nearby benchmark values with a justified order of magnitude.