Name: _____ Date: _____

Unit 1

2.1.7 — Percentage Increase and Decrease

Original Value • Percentage Change • Multipliers • Reverse Percentages • Applications

A. CORE IDEAS FROM THE LESSON

Complete each statement. Use the original value as the reference amount.

1. A percentage increase is found by calculating the percentage of the _____ value, then adding it.
2. A percentage decrease is found by calculating the percentage of the _____ value, then subtracting it.
3. An increase of 15% uses multiplier _____ ; a decrease of 15% uses multiplier _____ .
4. When finding percentage change, the denominator is the _____ value.

$$\text{new} = \text{original}\left(1 \pm \frac{p}{100}\right)$$

B. APPLY A SINGLE PERCENTAGE CHANGE

Write the multiplier and calculate the new value.

Original value and change	Multiplier	New value
$60 increased by 20%		
$90 decreased by 30%		
240 increased by 5%		
$120 increased by 15%		
$250 decreased by 12%		
1,800 increased by 8%		

C. MULTIPLIER SENSE CHECK

1. Write the multiplier for an 18% decrease: _____
2. Write the multiplier for a 6% increase: _____
3. Explain why an increase multiplier must be greater than 1 and a decrease multiplier must be less than 1.

_____

Name: _____ Date: _____

Unit 1

2.1.7 — Percentage Increase and Decrease

Original Value • Percentage Change • Multipliers • Reverse Percentages • Applications

D. FIND THE PERCENTAGE CHANGE

Show the difference, divide by the original value, then multiply by 100%.

$$\%\ \text{change} = \frac{|\text{new} - \text{original}|}{\text{original}} \times 100\%$$

Original	New	Increase or decrease?	Percentage change
$60	$75		
$80	$60		
40	50		
200	170		
72	90		
$2.40	$1.80		

E. REVERSE PERCENTAGES

The final amount is a known percentage of the original. Divide by the multiplier.

$$\text{original} = \frac{\text{final}}{\text{multiplier}}$$

1. A phone costs $540 after a 10% decrease. Find the original price.

_____

2. After a 25% decrease, a bicycle costs $270. Find the original price.

_____

3. After a 15% increase, a fee is $138. Find the original fee.

_____

4. After a 6% increase, a membership costs $50.88. Find the original cost.

_____

F. FIND AND CORRECT THE ERROR

A student says: "A 20% decrease of $80 gives $16 because 20% of 80 is 16."

1. What does $16 actually represent? _____
2. Give the correct final value and explain the missing step.

_____

Name: _____ **Date:** _____

Unit 1

2.1.7 — Percentage Increase and Decrease

Original Value • Percentage Change • Multipliers • Reverse Percentages • Applications

G. PERCENTAGE CHANGE IN CONTEXT

Choose the correct method. Include units and money notation where appropriate.

1. A jacket is reduced from $80 to $60. Find the percentage decrease.

   _____

2. A membership fee of $48 rises by 6%. Find the new fee.

   _____

3. A population of 1,800 rises by 8%. Find the new population.

   _____

4. A bottle is reduced from $2.40 to $1.80. Find the percentage decrease.

   _____

5. A store reduces a $350 item by 12%. Find the sale price.

   _____

H. INQUIRY — ALWAYS, SOMETIMES OR NEVER?

Claim: "A 20% increase followed by a 20% decrease returns to the starting amount."

1. Test the claim starting from 100.
2. Test the claim starting from 50.
3. Use multipliers to explain why the result is the same percentage change for any positive starting value.

_____

_____

_____

I. EXIT CHECK

1. Increase $80 by 25%: _____
2. Decrease $150 by 20%: _____
3. Find the percentage increase from 40 to 50: _____
4. A price falls from $90 to $72. Find the percentage decrease: _____

Name: _____ **Date:** _____

Unit 1

2.1.7 — Percentage Increase and Decrease

Original Value • Percentage Change • Multipliers • Reverse Percentages • Applications

J. EXTENDED CHALLENGE — SUCCESSIVE PERCENTAGE CHANGES

These problems extend the lesson. Use multipliers rather than adding or subtracting the percentages.

1. A $80 item is increased by 15%, then discounted by 20%. Find the final price and the overall percentage change from the original.

2. A population of 1,800 grows by 8%, then falls by 5%. Find the final population and the overall percentage change.

3. A bicycle originally costs $360. It is reduced by 25%, then the reduced price is increased by 10%. Find the final price and the overall percentage decrease.

4. A quantity is increased by 20% and then decreased by 20%. Use multipliers to show the overall percentage change.

K. EXTENDED CHALLENGE — WORK BACKWARDS AND FIND MISSING RATES

1. After a 20% increase and then a 15% decrease, an item costs $459. Find its original price.

2. A price is reduced by 20%. What percentage increase is needed to return exactly to the original price? Justify your answer.

3. A price rises from $240 to $276, then a discount reduces it to $248.40. Find the discount percentage.

4. Two shops start with the same $160 price. Shop A gives 30% off, then adds 8% tax. Shop B gives 20% off, then a further 10% loyalty discount. Which final price is lower, and by how much?

ANSWER KEY

Name: Date:

Unit 1

2.1.7 — Percentage Increase and Decrease — Solutions

Original Value • Percentage Change • Multipliers • Reverse Percentages • Applications

A. CORE IDEAS FROM THE LESSON

1. **original**
2. **original**
3. **1.15**; **0.85**
4. **original**

$$\text{new} = \text{original}\left(1 \pm \frac{p}{100}\right)$$

B. APPLY A SINGLE PERCENTAGE CHANGE

Original value and change	Multiplier	New value
\$60 increased by 20%	**1.20**	**\$72**
\$90 decreased by 30%	**0.70**	**\$63**
240 increased by 5%	**1.05**	**252**
\$120 increased by 15%	**1.15**	**\$138**
\$250 decreased by 12%	**0.88**	**\$220**
1,800 increased by 8%	**1.08**	**1,944**

C. MULTIPLIER SENSE CHECK

1. **0.82**
2. **1.06**
3. **An increase makes the new value more than 100% of the original, while a decrease makes it less than 100% of the original.**

Name: **Date:**

Unit 1

2.1.7 — Percentage Increase and Decrease — Solutions

Original Value • Percentage Change • Multipliers • Reverse Percentages • Applications

D. FIND THE PERCENTAGE CHANGE

Original	New	Direction	Percentage change
$60	$75	**Increase**	**25%**
$80	$60	**Decrease**	**25%**
40	50	**Increase**	**25%**
200	170	**Decrease**	**15%**
72	90	**Increase**	**25%**
$2.40	$1.80	**Decrease**	**25%**

$$\%\ \text{change} = \frac{|\text{new} - \text{original}|}{\text{original}} \times 100\%$$

E. REVERSE PERCENTAGES

1. **$540 ÷ 0.90 = $600**
2. **$270 ÷ 0.75 = $360**
3. **$138 ÷ 1.15 = $120**
4. **$50.88 ÷ 1.06 = $48**

$$\text{original} = \frac{\text{final}}{\text{multiplier}}$$

F. FIND AND CORRECT THE ERROR

1. **$16 is the amount of the decrease, not the final price.**
2. **$80 − $16 = $64**. Equivalently, **$80 × 0.80 = $64**.

Name: Date:

Unit 1

2.1.7 — Percentage Increase and Decrease — Solutions

Original Value • Percentage Change • Multipliers • Reverse Percentages • Applications

G. PERCENTAGE CHANGE IN CONTEXT

1. **($20 ÷ $80) × 100% = 25% decrease.**
2. **$48 × 1.06 = $50.88.**
3. **1,800 × 1.08 = 1,944.**
4. **($0.60 ÷ $2.40) × 100% = 25% decrease.**
5. **$350 × 0.88 = $308.**

H. INQUIRY — ALWAYS, SOMETIMES OR NEVER?

1. **100 → 120 → 96.**
2. **50 → 60 → 48.**
3. **The claim is false. The combined multiplier is 0.96, so the overall change is a 4% decrease.**

$$1.20 \times 0.80 = 0.96$$

$$(1 + r)(1 - r) = 1 - r^2$$

I. EXIT CHECK

1. **$100**
2. **$120**
3. **25% increase**
4. **20% decrease**

Name: Date:

Unit 1

2.1.7 — Percentage Increase and Decrease — Solutions

Original Value • Percentage Change • Multipliers • Reverse Percentages • Applications

J. EXTENDED CHALLENGE — SUCCESSIVE PERCENTAGE CHANGES

1. **$80 × 1.15 × 0.80 = $73.60.** The combined multiplier is 0.92, so the overall change is an **8% decrease**.
2. **1,800 × 1.08 × 0.95 = 1,846.8**, about **1,847 people**. The combined multiplier is 1.026, so the overall change is a **2.6% increase**.
3. **$360 × 0.75 × 1.10 = $297.** Since $297 ÷ $360 = 0.825, the overall change is a **17.5% decrease**.
4. **1.20 × 0.80 = 0.96**, so the overall change is a **4% decrease**.

K. EXTENDED CHALLENGE — WORK BACKWARDS AND FIND MISSING RATES

1. Combined multiplier: **1.20 × 0.85 = 1.02**. Original price: **$459 ÷ 1.02 = $450**.
2. After a 20% decrease the multiplier is 0.80. To return to 1, use **1 ÷ 0.80 = 1.25**, so the required increase is **25%**.
3. **$276 - $248.40 = $27.60**, and **$27.60 ÷ $276 × 100% = 10%**.
4. Shop A: **$160 × 0.70 × 1.08 = $120.96**. Shop B: **$160 × 0.80 × 0.90 = $115.20**. **Shop B is lower by $5.76.**