Grade Level/Course: Grade 7

Lesson/Unit Plan Name: Percent of Increase and Decrease

Rationale/Lesson Abstract: Students will learn multiple methods for finding the percent of increase or decrease.

Timeframe: 1 or 2 days

Common Core Standard(s): 7.RP.3
Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

Instructional Resources/Materials: A copy for each student of the assessment page.

Activity/Lesson:

Percent of Increase and Decrease

You can find the percent of increase or decrease by
- first finding the **difference** between the original amount and the new amount,
- then answering this question: "This difference is what percent of the **original** amount?
- Look at the context – is the amount increasing or decreasing? Answer the question accordingly.

Example 1: A pair of jeans cost $30 originally. They were marked down to $18. What is the percent of decrease?

The difference in the original and new amount is: $\$30 - \$18 = \$12$.
The original amount is $30.

Question: $12 is what percent of $30?

Method 1: Bar Models

(a)

100 %

x %

| 6 | 6 | 6 | 6 | 6 |

12

30

100 %

x %

| 20% | 20% | 20% | 20% | 20% |
| 6 | 6 | 6 | 6 | 6 |

12

30

$x\% = 40\%$

(b)

0	
12	
24	
36	

0	0%
6	
12	
18	
24	
30	100%

0	0%
6	20%
12	40%
18	60%
24	80%
30	100%

(c)

100 %

$30

$18

100 %

$30

$18 $12

x %

$$\frac{12}{30} = \frac{x}{100}$$

$$\frac{6 \cdot 2}{6 \cdot 5} = \frac{x}{100}$$

$$\frac{2}{5} = \frac{x}{100}$$
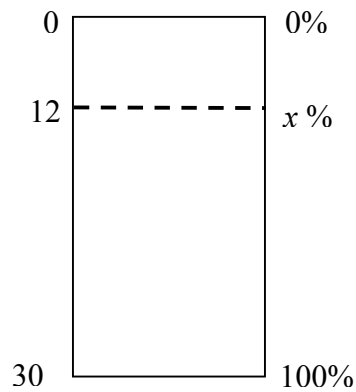
$$100\left(\frac{2}{5}\right) = 100\left(\frac{x}{100}\right)$$

$$40 = x$$

∴ Since 12 is 40 % of 30, the percent of decrease is 40%.

Activity/Lesson continued:

Method 2: **Proportion**

0		0%
12	- - - - -	x %
30		100%

$$\frac{12}{30} = \frac{x}{100}$$

$$\frac{6 \cdot 2}{6 \cdot 5} = \frac{x}{100}$$

$$\frac{2}{5} = \frac{x}{100}$$

$$\frac{2}{5} \cdot \frac{20}{20} = \frac{x}{100}$$

$$\frac{40}{100} = \frac{x}{100}$$

$$\therefore \ x = 40$$

$\therefore$ The percent of decrease is 40%

Method 3: **Direct translation**

$12 is what percent of $30??

$$12 \quad = \quad \frac{x}{100} \quad g \ 30$$

$$12 = \frac{x}{100} \cdot \frac{30}{1}$$

$$12 = \frac{x \cdot 3 \cdot \cancel{10}}{10 \cdot \cancel{10}}$$

$$12 = \frac{x \cdot 3}{10}$$

$$10(12) = 10\left(\frac{3 \cdot x}{10}\right)$$

$$120 = 3x$$

$$\frac{120}{3} = \frac{3x}{3}$$

$$40 = x$$

$\therefore$ 12 is 40% of 30.
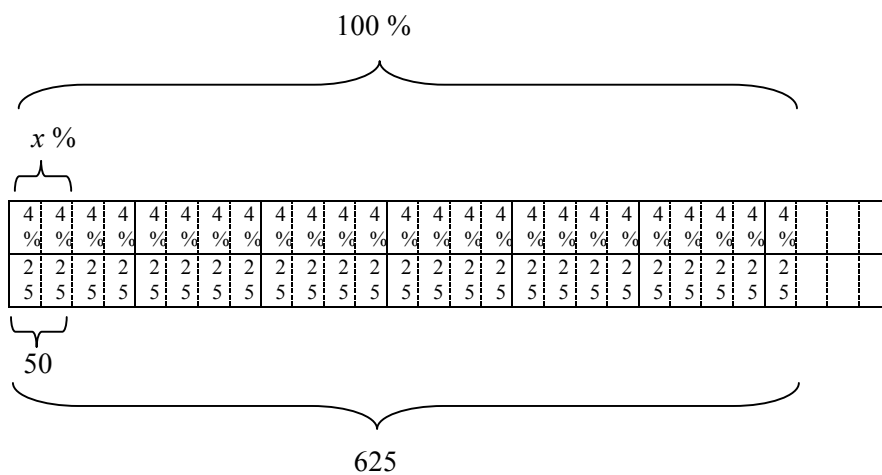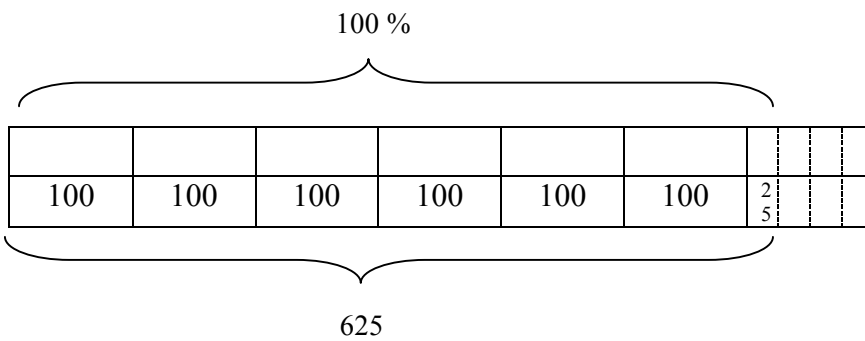
Activity/Lesson continued:

Example 2: A school had 625 students enrolled last year. This year, 675 students are enrolled. What is the percent of increase in enrollment?

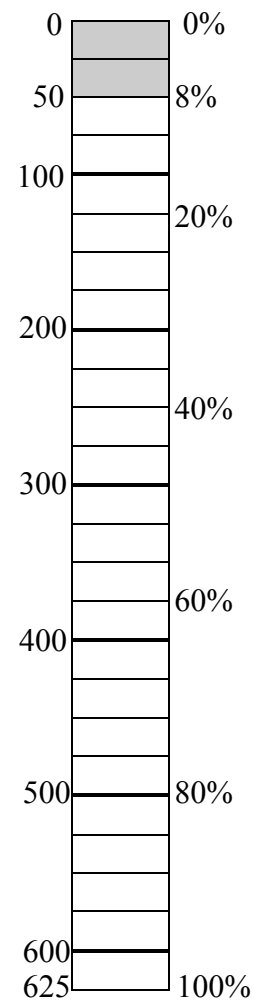The difference in the original and new amount is: $675 - 625 = 50$.
The original amount is 625.

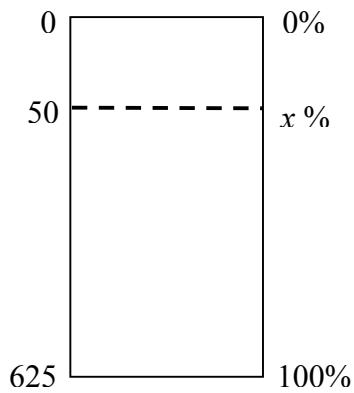**Question:** 50 is what percent of 625?

Method 1: **Bar Models**

$x \% = 8 \%$

∴ Since 50 is 8 % of 625, the percent of increase is 8%.

Activity/Lesson continued:

Method 2: **Proportion**

0		0%
50	- - - - - - -	x %
625		100%

$$\frac{50}{625} = \frac{x}{100}$$

$$\frac{25}{25} \cdot \frac{2}{25} = \frac{x}{100}$$

$$\frac{2}{25} = \frac{x}{100}$$

$$x = 8$$

∴ The percent of increase is 8%

Method 3: **Direct translation**

50 is what percent of 625?

↓ ↓   ↓   ↓ ↓

$$50 \quad = \quad \frac{x}{100} \qquad \text{g } 625$$

$$50 = \frac{x}{100} \cdot \frac{625}{1}$$

$$50 = \frac{x \cdot 25 \cdot \cancel{25}}{4 \cdot \cancel{25}}$$

$$50 = \frac{x \cdot 25}{4}$$

$$4(50) = 4\left(\frac{25 \cdot x}{4}\right)$$

$$200 = 25x$$

$$\frac{200}{25} = \frac{25x}{25}$$

$$8 = x$$

∴ 50 is 8% of 625, so the percent of increase is 8%

Activity/Lesson continued:

You Try: A blouse cost $40 originally. It was marked up to $50. What was the percent of increase? Solve at least two different ways.
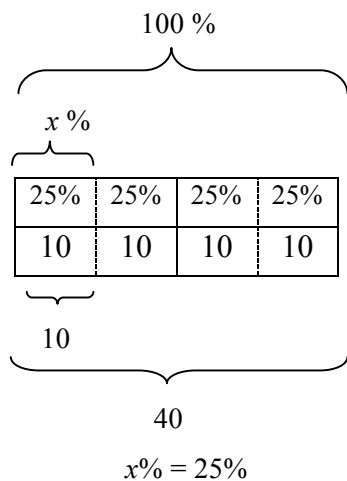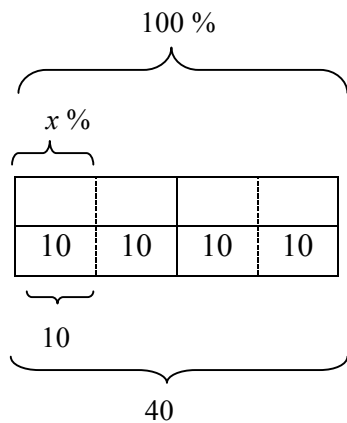
Solution:
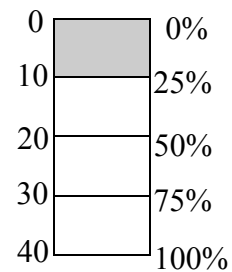The difference in the original and new amount is: $50 - $40 = $10.
The original amount is $40.
Question: $10 is what percent of $40?

Method 1: **Bar Diagrams**

100 %

x %

| 10 | 10 | 10 | 10 |

10

40

100 %

x %

| 25% | 25% | 25% | 25% |
| 10 | 10 | 10 | 10 |

10

40

x% = 25%

$10 is 25% of $40, so the
percent of increase is 25%.

0   0%
10   25%
20   50%
30   75%
40   100%

$10 is 25% of $40, so the
percent of increase is 25%.

Activity/Lesson continued:

Method 2: **Proportion**
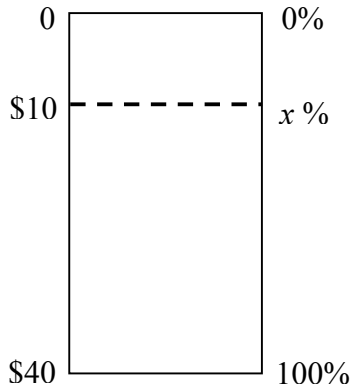
$$\frac{10}{40} = \frac{x}{100}$$

$$\frac{1}{4} = \frac{x}{100}$$

$$\frac{1}{4} \cdot \frac{25}{25} = \frac{x}{100}$$

$$\frac{25}{100} = \frac{x}{100}$$

$$x = 25$$

Method 3: **Direct translation**

$10 is what percent of $40??

$$10 \quad = \quad \frac{x}{100} \qquad g \ 40$$

$$10 = \frac{x}{100} \cdot \frac{40}{1}$$

$$10 = \frac{x \cdot 2 \cdot \cancel{20}}{5 \cdot \cancel{20}}$$

$$10 = \frac{x \cdot 2}{5}$$

$$5(10) = 5\left(\frac{2 \cdot x}{5}\right)$$

$$50 = 2x$$

$$25 = x$$

∴ $10 is 25% of $40, so the percent of increase is 25%.

Assessment: This can be given as an end of class assessment, or to take home.

Name_____

Percent of Increase and Decrease

1) **Before you solve problems A and B below, read the problems and answer the following question:**
   - How do you think the answers will compare? Why?

   A) Last year, Ace Jeans cost $20 a pair at BJ's Department Store. This year, Ace Jeans cost $25 a pair. Find the percent of increase. (Use at least two different approaches.)

   B) Last week, BJ's put the $25 jeans on sale for $20. Find the percent of decrease. (Use at least two different approaches.)

2) How do your answers for #1 and #2 compare? Show/explain why this is true.

Assessment solutions:

1) <u>Before</u> **you solve problems A and B below, read the problems and answer the following question:**
   - How do you think the answers will compare? Why?

     Students might think the percent of increase for A will be the same as the percent of decrease in B, since in A, the price goes up from $20 to $25 and in B, the price goes down from $25 to $20. You might have the students share their thoughts with the class on this before they solve the problems.

   A) Last year, Ace Jeans cost $20 a pair at BJ's Department Store. This year, Ace Jeans cost $25 a pair. Find the percent of increase. (Use at least two different approaches.)

     The percent of increase is 25%. Check to see that students used at least two different approaches.

   B) Last week, BJ's put the $25 jeans on sale for $20. Find the percent of decrease. (Use at least two different approaches.)

     The percent of decrease is 20%. Check to see that students used at least two different approaches.

2) How do your answers for #1 and #2 compare? Show/explain why this is true.

     The percent of increase is greater than the % of decrease. This happens because you are dividing the same numerator by 2 different numbers. For the percent of increase, you are dividing by a smaller number than for the percent of decrease.

     $a =$ the larger amount
     $b =$ the smaller amount

     % of increase $= \dfrac{a-b}{b}$

     % of decrease $= \dfrac{a-b}{a}$

     $$\dfrac{a-b}{b} > \dfrac{a-b}{a}$$

Assessment solutions continued:

The next day, have students share their responses to this assessment. You can have students explore finding the decimal equivalents of fractions with the same numerator and different denominators.

$$\frac{5}{1} = 5$$

$$\frac{5}{2} = 2.5$$

$$\frac{5}{3} = 1.\overline{6}$$

$$\frac{5}{4} = 1.25$$

$$\frac{5}{5} = 1$$

$$\frac{5}{6} = 0.8\overline{3}$$

Notice that as the denominator increases, the value of the fraction decreases. So the percent of increase will always be greater than the percent of decrease when you are using the same two numbers.