Warm-Up

Grade 5 NS 1.2

What is 50% of 40?

A 2000

B 200

C 20

D 2

- Use three approaches to find the answer.

Grade 6 NS 1.4

What is 60% of 30?

A 1.8

B 18

C 180

D 1800

- How might a student obtain each of the answers?

Review: Grade 3 AF 1.1

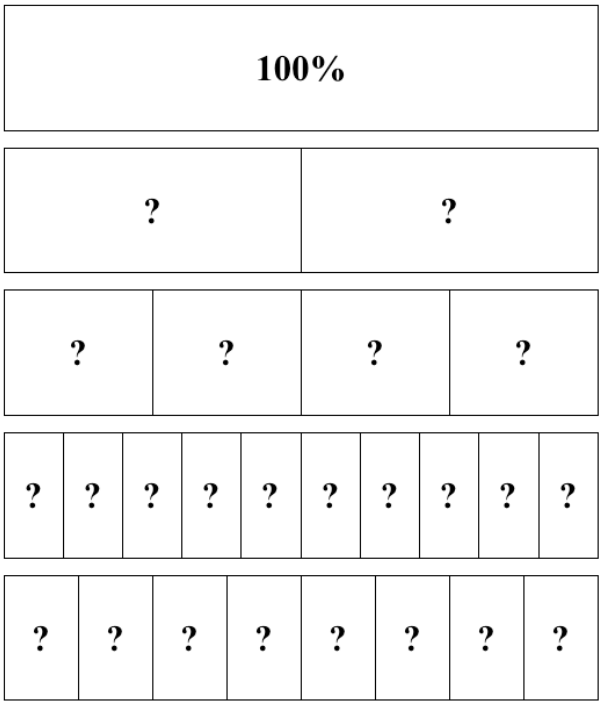
Mark is buying a jacket that regularly costs $55. If he receives a $10 discount, what is the final sale price of the jacket?

- Explain the meaning of the word **discount**.

- What does **sale price** mean?

Other:

Fill in the missing percentages.



Using Bar Models to Solve Percent Word Problems

Bar models can be used to provide an alternative way to visualize percent problems that involve discount, sale price, and markup. Bar models help students build upon their prior understanding of percentages and apply that knowledge to solving word problems.

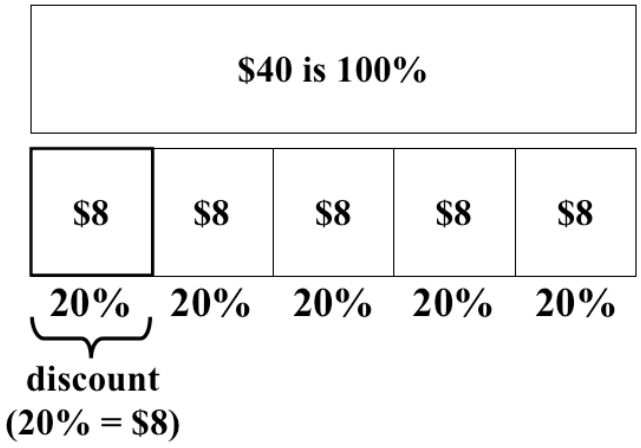
Today's Objective: Using bar models to solve percent problems involving discount, sale price, and markup.

Standards: Grade 6 NS 1.4 and Grade 7 NS 1.7

Example 1: Problem involving discount

The price of a new pair of shoes is $40. If there is a 20% discount on all shoes, how much is deducted from the original price?

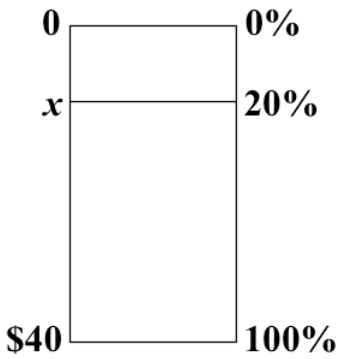
Bar Model



∴ $8 is deducted from $40 (the discount)

Method 2 (Proportions)

What is 20% of $40?



$$\frac{x}{40} = \frac{20}{100}$$
$$\frac{x}{40} = \frac{2}{10}$$
$$\frac{x}{40} = \frac{2}{10} \cdot \frac{4}{4}$$
$$\frac{x}{40} = \frac{8}{40}$$
$$x = 8$$

∴ $8 is deducted from $40 (the discount)

Method 3 (Direct Translation)

What is 20% of $40?

$$x = 20\% \cdot \$40$$
$$x = 0.20 \cdot 40$$
$$x = 8$$

∴ $8 is deducted from $40 (the discount)

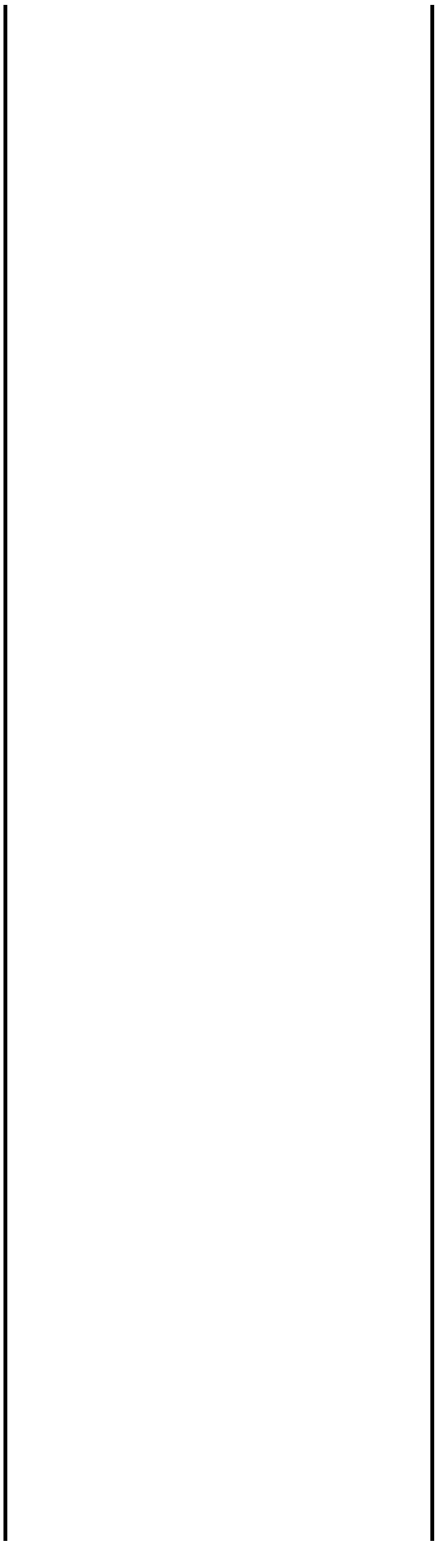
$$x = 20\% \cdot \$40$$
$$x = \frac{20}{100} \cdot 40$$
$$x = \frac{2}{10} \cdot 40$$
$$x = \frac{2 \cdot 4 \cdot 10}{10}$$
$$x = 8$$

∴ $8 is deducted from $40 (the discount)

Your Turn 1: Problem involving discount

A jacket originally costs $70. Wilasha bought it yesterday at 30% off. How much was her discount?

Bar Model



Method 2

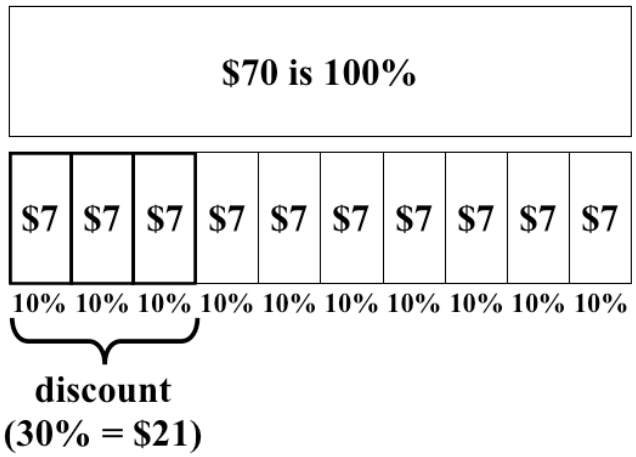
Method 3

Your Turn 1: Problem involving discount (solution)

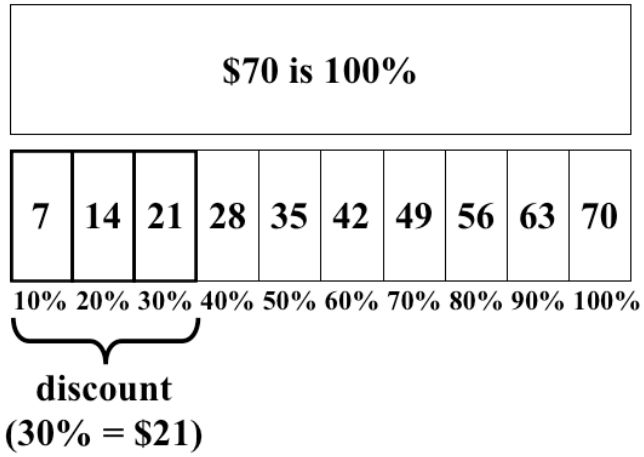
A jacket originally costs \$70. Wilasha bought it yesterday at 30% off. How much was her discount?

Bar Model

Bar Model 1



Bar Model 2

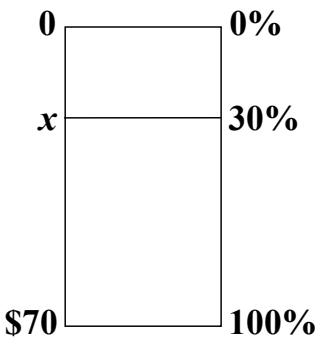


\$21 is 30% of \$70

∴ her discount was \$21

Method 2
(Proportions)

What is 30% of \$70?



$$\frac{x}{70} = \frac{30}{100}$$
$$\frac{x}{70} = \frac{3}{10}$$
$$\frac{x}{70} = \frac{3}{10} \cdot \frac{7}{7}$$
$$\frac{x}{70} = \frac{21}{70}$$
$$x = 21$$

\$21 is 30% of \$70

∴ her discount was \$21

Method 3
(Direct Translation)

What is 30% of \$70?

$$x = 30\% \cdot \$70$$
$$x = 0.30 \cdot 70$$
$$x = 21$$

\$21 is 30% of \$70

∴ her discount was \$21

$$x = 30\% \cdot \$70$$
$$x = \frac{3}{10} \cdot 70$$
$$x = \frac{3 \cdot 7 \cdot 10}{10}$$
$$x = 21$$

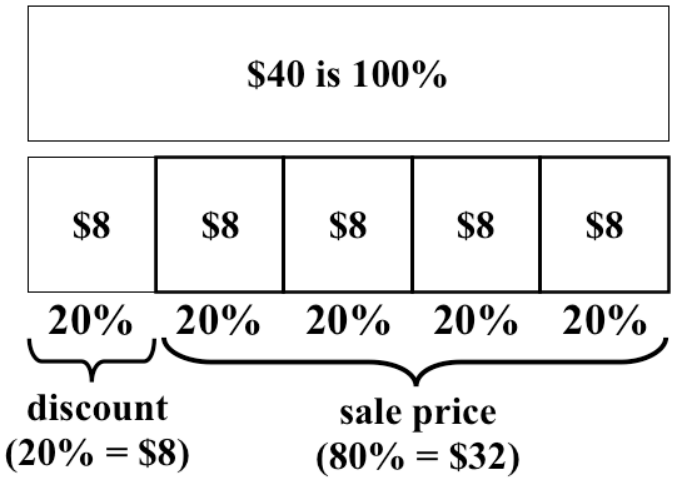
\$21 is 30% of \$70

∴ her discount was \$21

Example 2: Problem involving discount and sale price

The price of a new pair of shoes is \$40. If there is a 20% discount on all shoes, what is the final sale price?

Bar Model

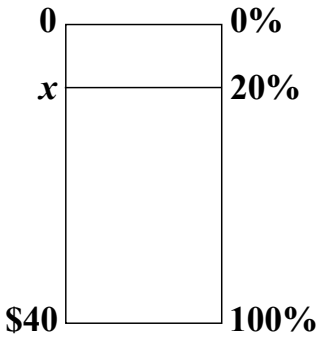


20% of \$40 is \$8 (discount)
80% of \$40 is \$32 (sale price)

∴ the final price is \$32

Method 2
(Proportions)

What is 20% of \$40?



$$\frac{x}{40} = \frac{20}{100}$$
$$\frac{x}{40} = \frac{2}{10}$$
$$\frac{x}{40} = \frac{2}{10} \cdot \frac{4}{4}$$
$$\frac{x}{40} = \frac{8}{40}$$
$$x = 8$$

20% of \$40 is \$8 (discount)

original price discount

\$40 – \$8 = \$32

sale price

∴ the final price is \$32

Method 3
(Direct Translation)

What is 20% of \$40?

$$x = 20\% \cdot \$40$$
$$x = \frac{20}{100} \cdot 40$$
$$x = \frac{2}{10} \cdot 40$$
$$x = \frac{1}{5} \cdot 40$$
$$x = \frac{5 \cdot 8}{5}$$
$$x = 8$$

20% of \$40 is \$8

\$40 – \$8 = \$32

∴ the final price is \$32

$$x = 20\% \cdot \$40$$
$$x = 0.20 \cdot 40$$
$$x = 8$$

20% of \$40 is \$8

\$40 – \$8 = \$32

∴ the final price is \$32

Your Turn 2a: Problem involving discount and sale price

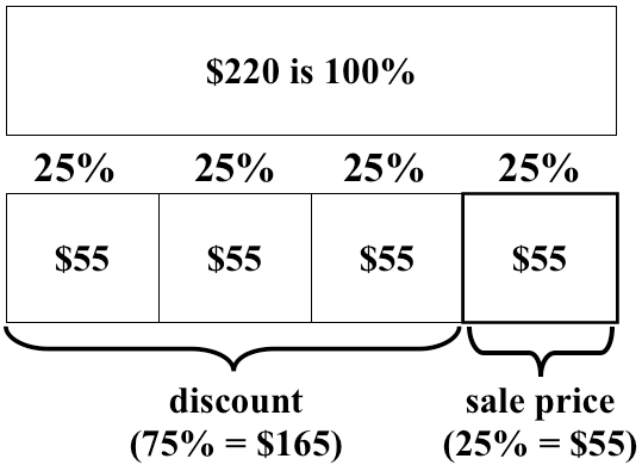
An e-book reader regularly sells for $220. It is on sale for 75% off. What is the sale price of the reader?

Bar Model | **Method 2** | **Method 3**

Your Turn 2a: Problem involving discount and sale price (solution)

An e-book reader regularly sells for \$220. It is on sale for 75% off. What is the sale price of the reader?

Bar Model

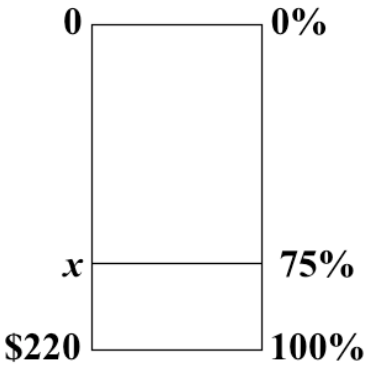


75% of \$220 is \$165 (discount)
25% of \$220 is \$55 (sale price)

∴ the sale price is \$55

Method 2
(Proportions)

What is 75% of \$220?



$$\frac{x}{220} = \frac{75}{100}$$

$$\frac{x}{220} = \frac{3}{4}$$

$$4 \bullet x = 3 \bullet 220$$

$$4x = 660$$

$$\frac{4x}{4} = \frac{660}{4}$$

$$x = 165$$

75% of \$220 is \$165 (discount)

original price — discount

\$220 – \$165 = \$55

sale price

∴ the sale price is \$55

Method 3
(Direct Translation)

What is 75% of \$220?

$$x = 75\% \bullet \$220$$

$$x = 0.75 \bullet 220$$

$$x = 165$$

75% of \$220 is \$165

\$220 – \$165 = \$55

∴ the sale price is \$55

$$x = 75\% \bullet \$220$$

$$x = \frac{75}{100} \bullet 220$$

$$x = \frac{3}{4} \bullet 220$$

$$x = \frac{660}{4}$$

$$x = 165$$

75% of \$220 is \$165

\$220 – \$165 = \$55

∴ the sale price is \$55

Your Turn 2b: Problem involving discount and sale price

A pair of noise-canceling headphones regularly sells for $116. They are on sale for 75% off. What is the sale price of the headphones?

Bar Model

Method 2
(Proportions)

Method 3
(Direct Translation)

Your Turn 2b: Problem involving discount and sale price (solution)

A pair of noise-canceling headphones regularly sells for $116. They are on sale for 75% off. What is the sale price of the headphones?

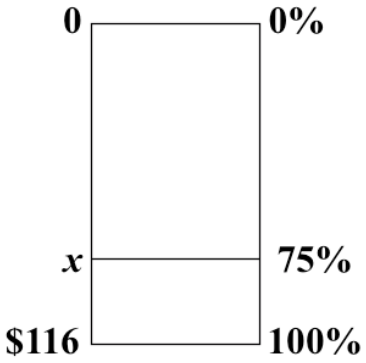
Bar Model

75% of $116 is $87 (discount)
25% of $116 is $29 (sale price)

∴ the sale price is $29

Method 2
(Proportions)

What is 75% of $116?



$$\frac{x}{116} = \frac{75}{100}$$
$$\frac{x}{116} = \frac{3}{4}$$
$$4 \bullet x = 3 \bullet 116$$
$$4x = 348$$
$$\frac{4x}{4} = \frac{348}{4}$$
$$x = 87$$

75% of $116 is $87 (discount)

original price discount

$116 – $87 = $29

sale price

∴ the sale price is $29

Method 3
(Direct Translation)

What is 75% of $116?

$$x = 75\% \bullet \$116$$
$$x = 0.75 \bullet 116$$
$$x = 87$$

75% of $116 is $87

$116 – $87 = $29

∴ the sale price is $29

$$x = 75\% \bullet \$116$$
$$x = \frac{75}{100} \bullet 116$$
$$x = \frac{3}{4} \bullet 116$$
$$x = \frac{348}{4}$$
$$x = 87$$

75% of $116 is $87

$116 – $87 = $29

∴ the sale price is $29

Example 3a: Problem involving multiple discounts

Jorge bought a watch on sale for 50% off the original price and another 50% off the discounted price. If the watch originally costs $70, what was the final sale price that Jorge paid for the watch?

Bar Model

∴ the final sale price is $17.50

Method 2
(Direct Translation)

What is 50% of $70?

$$x = \frac{50}{100} \cdot 70$$
$$x = \frac{1}{2} \cdot 70$$
$$x = \frac{2 \cdot 35}{2}$$
$$x = 35$$

50% of $70 is $35 (1st discount)

$70 – $35 = $35 (1st discounted price)

What is 50% of $35?

$$x = \frac{50}{100} \cdot 35$$
$$x = \frac{1}{2} \cdot 35$$
$$x = \frac{35}{2}$$
$$x = 17.5$$

50% of $35 is $17.50 (2nd discount)

$35 – $17.50 = $17.50
(final sale price)

∴ the final sale price is $17.50

Example 3b: Problem involving multiple discounts

Jorge bought a watch on sale for 25% off the original price and another 75% off the discounted price. If the watch originally costs $64, what was the final sale price that Jorge paid for the watch?

Bar Model

∴ the final sale price is $12

Method 2
(Direct Translation)

What is 25% of $64?

$$x = \frac{25}{100} \cdot 64$$

$$x = \frac{1}{4} \cdot 64$$

$$x = \frac{4 \cdot 16}{4}$$

$$x = 16$$

25% of $64 is $16 (1st discount)

$64 – $16 = $48 (1st discounted price)

What is 75% of $48?

$$x = \frac{75}{100} \cdot 48$$

$$x = \frac{3}{4} \cdot 48$$

$$x = \frac{3 \cdot 4 \cdot 12}{4}$$

$$x = 36$$

75% of $48 is $36 (2nd discount)

$48 – $36 = $12
(final sale price)

∴ the final sale price is $12

Your Turn 3: Problem involving multiple discounts

Antonia is buying a space heater that regularly costs $90. It is on sale for 40% off with an additional 25% off the discounted price. What is the final sale price of the heater?

Bar Model

Method 2

Your Turn 3: Problem involving multiple discounts (solution)

Antonia is buying a space heater that regularly costs $90. It is on sale for 40% off with an additional 25% off the discounted price. What is the final sale price of the heater?

Bar Model

∴ the final sale price is $40.50

Method 2
(Direct Translation)

What is 40% of $90?

$$x = 40\% \cdot \$90$$
$$x = 0.40 \cdot 90$$
$$x = 36$$

40% of $90 is $36 (1st discount)

$90 – $36 = $54 (1st discounted price)

What is 25% of $54?

$$x = 25\% \cdot \$54$$
$$x = 0.25 \cdot 54$$
$$x = 13.50$$

25% of $54 is $13.50 (2nd discount)

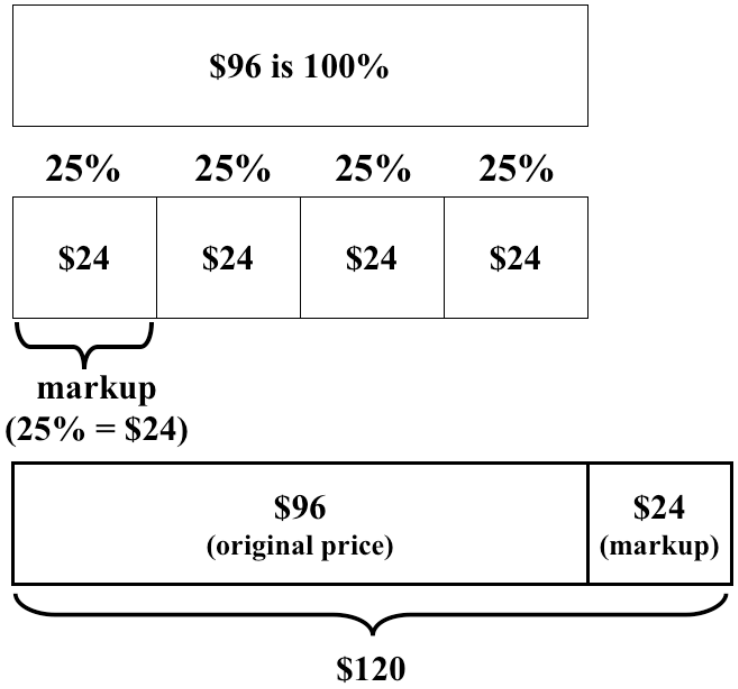
$54 – $13.50 = $40.50
(final sale price)

∴ the final sale price is $40.50

Example 4: Problem involving markup

A few years ago, a skate shop originally sold a skateboard for $96. Today the same skateboard is sold with a markup of 25%. How much does the skateboard cost today?

Bar Model



$24 is 25% of $96 (markup)

original price markup

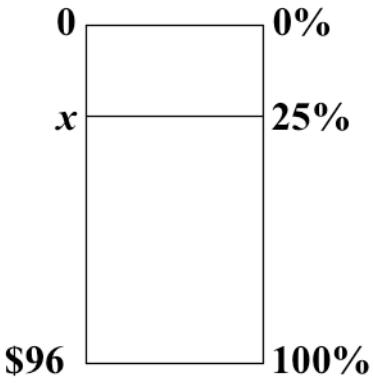
$96 + $24 = $120

selling price

∴ the cost is $120

Method 2
(Proportions)

What is 25% of $96?



$$\frac{x}{96} = \frac{25}{100}$$

$$\frac{x}{96} = \frac{1}{4}$$

$$96\left(\frac{x}{96}\right) = 96\left(\frac{1}{4}\right)$$

$$x = \frac{96}{4}$$

$$x = \frac{4 \cdot 24}{4}$$

$$x = 24$$

$24 is 25% of $96 (markup)

$96 + $24 = $120

∴ the cost is $120

Your Turn 4: Problem involving markup

An amusement park recently increased its family season pass by 22%. If the original price of the pass was $150, what is the cost of the pass after markup?

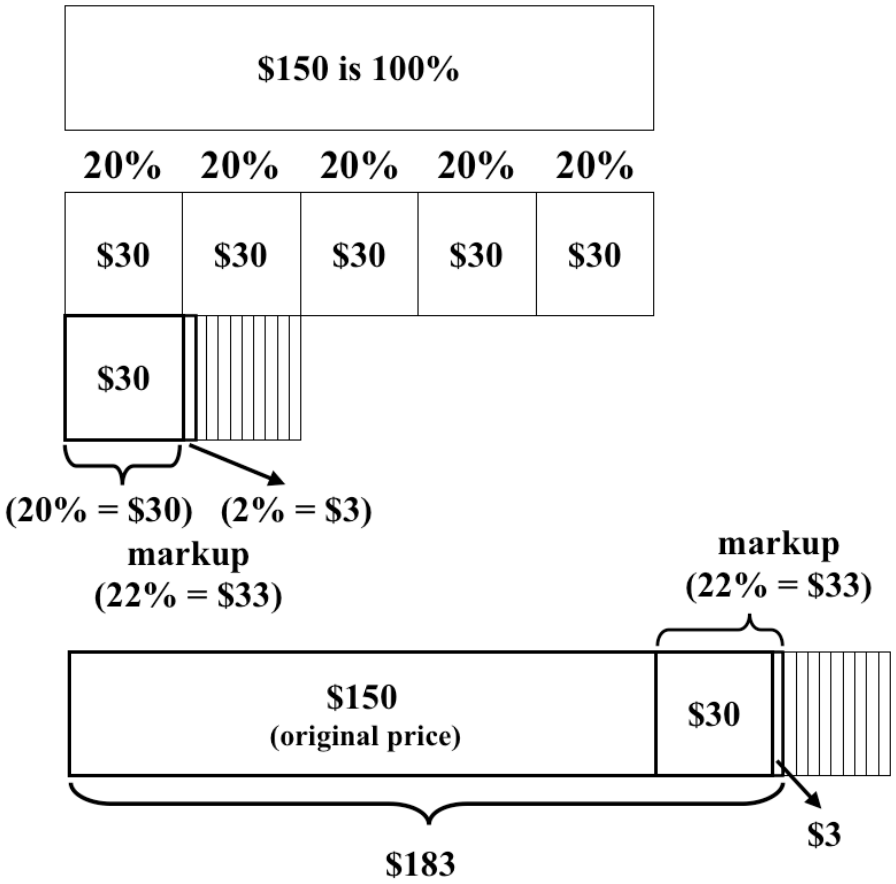
Bar Model

Method 2

Your Turn 4: Problem involving markup (solution)

An amusement park recently increased its family season pass by 22%. If the original price of the pass was $150, what is the cost of the season pass after markup?

Bar Model



$33 is 22% of $150 (markup)

original price markup selling price

$150 + $33 = $183

∴ the cost is $183

Method 2
(Direct Translation)

What is 22% of $150?

$$x = 22\% \cdot \$150$$
$$x = 0.22 \cdot 150$$
$$x = 33$$

$33 is 22% of $150 (markup)

$150 + $33 = $183

∴ the cost is $183

$$x = 22\% \cdot \$150$$
$$x = \frac{22}{100} \cdot 150$$
$$x = \frac{2 \cdot 11 \cdot 3 \cdot 5 \cdot 10}{2 \cdot 5 \cdot 10}$$
$$x = 33$$

$33 is 22% of $150 (markup)

$150 + $33 = $183

∴ the cost is $183

Extension 1: Problem involving discount and tax

Saydi is buying a pair of jeans that regularly cost $60. They are on sale for 40% off. If the tax rate is 9%, what is the sale price of the jeans including tax?

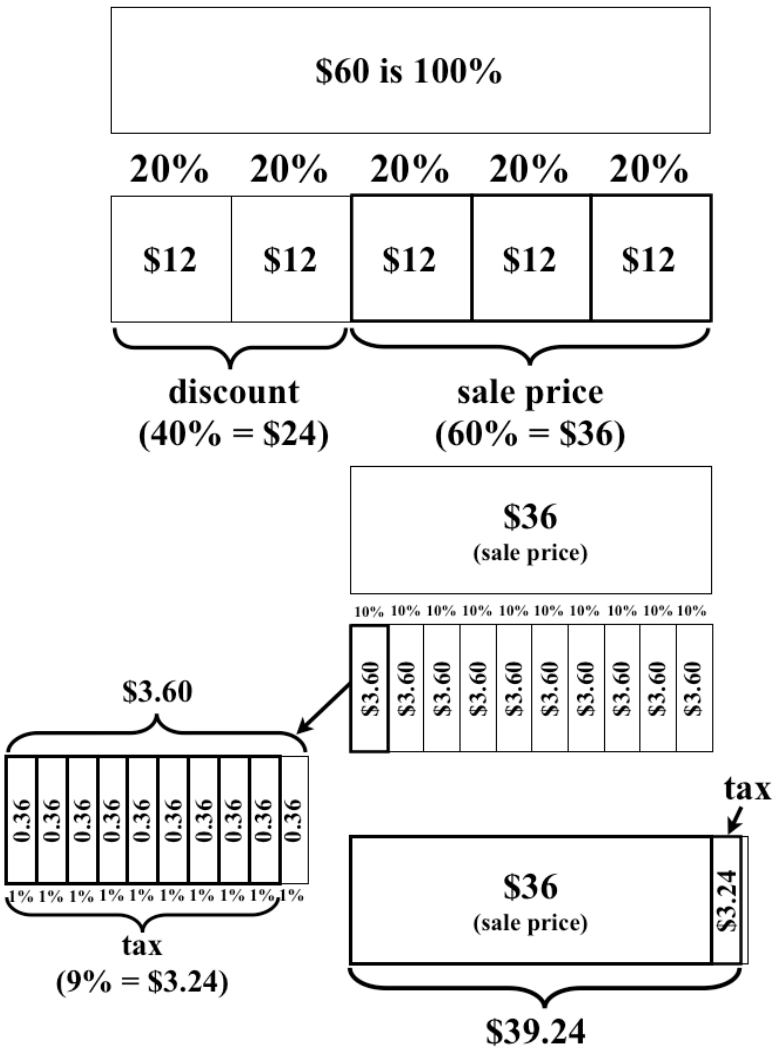
Bar Model

Method 2
(Direct Translation)

Extension 1: Problem involving discount and tax (solution)

Saydi is buying a pair of jeans that regularly cost $60. They are on sale for 40% off. If the tax rate is 9%, what is the sale price of the jeans including tax?

Bar Model



sale price + tax

$36 + $3.24 = $39.24

sale price with tax

∴ the sale price including tax is $39.24

Method 2
(Direct Translation)

What is 40% of $60?

$$x = 40\% \cdot \$60$$

$$x = 0.40 \cdot 60$$

$$x = 24$$

40% of $60 is $24 (discount)

$60 – $24 = $36 (sale price)

What is 9% of $36?

$$x = 9\% \cdot \$36$$

$$x = 0.09 \cdot 36$$

$$x = 3.24$$

9% of 36 is 3.24 (tax)

$36 + $3.24 = $39.24
(sale price including tax)

∴ the sale price including tax is $39.24