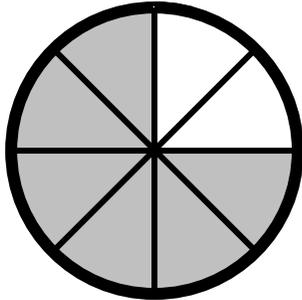# Sect 4.4 – Percent Problems

Objective 1:   Understanding the basic percent proportion.

Recall the following example from a previous section:

a)   What percent of the figure is shaded?

Solution:

a)   Since 6 out of eight slices are shaded, then the fraction that is

shaded is $\frac{6}{8} = \frac{3}{4}$. To find the percent, we need to find the

numerator of the fraction that has a denominator of 100:
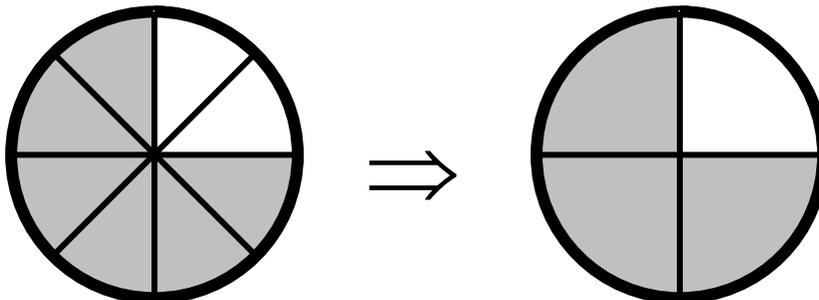
$\frac{3}{4} = \frac{p}{100}$ (cross multiply)

$300 = 4p$ (divide by 4)

$p = 75\%$.

So, 75% of the pie is shaded.

Since $\frac{6}{8}$ reduces $\frac{3}{4}$, we can look at the figure as having 3 out of 4 parts

shaded:

Notice that the part shaded (amount) over the whole (base) was equal to the percent over 100:

$$\frac{\text{Amount (part)}}{\text{Base (whole)}} \qquad \frac{3}{4} = \frac{p}{100} \qquad \frac{\text{Percent}}{100}$$

Since the amount (part) is a percent of the base (whole), this gives us a way to set-up and solve percent problems.

The percent proportion:

In the equation <u>amount</u> is a <u>percent</u> of the <u>base</u>, we can put the quantities into the proportion:

$$\frac{amount}{base} = \frac{percent}{100}$$

Then, we can cross multiply and solve.

The amount is always associated with the word "is", the base with the word "of" and the percent is always over 100, so the following is a helpful way to remember how to set-up the proportion:

$$\text{"is"} \quad \frac{amount}{base} = \frac{percent}{100} \quad \text{"%"} \atop \text{"of"} \qquad\qquad\qquad \text{"100"}$$

Keep in mind the "is" over "of" goes alphabetically, so the "is" is on top and the "of" is on the bottom.

Solve the following using the percent proportion:

Ex. 1   What is 65% of 820?
  <u>Solution:</u>
  The base (whole) is 820, the percent is 65%, so we are looking for the amount (part):

$$\text{"is"} \quad \frac{A}{820} = \frac{65}{100} \quad \text{"%"} \atop \text{"of"} \qquad\qquad\qquad \text{"100"}$$

$$\frac{A}{820} = \frac{65}{100} \quad \text{(cross multiply)}$$

$$A \bullet 100 = 820 \bullet 65 \quad \text{(simplify)}$$
$$100A = 53300 \quad \text{(divide by 100)}$$
$$\frac{100A}{100} = \frac{53300}{100}$$
$$A = 533.$$

Ex. 2   What is 35% of 95?
  <u>Solution:</u>
  The base (whole) is 95, the percent is 35%, so we are looking for the amount (part):

$$\text{"is"} \quad \frac{A}{95} = \frac{35}{100} \quad \text{"%"} \atop \text{"of"} \qquad\qquad\qquad \text{"100"}$$

$$\frac{A}{95} = \frac{35}{100} \quad \text{(cross multiply)}$$

A•100 = 95•35   (simplify)
100A = 3325   (divide by 100)
$$\frac{100A}{100} = \frac{3325}{100}$$
A = 33.25.

Ex. 3   2280 is 38% of what?
Solution:
The amount (part) is 2280, the percent is 38%, so we are looking for the base (whole):

"is" $\dfrac{2280}{B}$ = $\dfrac{38}{100}$ "%"
"of"   "100"

$$\frac{2280}{B} = \frac{38}{100} \quad \text{(cross multiply)}$$

2280•100 = B•(38)   (simplify)
228000 = 38B   (divide by 38)
$$\frac{228000}{38} = \frac{38B}{38}$$
B = 6000.

Ex. 4   250% of what is 200?
Solution:
The amount (part) is 200, the percent is 250%, so we are looking for the base (whole):

"is" $\dfrac{200}{B}$ = $\dfrac{250}{100}$ "%"
"of"   "100"
$$\frac{200}{B} = \frac{250}{100} \quad \text{(cross multiply)}$$

200•100 = B•250   (simplify)
20000 = 250B   (divide by 250)
$$\frac{20000}{250} = \frac{250B}{250}$$
B = 80.

Ex. 5   What percent of 54 is 45?
    <u>Solution:</u>
    The amount (part) is 45, the base (whole) is 54, so we are looking for
    the percent:

"is" $\dfrac{45}{54} = \dfrac{p}{100}$ "%"
"of"   "100"

$\dfrac{45}{54} = \dfrac{p}{100}$ (cross multiply)

45•100 = 54•p   (simplify)
4500 = 54p   (divide by 54)
$\dfrac{4500}{54} = \dfrac{54p}{54}$

$p = 83.\overline{3}\% \text{ or } 83\dfrac{1}{3}\%$

Ex. 6   200 is what percent of 500?
    <u>Solution:</u>
    The amount (part) is 200, the base (whole) is 500, so we are looking
    for the percent:

"is" $\dfrac{200}{500} = \dfrac{p}{100}$ "%"
"of"   "100"

$\dfrac{200}{500} = \dfrac{p}{100}$ (cross multiply)

200•100 = 500•p   (simplify)
20000 = 500p   (divide by 500)
$\dfrac{20000}{500} = \dfrac{500p}{500}$

p = 40%

Objective 2:   Solving applications using the percent proportion.

The key to solve applications with percents is distilling the problem down
into a simple sentence like the sentences we solved in section 6.4. We will
start by identifying the amount, the percent, and the base and filling in the
basic sentence: <u>Amount</u> is a <u>Percent</u> of the <u>Base</u>
Afterwards, we will set-up the percent proportion and solve the problem.

Solve the following:

Ex. 7   The profits from Sink Stopper Plumbing Company fell by $13,950 or 45% this year. What profit did they turn last year?
Solution:
The drop in profits ($13,950) is 45% of last year's profit. Thus,
    $13,950 is 45% of <u>last year's profit</u>
So, we are looking for the base:

$$\frac{\text{"is"}}{\text{"of"}} \quad \frac{13950}{B} = \frac{45}{100} \quad \frac{\text{"\%"}}{100} \qquad \text{(cross multiply)}$$

13950(100) = B(45)
45B = 1395000   (divide by 45)
B = 31000
Therefore, last year's profit was $31,000.

Ex. 8   Katz's Catering Service needs 48 pounds of fresh mixed greens to make salads for a banquet. Since the catering service will lose some of the fresh mixed to spoilage, they order 60 pounds of mixed greens. What percent of the greens is the Catering Service expecting to lose to spoilage?
Solution:
The amount lost to spoilage is 60 – 48 = 12 pounds.
The amount spoiled (12 lb) is p% of the order (60 lb). Thus,
    12 is <u>P%</u> of 60
Hence, we are looking for the percent:

$$\frac{\text{"is"}}{\text{"of"}} \quad \frac{12}{60} = \frac{P}{100} \quad \frac{\text{"\%"}}{100} \qquad \text{(cross multiply)}$$

12(100) = 60P
1200 = 60P   (divide by 60)
P = 20%
So, 20% of the mixed greens will be lost to spoilage.

Ex. 9   The Great Wall Building Company submits a bid of $12,560,000 on the repair of a bridge. If 35% of the bid includes material costs, how much of the bid was for material costs?
Solution:
    The material cost is 35% of the bid ($12,560,000). Thus,
    <u>The material cost</u> is 35% of 12560000
So, we are looking for the amount:

$$\frac{\text{"is"}}{\text{"of"}} \quad \frac{A}{12560000} = \frac{35}{100} \quad \frac{\text{"\%"}}{100} \qquad \text{(cross multiply)}$$

100A = 12560000(35)
100A = 439600000   (divide by 100)
A = 4396000

Hence, the material cost was $4,396,000.

Ex. 10   The volumetric efficiency of a certain engine is 87.3% meaning that the actual airflow is 87.3% of the theoretic airflow. If the actual airflow is 239.4 cfm (cubic feet per minute), what is the theoretic airflow of this engine (to the nearest tenth)?
Solution:
The actual airflow (239.4 cfm) is 87.3% of the theoretic airflow. Thus,
    239.4 is 87.3% of <u>the theoretic airflow</u>
So, we are looking for the base:

$\frac{\text{"is"}}{\text{"of"}}$ $\frac{239.4}{B} = \frac{87.3}{100}$ $\frac{\text{"%"}}{100}$ (cross multiply)

239.4(100) = b(87.3)
87.3B = 23940   (divide by 87.3)
B = 274.226… ≈ 274.2

Hence, the theoretic airflow is 274.2 cfm.

Ex. 11   An electrician needs to install a fuse for a new motor with a current of 65 amperes. If the fuse must be rated at 180% of the motor current, what size fuse will the electrician need?
Solution:
        The fuse size is 180% of the motor current (65 amp). Thus,
        <u>The fuse size</u> is 180% of 65
So, we are looking for the amount:

$\frac{\text{"is"}}{\text{"of"}}$ $\frac{A}{65} = \frac{180}{100}$ $\frac{\text{"%"}}{100}$ (cross multiply)

100A = 65(180)
100A = 11700   (divide by 100)
A = 117

Hence, the fuse size needs to be 117 amperes.

Ex. 12   If six ounces of pure acid is mixed with thirty-four ounces of water, what is the percent concentration of acid in the resulting solution?
Solution:
The total amount of the resulting solution is 6 oz + 34 oz = 40 oz.
The amount of acid (6 oz) is <u>P%</u> of the total solution (40 oz). Hence,

6 is <u>P%</u> of 40

Thus, we are looking for the percent:

$\dfrac{\text{"is"}}{\text{"of"}}$ $\dfrac{6}{40} = \dfrac{P}{100}$ $\dfrac{\text{"%"}}{100}$ (cross multiply)

6(100) = 40P

40P = 600 (divide by 40)

P = 15%

So, the solution is 15% acid.

Ex. 13 Juanita made a down payment of $36,480 on the purchase of new home. If this was 24% of the cost of the new home, find the cost of the new home.

Solution:

The money down ($36,480) is 24% of the cost of the house. Thus,

36480 is 24% of <u>the cost of the house</u>

So, we are looking for the base:

$\dfrac{\text{"is"}}{\text{"of"}}$ $\dfrac{36480}{B} = \dfrac{24}{100}$ $\dfrac{\text{"%"}}{100}$ (cross multiply)

36480(100) = b(24)

24B = 3648000 (divide by 24)

B = 152000

Hence, the cost of the house was $152,000.

Ex. 14 Out of 4000 microchips produced, 72 microchips were found to be defective. What percent of the chips produce were defective?

Solution:

The defective chips (72 chips) is <u>P%</u> of the total (4000 chips). Hence,

72 is <u>P%</u> of 4000

Thus, we are looking for the percent:

$\dfrac{\text{"is"}}{\text{"of"}}$ $\dfrac{72}{4000} = \dfrac{P}{100}$ $\dfrac{\text{"%"}}{100}$ (cross multiply)

72(100) = 4000P

4000P = 7200 (divide by 4000)

P = 1.8%

So, 1.8% of the chips produced were defective.