"SEES" the Problem

A Critical Thinking Template for Problem-Solving

- State the problem in your own words.

Analyze and interpret relevant information.

- Elaborate the problem: discuss the purpose, assumptions, relevant information, questions

Explain questions, problems and/or issues.

- Exemplify and/or illustrate the problem: describe the problem with an example, counterexample, picture, diagram, graph, etc. This may help clarify your "point of view" and suggest potential conclusions.

Evaluate information to determine potential conclusions.

- Solve the problem: use mathematical concepts and reasoning to make inferences and draw a conclusion. What are the implications and/or consequences of your conclusion?

Generate a well-reasoned conclusion.

“SEES the Problem”
A Critical Thinking Template for Problem-Solving

Name: ______________________________________ Date: _____________
Assignment #____________

20 points each

State	
Elaborate	
Exemplify	
Solve	
Grammar/Spelling	
TOTAL GRADE	

1. **S**tate the problem in your own words.

2. **E**laborate the problem: discuss the purpose, assumptions, relevant information, questions.

3. **E**xemplify and/or illustrate the problem: describe the problem with an example, counterexample, picture, diagram, graph, etc. This may help clarify your "point of view" and suggest potential conclusions.

4. **S**olve the problem: use mathematical concepts and reasoning to make inferences and draw a conclusion. What are the implications and/or consequences of your conclusion?

“SEES” the Problem

In this presentation, you will see an example of how to solve a survey problem using set concepts and the “SEES” process.

Then, you will solve a similar problem using this methodology.

EXAMPLE:
Solving a Survey Problem

A group of 140 people were questioned about particular sports that they play regularly. The following data was gathered:

93 play golf
70 go bowling
40 play tennis
40 play golf and go bowling
25 go bowling and play tennis
28 play golf and play tennis
20 do all three

Based on this survey data, determine the answers to the following questions:

a) How many people only play golf?

b) How many people don't play any of the sports?

"SEES" SOLUTION:

State the problem in your own words

140 people were surveyed about which of the following three sports they play regularly:

- Golf
- Bowling
- Tennis

Based on the data gathered, determine how many of the 140 people:

- played golf regularly (but not bowling and not tennis)
- didn't play any of the three sports on a regular basis.

“SEES” SOLUTION:
Elaborate the problem

The 140 people surveyed gave the following responses:

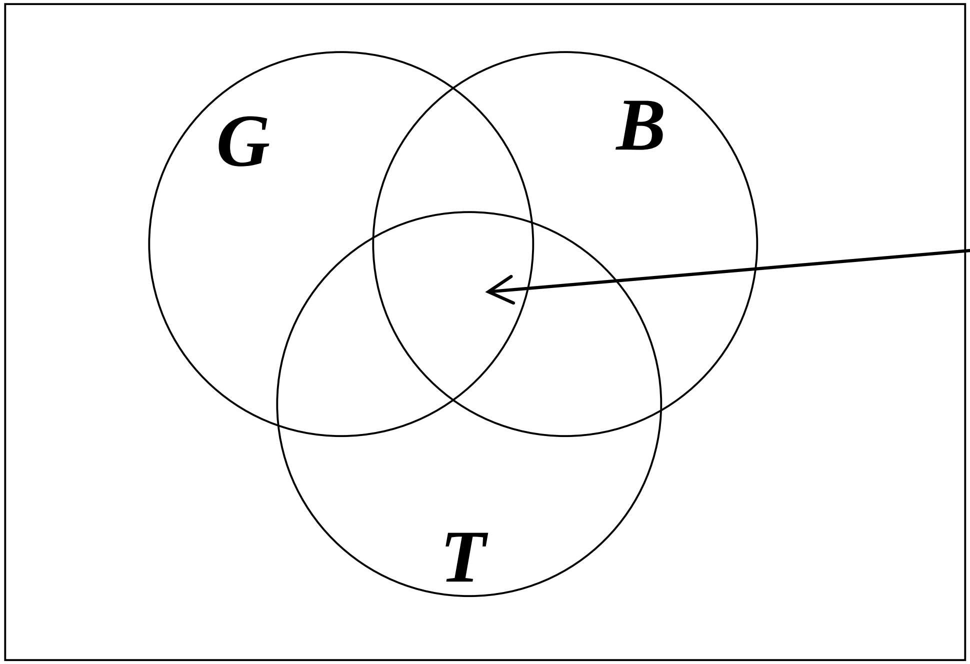
93 play golf	40 play golf and go bowling
70 go bowling	25 go bowling and play tennis
40 play tennis	28 play golf and play tennis

20 do all three

However, it is clear from the given data that some people play two or more sports on a regular basis. Therefore, to determine how many people played *only* golf or how many people played *none* of the sports, we need to structure the data to be able to see how many people played only one of the sports, how many people played exactly two of the sports, and how many people played all three sports. This is most easily accomplished using a ***Venn diagram***.

"SEES" SOLUTION:
Exemplify and/or illustrate the problem

Let G = Set of people who play golf
Let B = Set of people who go bowling
Let T = Set of people who play tennis



Start with "play all 3"

93 play golf
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"SEES" SOLUTION:
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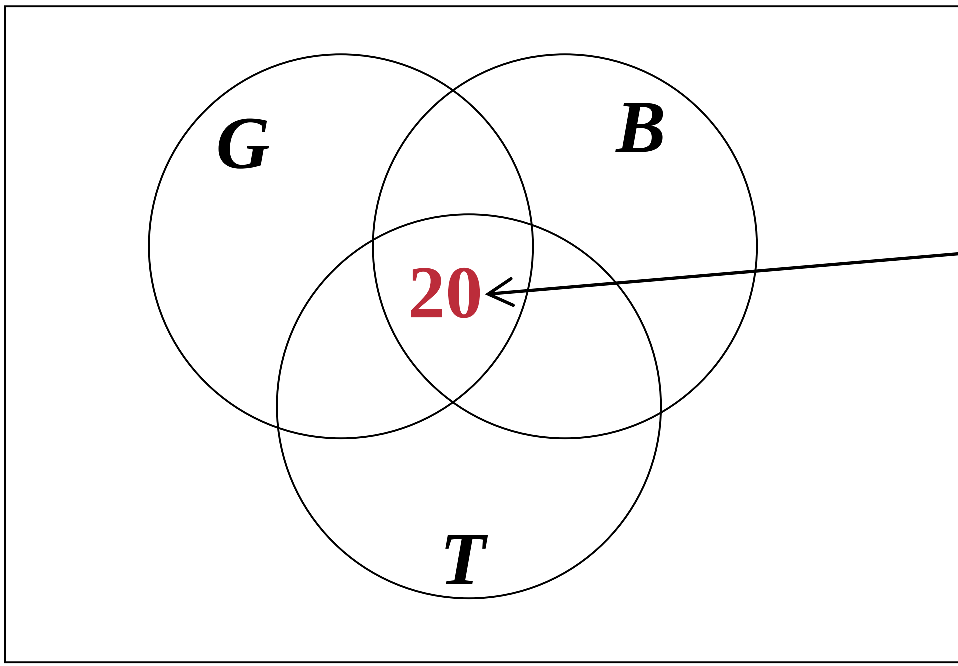

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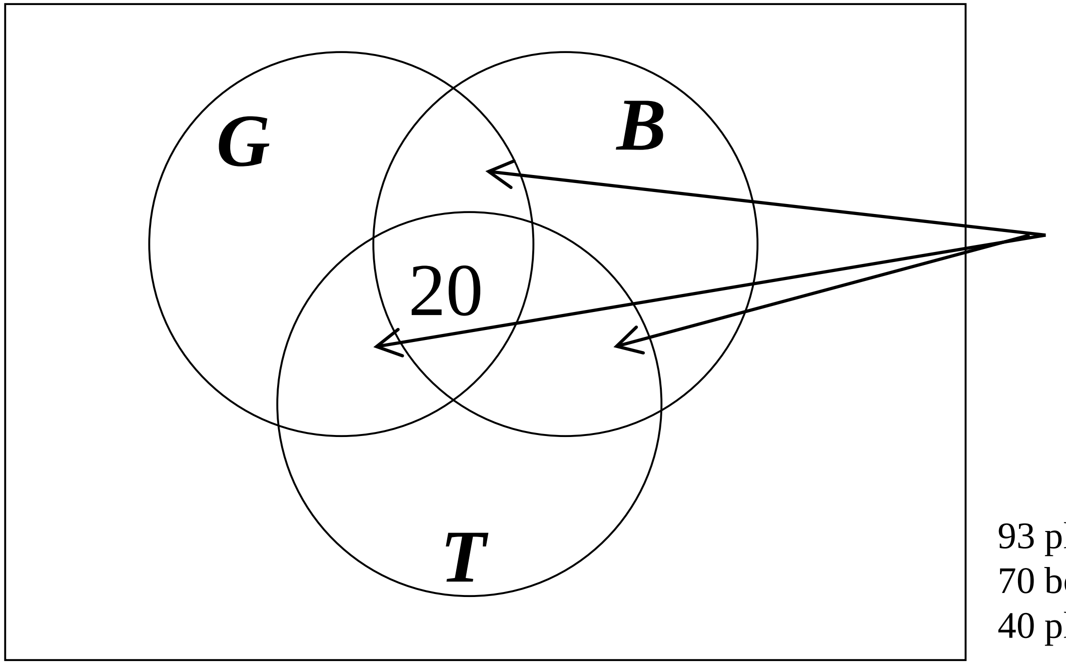

Subtract to get

93 play golf
70 bowl
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28 play golf and play tennis

20 do all three

"SEES" SOLUTION:
Exemplify and/or illustrate the problem

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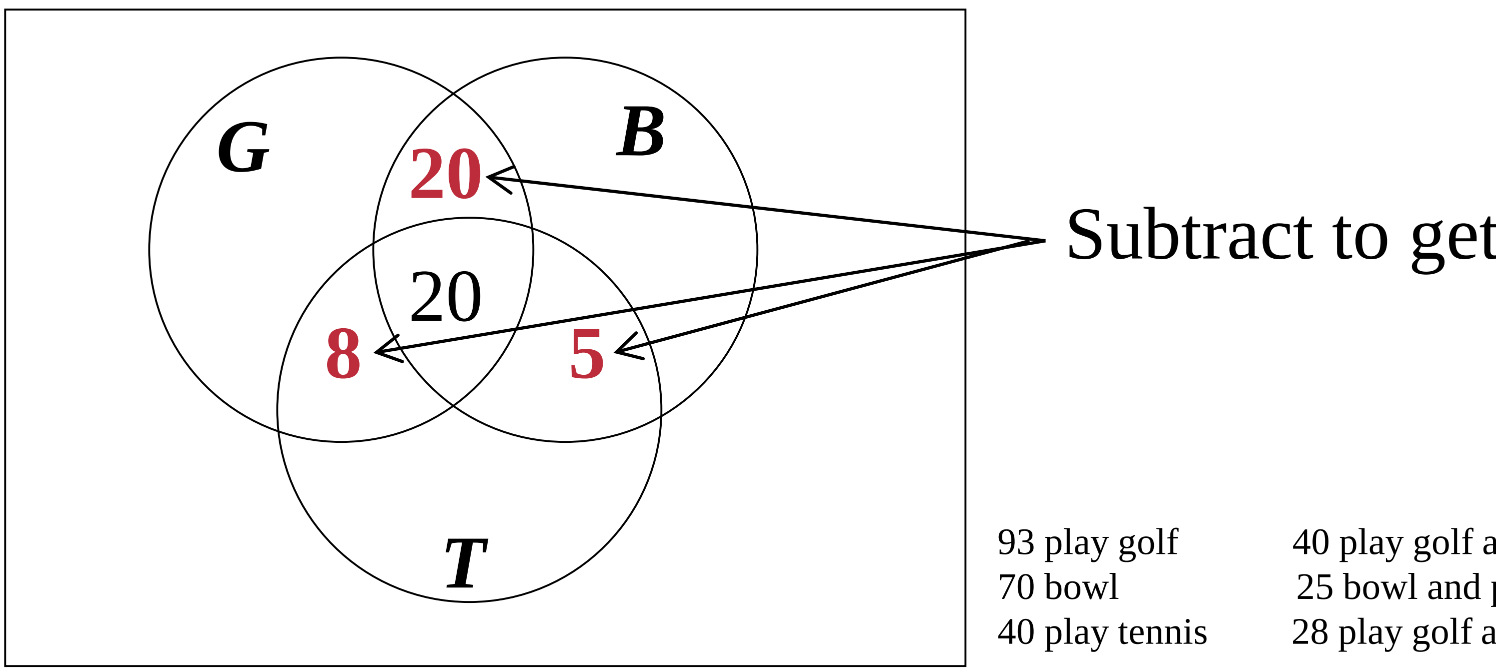

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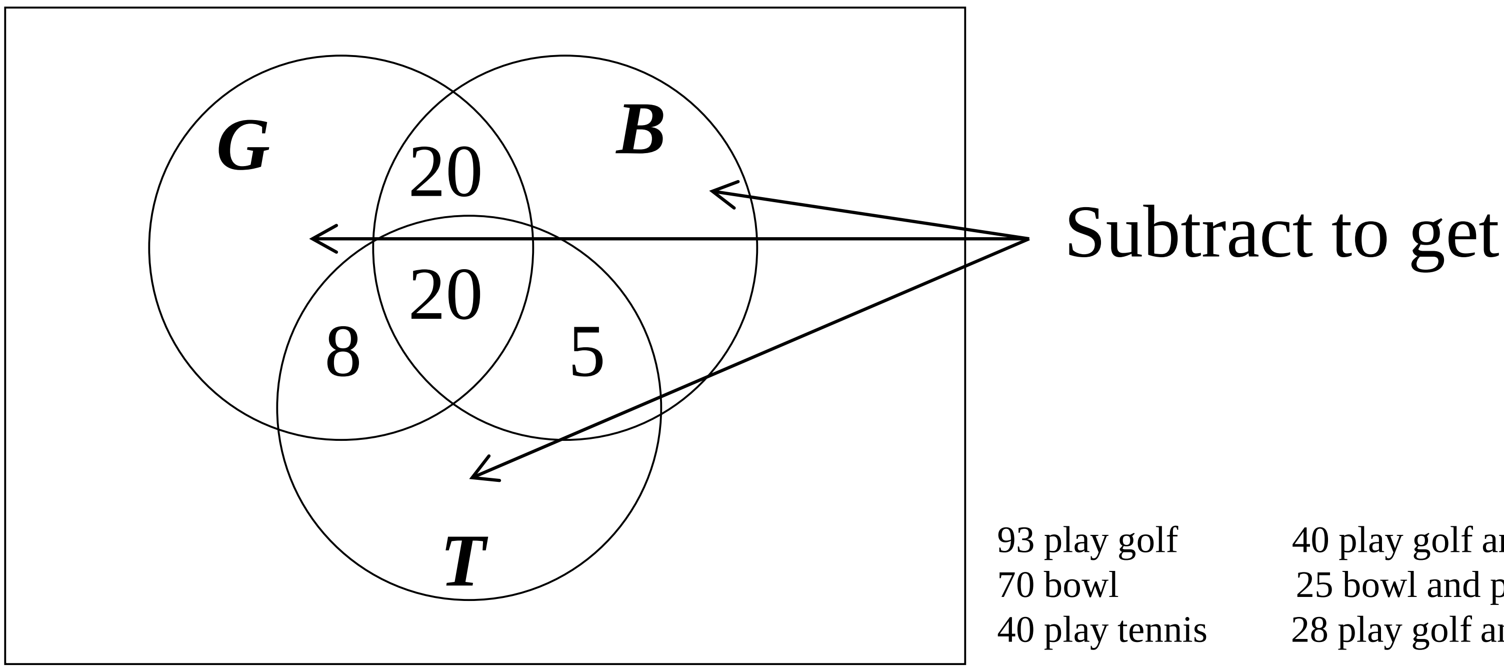

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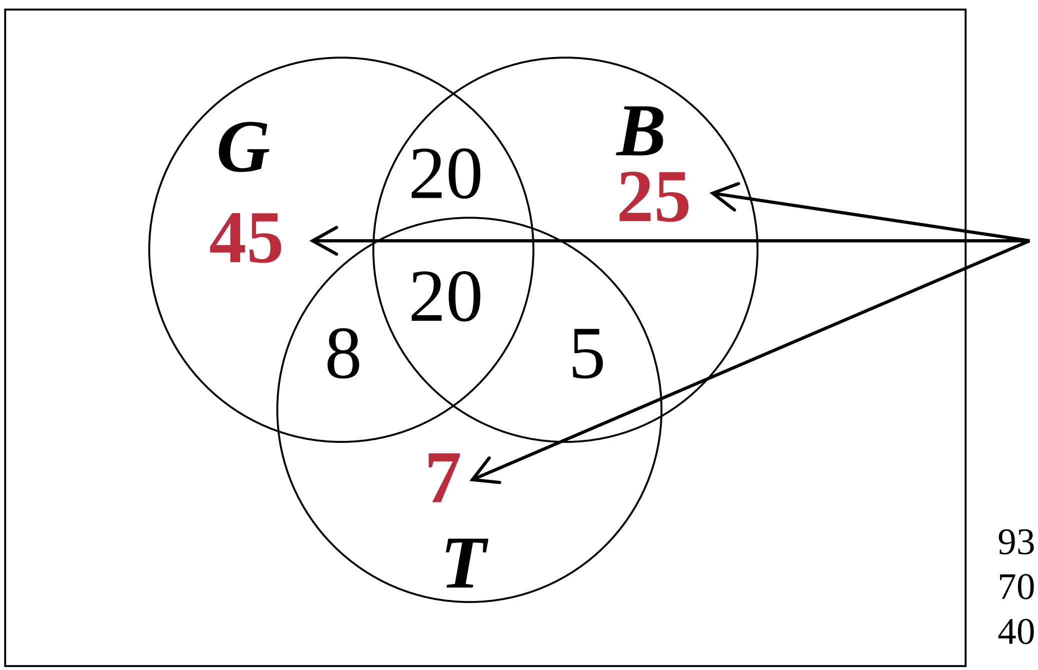

Subtract to get

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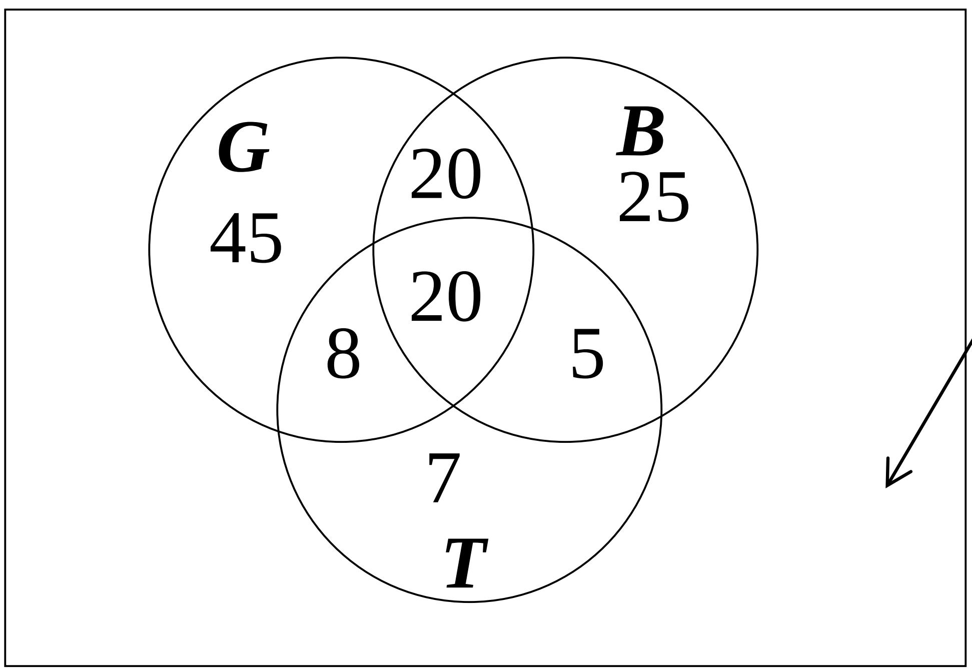

Subtract total shown from 140 to get

"SEES" SOLUTION:

Exemplify and/or illustrate the problem

Let G = Set of people who play golf
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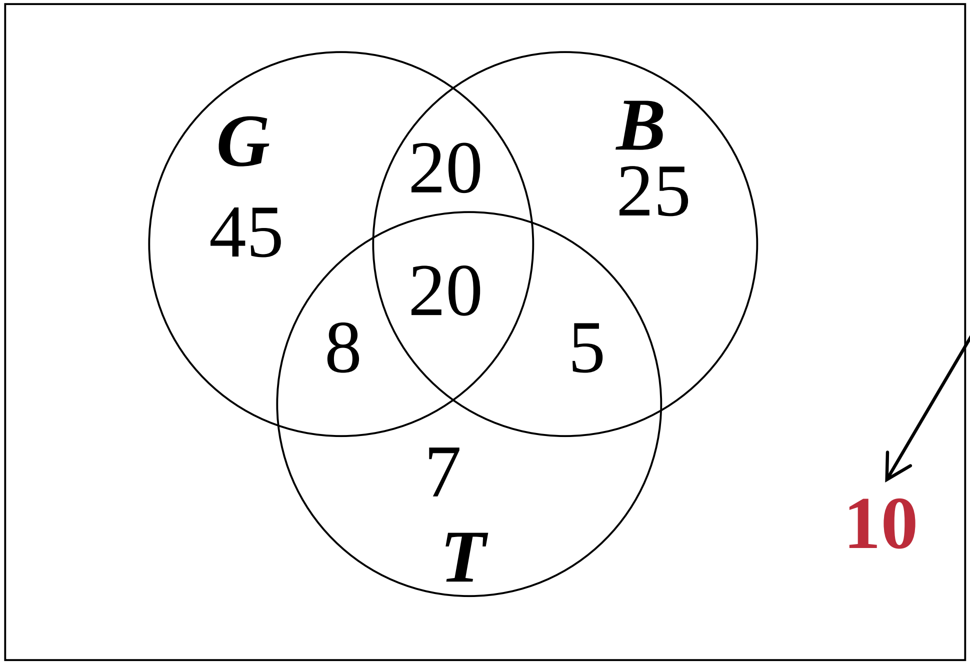
Let T = Set of people who play tennis



Subtract total shown from 140 to get

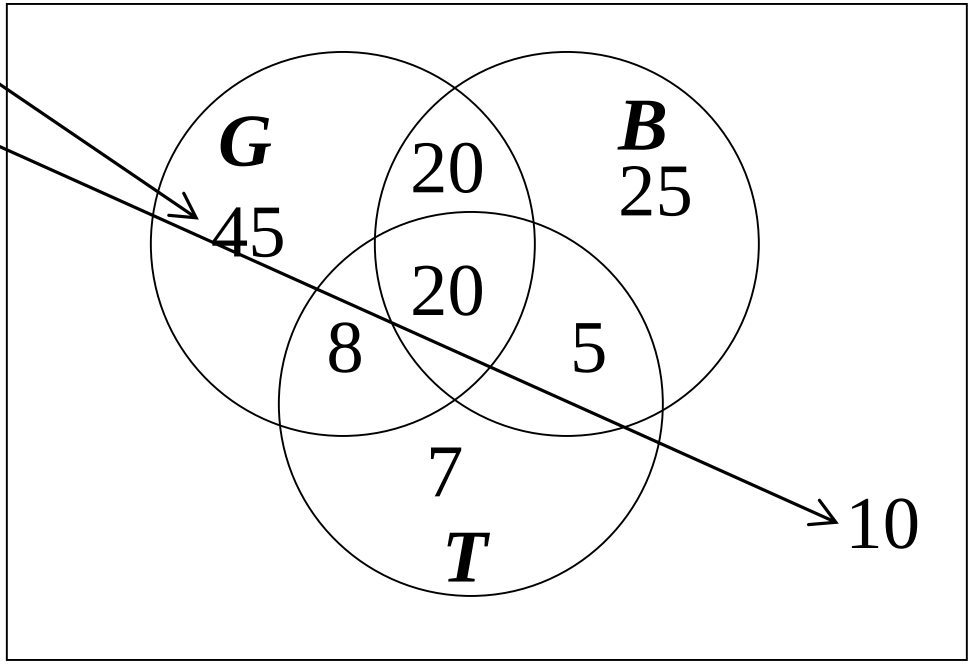
"SEES" SOLUTION:
Solve the problem

a) How many people play *only* golf?

45

b) How many people don't play any of the sports?

10



ASSIGNMENT:
Solve a Survey Problem

A group of 113 tourists were asked about which places they were going to visit in San Francisco. The following data was gathered:

63 plan to visit the Golden Gate 49 plan to visit Chinatown
11 plan to visit Alcatraz and Chinatown, but *not* the Golden Gate
12 plan to visit Alcatraz and the Golden Gate, but *not* Chinatown
19 plan to visit the Golden Gate and Chinatown, but *not* Alcatraz
7 plan to visit *all three* places 14 plan to visit *none of the three* places

Based on this survey data, determine how many plan to visit *Alcatraz only*.

Solve the problem using the "SEES" methodology:

- **S**tate the problem in your own words.
- **E**laborate the problem: discuss the purpose, assumptions, relevant information, questions.
- **E**xemplify and/or illustrate the problem: describe the problem with an example, counterexample, picture, diagram, graph, etc.
- **S**olve the problem: use mathematical concepts and reasoning to make inferences and draw a conclusion. What are the implications and/or consequences of your conclusion?

“SEES” the Problem

In this presentation, you will see an example of how to determine if an argument is valid or invalid using logic concepts and the “SEES” process.

Then, you will solve a similar problem using this methodology.

EXAMPLE:
Solving a Logic (Validity) Problem

Is the following argument valid?

The family will go to the beach if and only if the sky is blue.
There is no traffic or the sky is blue.
There is traffic.

Therefore, the family will go to the beach.

“SEES” SOLUTION:
State the problem in your own words

We may assume that the three statements above the line are true.

Based on those assumptions, we need to determine if the conclusion (“The family will go to the beach”) is always true.

“SEES” SOLUTION:
Elaborate the problem

This argument assumes that the following statements are true:

- The family will go to the beach if and only if the sky is blue.
- There is no traffic or the sky is blue.
- There is traffic.

We need to use mathematical logic to determine if the conclusion:

- The family will go to the beach.

is always true based on these three assumptions.

"SEES" SOLUTION:
Exemplify and/or illustrate the problem

We will convert the argument to symbolic form so that we can create a truth table to analyze the argument's validity.

Let p = "The family will go to the beach."
Let q = "The sky is blue."
Let r = "There is traffic."

Then the argument:

The family will go to the beach if and only if the sky is blue.
There is no traffic or the sky is blue.
There is traffic.

Therefore, the family will go to the beach.

has the symbolic form:

$$\begin{array}{l} p \leftrightarrow q \\ \sim r \lor q \\ \underline{r \qquad\qquad} \\ p \end{array}$$

"SEES" SOLUTION:
Solve the problem

$p \leftrightarrow q$

$\sim r \vee q$

$\underline{r \qquad\qquad}$

p

- Create a truth table with columns for p, q, r, ~r, p ↔ q, and ~r ∨ q.
- Cross out rows for which the assumptions p ↔ q, ~r ∨ q, and r are false.
- In the only remaining row, the conclusion, p, is true.

Therefore, the argument is valid.

p has to be *true*

p	q	r	$\sim r$	$p \leftrightarrow q$	$\sim r \vee q$
T	T	T	F	T	T
~~T~~	~~T~~	~~F~~	~~T~~	~~T~~	~~T~~
~~T~~	~~F~~	~~T~~	~~F~~	~~F~~	~~F~~
~~T~~	~~F~~	~~F~~	~~T~~	~~F~~	~~T~~
~~F~~	~~T~~	~~T~~	~~F~~	~~F~~	~~T~~
~~F~~	~~T~~	~~F~~	~~T~~	~~F~~	~~T~~
~~F~~	~~F~~	~~T~~	~~F~~	~~T~~	~~F~~
~~F~~	~~F~~	~~F~~	~~T~~	~~T~~	~~T~~

r is *false*

p↔q is *false*

~r ∨ q is *false*

r is *false*

ASSIGNMENT:
Solve a Logic (Validity) Problem

Is the following argument valid?

If he is hungry, then he will eat.
If he eats, then he will not go to sleep.
He went to sleep.

Therefore, he is not hungry.

Solve the problem using the "SEES" methodology:

- **S**tate the problem in your own words.
- **E**laborate the problem: discuss the purpose, assumptions, relevant information, questions.
- **E**xemplify and/or illustrate the problem: describe the problem with an example, counterexample, picture, diagram, graph, etc.
- **S**olve the problem: use mathematical concepts and reasoning to make inferences and draw a conclusion. What are the implications and/or consequences of your conclusion?

"SEES" the Problem

In this presentation, you will see an example of how to solve a geometry problem using similar triangles and the "SEES" process.

Then, you will solve a similar problem using this methodology.

EXAMPLE:
Solving a Geometry Problem

How high is a tree that casts a shadow which is 32 feet long at the same time that a nearby 8-foot post casts a shadow which is 14 feet long?

"SEES" SOLUTION:

State the problem in your own words

We want to find the height of a tree that casts a 32-foot long shadow.

The only additional information that we are given is that there is an 8-foot post (which is close to the tree) that casts a 14-foot long shadow at the same time of day.

"SEES" SOLUTION:
Elaborate the problem

In order to determine the height of the tree, we need to use Geometry to relate the tree to the nearby post.

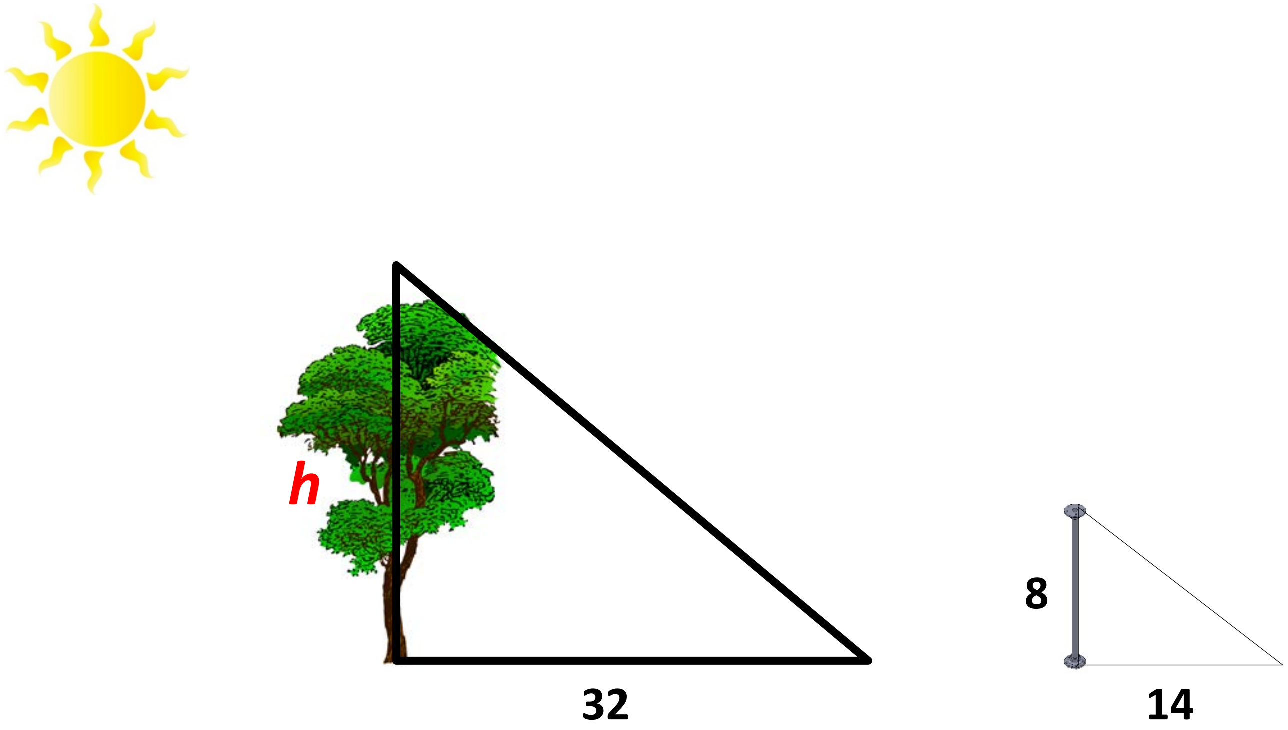
Because the sun is casting shadows on the tree and the post at the same time, we can set up similar triangles to help us solve the problem.

Let's start by drawing a picture to illustrate the problem.

"SEES" SOLUTION:

Exemplify and/or illustrate the problem

Draw and label similar triangles to illustrate the given information.



"SEES" SOLUTION:
Solve the problem

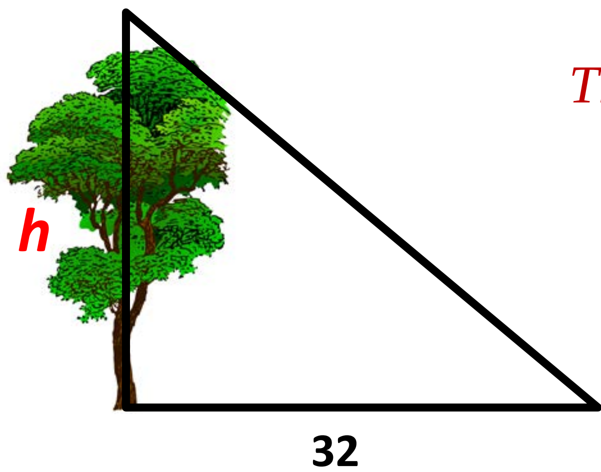
Set up a proportion and solve for h:

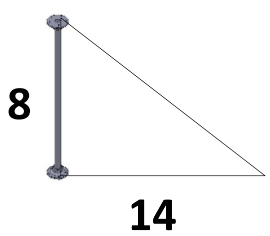
$$\frac{h}{8} = \frac{32}{14}$$

$$h = 8\left(\frac{32}{14}\right)$$

$$\approx 18.3$$

The tree is about 18.3 ft. high.

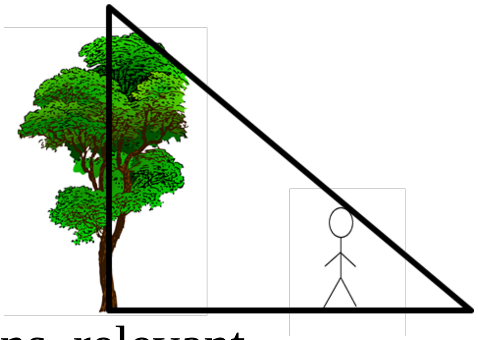




ASSIGNMENT:
Solve a Geometry Problem

Mark, who is 1.7 m tall, wishes to find the height of a tree with a shadow 31.23 m long. He walks 20.45 m from the base of the tree until his head is in a position where the tip of his shadow exactly overlaps the end of the tree's shadow.

How tall is the tree? Round your answer to the nearest hundredth of a meter.



Solve the problem using the "SEES" methodology:

- **S**tate the problem in your own words.
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“SEES” the Problem

In this presentation, you will see an example of how to solve a probability problem using the “SEES” process.

Then, you will solve a similar problem using this methodology.

EXAMPLE:
Solving a Probability Problem

A manufacturer of portable CD players has determined that, on average, 4% of its products tend to be defective.

The manufacturer has produced a batch of 8000 CD players and wants to determine if the batch will be accepted or rejected.

The manufacturer has decided that it will randomly test 9 of the CD players *with replacement*, and if at least one of the CD players tested is defective, then the entire batch will be rejected.

Find the probability that the entire batch will be rejected.

- Round your final answer to two decimal places.

"SEES" SOLUTION:

State the problem in your own words

A manufacturer of CD players wants to test the quality of its current batch of 8000 CD players to decide if it will accept the batch and release it to the public for sale, or if it will reject the batch due to low quality and produce a new batch instead.

Past history has shown that 4% of the manufacturer's CD players tend to be defective on average. For this batch, the manufacturer has decided to randomly test 9 of the CD players (replacing each one in the batch after testing), and if at least one of the CD players is found to be defective, it will reject the batch; otherwise, it will accept the batch for general release.

We are asked to find the probability (rounded to two decimal places) that the batch will be rejected.

"SEES" SOLUTION:
Elaborate the problem

- Because 4% of the CD players tend to be defective on average, if we test just one CD player at random, the probability that it will be defective is 4%=0.04. Thus, the probability that it will *not* be defective is 96%=0.96.
- Because each CD player tested is replaced into the batch after it is tested, we can assume that the 9 tests are independent events.
- We must now determine how to calculate the probability that at least 1 of the 9 CD players tested is defective.

“SEES” SOLUTION:
Exemplify and/or illustrate the problem

Let’s start by doing a simpler version of the problem: *If we test just 2 CD players, what is the probability that at least one of them is defective?*

Define the events E_1 and E_2 as follows:

E_1 = the first CD player tested is defective
E_2 = the second CD player tested is defective

We will calculate the probability of E_1 or E_2 by using the “not” technique:

$$\begin{aligned} P(E_1 \text{ or } E_2) &= 1 - P(\,(E_1 \text{ or } E_2)'\,) \\ &= 1 - P(\,E_1' \text{ and } E_2'\,) && \leftarrow \text{De Morgan's Law} \\ &= 1 - P(\,E_1'\,)P(\,E_2'\,) && \leftarrow \text{Independence of the events} \\ &= 1 - (.96)(.96) = .0784 = 7.84\% \end{aligned}$$

Because De Morgan’s Law and the formula for the probability of independent events extends to any number of events, we can use this strategy to solve our problem.

"SEES" SOLUTION:

Solve the problem

Define the event E = **at least 1 of the 9** CD players tested is defective.

We want to calculate P(E).

Note that event E' = **none of the 9** CD players tested is defective.

$$
\begin{aligned}
P(E) &= 1 - P(E') \\
&= 1 - (.96)^9 && \leftarrow \text{De Morgan's Law and Independence of the 9 events} \\
&= 0.307466 \\
&= 30.75\% && \leftarrow \text{Rounded to two decimal places}
\end{aligned}
$$

Therefore, there is a 30.75% chance that the entire batch of CD players will be rejected.

ASSIGNMENT:
Solve a Probability Problem

It has been determined that when a rocket is launched, there is a 1% chance that debris from the launch pad will strike the rocket.

Find the probability that any 10 launches will result in debris from the launch pad striking at least one of the 10 rockets.

- You may assume that the launches are independent events.
- Round your final answer to two decimal places.

Solve the problem using the "SEES" methodology:

- **S**tate the problem in your own words.
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