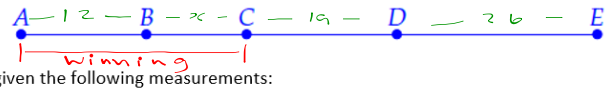
# Lesson 8: Solving for Unknowns in Geometric Probability Questions

May 10, 2023

3.1.1 Practice

We are given the following line segment that is a target for a game. To win the game, a dart thrown randomly at the line segment must land between point A and C:




We are also given the following measurements:

- $m\overline{AB} = 12$ measurement of line segment AB.
- $m\overline{BC} = ?$
- $m\overline{CD} = 19$
- $m\overline{DE} = 26$

The target was modified by changing the measure of line segment BC in an unknown way. The probability of winning used to be $\frac{8}{25}$, but by modifying the original target the probability of winning decreased by 7%. Determine the measure of line segment BC.

WANT: $m\overline{BC} = x$

TOOL:

$P = \frac{\text{target length}}{\text{total length}}$

$P(\text{win}_{\overline{AC}}) = \frac{m\overline{AC}}{m\overline{AE}}$

INFO (1) $P(\text{win}_{\overline{AC}}) = ?$

$m\overline{AC} = ?$

$\overline{AC} = \overline{AB} + \overline{BC}$

$\overline{AC} = 12 + x$

$m\overline{AE} = ?$

$\overline{AE} = \overline{AB} + \overline{BC} + \overline{CD} + \overline{DE}$

$\overline{AE} = 12 + x + 19 + 26$

$\overline{AE} = 57 + 1x$

Find $P(\text{win}_{\overline{AC}})$

new $P(\text{win}_{\overline{AC}})$ = old $P(\text{win})$ − 7%

$= \frac{8}{25} \times 100\% - 7\%$ (make the prob. in same for.)

$= 32\% - 7\%$

new $P(\text{win}_{\overline{AC}}) = 25\%$

sub in values

$P(\text{win}_{\overline{AC}}) = \frac{m\overline{AC}}{m\overline{AE}}$

Before:

$25\% = \frac{12 + x}{57 + x}$

$0.25 = \frac{12 + x}{57 + x}$

BEDMAS

Bring x's together w/ cross multiplying

$0.25(57 + x) = 12 + x$

Left side Right side

$14.25 + 0.25x = 12 + x$

$14.25 + 0.25x - 1x = 12$

$-14.25$

$14.25 - 0.75x = 12 - 14.25$

$\frac{-0.75x}{-0.75} = \frac{-2.25}{-0.75}$

$x = 3$

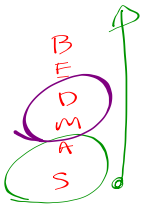
$\therefore m\overline{BC} = 3$ units

Solve

do 0.0.

$x \leftrightarrow \frac{0}{0}$

$+ \leftrightarrow -$




isolate x:

$x =$ ____

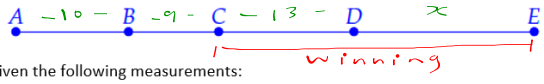
You do:

3.1 Example

If finished go on to example 3.2

3.1 Example

We are given the following line segment that is a target for a game. To win the game, a dart thrown randomly at the line segment must land between point C and E:




We are also given the following measurements:

- $m\overline{AB} = 10$
- $m\overline{BC} = 9$
- $m\overline{CD} = 13$
- $m\overline{DE} = ?$

$\overline{CD} + \overline{DE} = 13 + x$

$\overline{AD} + \overline{DE} = 32 + x$

new $P(\text{win})_{\overline{CE}} = \dfrac{\text{target length}}{\text{total length}}$

new $P(\text{win})_{\overline{CE}} = \dfrac{\overline{CD} + \overline{DE}}{\overline{AD} + \overline{DE}}$

$\dfrac{6}{10} = \dfrac{3}{5}$

The target was modified by changing the measure of line segment DE in an unknown way. The probability of winning used to be $\frac{1}{2}$, but by modifying the original target the probability of winning increased by 10%. Determine the measure of line segment DE.

$+10\% = \frac{1}{2} + 10\% = 50\% + 10\%$

new $P(\text{win}) = 60\%$

$0.6 = \dfrac{13 + x}{32 + x}$

$0.6(32 + x) = 13 + x$

$19.2 + 0.6x = 13 + x$

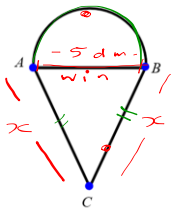
$19.2 - 0.4x = 13 - 19.2$

$\dfrac{-0.4x}{-0.4} = \dfrac{-6.2}{-0.4}$

$x = 15.5$

3.2 Example

We are given the following target shaped as an ice cream cone. A movable pin speeds along the path outlined below. To win the game, the pin must be stopped along the line segment AB.




$\overset{\frown}{AB}$ = arc AB (in this example $\overset{\frown}{AB}$ is a half-circle a semi-circle)

$\overline{AB}$ = diameter of half circle

$\therefore d = 5\ dm$

$\therefore r = 2.5\ dm$

$C = 2\pi r$

$\frac{1}{2}C = \frac{1}{2}(2\pi r)$

$\boxed{\frac{1}{2}C = \pi r}$

We are also given the following information:

- Arc AB is half a circle
- $m\overset{\frown}{AB} = ?$
- $m\overline{AB} = 5\ dm$
- The probability of the pin stopping along line segment AC is the same as that of line segment BC. $\therefore m\overline{AC} = m\overline{BC}$

The target was modified by changing the measure of line segment AC and BC in the exact same unknown way. The probability of winning used to be 0.3, but by modifying the original target the probability of winning decreased by 10%. Determine the measure of line segment AC and BC.

$P_{win} = 0.3^{100\%} - 10\%$

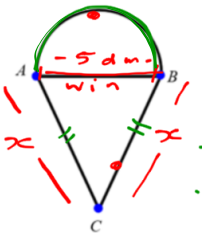
$P_{win} = 30\% - 10\%$

$= 20\%$

$\boxed{P_{win} = 0.2}$

$P_{win} = \frac{\text{target length}}{\text{total length}}$

$P(win)_{\overset{\frown}{AB}} = \frac{m\overline{AB}}{m\overline{AB} + m\overset{\frown}{AB} + m\overline{AC} + m\overline{BC}}$




length of $\overset{\frown}{AB}$:

$\boxed{\frac{1}{2}C = \pi r}$

C = circumference (measurement) length of the perimeter

- arc is part of the outer perimeter

$0.2 = \frac{5}{5 + \pi r + x + x}$

$0.2 = \frac{5}{5 + \pi(2.5) + 2x}$

$\frac{0.2}{1} = \frac{5}{12.85 + 2x}$

$0.2(12.85 + 2x) = 5$

$2.57 + 0.4x = 5 - 2.57$

$\frac{0.4x}{0.4} = \frac{2.43}{0.4}$

$\boxed{x = 6.075}$

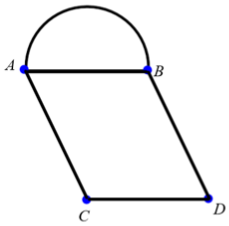
BEDM

A

S

3.2.1 Practice

We are given the following target shaped as a lawn chair. A movable pin speeds along the path outlined below. To win the game, the pin must be stopped along arc AB.



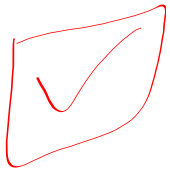

We are also given the following information:

- Arc AB is half a circle
- $m\widehat{AB} = ?$
- $m\overline{AB} = 4\ dm$
- The probability of the pin stopping along line segment AC is the same as that of line segment BD.
- The probability of the pin stopping along line segment AB is the same as that of line segment CD.

The target was modified by changing the measure of line segment AC and BD in the exact same unknown way. The probability of winning used to be 0.15, but by modifying the original target the probability of winning increased by 5%. Determine the measure of line segment AC and BD.

## *Tentative Schedule*

| | |
|---|---|
| 28 | MTH-3052: Data Collection – **L1** – Intro to Data Collection and Definitions. Bias and Sampling Methods. Organizing Distributions of Raw Data into Condescended Data Tables with Frequency and Relative Frequency |
| **MAY 2023** | |
| 1 | MTH-3052: Data Collection – **L2** – Constructing Tables of Condescended Data Grouped into Classes. Reading and Constructing Histograms. Reading Bar and Circle Graphs. Determining the Measures of Central Tendency (Mean, Median, and Mode) of a Distribution. Determining a Measure of Dispersion (Range). Determining Weighted Mean. |
| 2 | MTH-3052: Data Collection – **L3** – Solving for an Unknown in a Weighted Mean Question. Determining Mean, Median, and Mode of Distributions in Condescended Data Tables. |
| 3 | MTH-3052: Data Collection – **L4** – Quartiles and Box-and-Whisker Plot |
| 4 | MTH-3052: Data Collection – **L5** – Statistical Tasks |
| 5 | In-Class Assignment AND Creation of Memory Aid |
| 8 | MTH-3052: Data Collection – **L6** – Translating Odds and Probabilities |
| 9 | MTH-3052: Data Collection – **L7** – Probability Trees and Tasks |
| 10 | MTH-3052: Data Collection – **L8** – Geometric Probability and Tasks |
| 11 | Take-up In-Class Assignment AND more probability task practice |
| 12 | NO SCHOOL – PEDAGOGICAL DAY |
| 15 | MTH-3052: Data Collection – Pre-test |
| 16 | MTH-3052: Data Collection – Take up Pre-Test and Review |
| 17 | MTH-3052: Data Collection – Practice Pre-test |
| 18 | MTH-3052: Data Collection – Practice Pre-test |
| 19 | MTH-3052: Data Collection – EXAM |



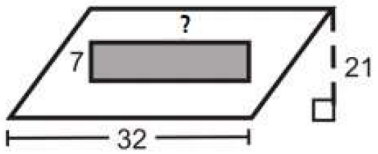
- Practice Pretest – 15
- Real Pretest – 16
- Take-up Pretest – 17
- Practice Pretest – 18

More Solving:

### 3.2 Missing Measurements in Two Dimensions

**Example** We can also find missing measurements in two dimensions!

The probability of randomly selecting a point from the shaded area is $\frac{1}{6}$. Given this, determine the length of the rectangle.




WANT : length
1 unk

TOOL: 1 eq

$P = \frac{\text{target area}}{\text{total area}}$

$P_{SR} = \frac{1}{6}$

sub in

INFO

$P_{SR} = \frac{1}{6}$

$\ell = ?$

$w = 7$

$b = 32$

$h = 21$

$P_{SR} = \frac{\text{area}_{SR}\,(\text{rect})}{\text{area parallelogram}}$

$P_{SR} = \frac{\ell \cdot w}{b \times h}$

coefficient

$2x = x \cdot 2$

$\frac{1}{6} = \frac{\ell \cdot 7}{32 \times 21}$

$\frac{1}{6} = \frac{7 \cdot \ell}{672}$

cross multiple

$672 = 6(7 \cdot \ell)$

$\frac{672}{42} = \frac{42 \cdot \ell}{42}$

$\ell = 16$

good ✓

$6(7\ell + 2)$

$42\ell + 12$

not good

$6(7(\ell + 2))$

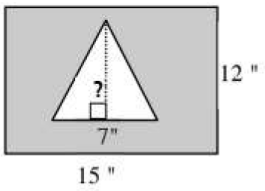
not good

$6(7\ell)$

You do:

$\frac{33}{40}$

### 3.2.1 Practice




The probability of randomly selecting a point from the shaded area is $\frac{7}{40}$. Given this, determine the height of the triangle.

After do

- p 201 #4.14 ★★ v. good practice question
- Hmwk: finish handouts