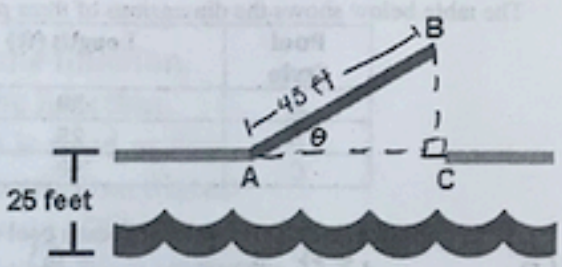
U6 HW5B

Name Key Per

1. The Drawbridge Problem

A drawbridge is to be constructed over a waterway in Kaliningrad, Russia. $\overline{AB}$ is the portion of the bridge that pivots and A is the pivot point. The length of $\overline{AB}$ is 43 feet. Let θ represent the angle that is formed by $\overline{AB}$ and $\overline{AC}$ as the bridge opens up. The distance from the surface of the water to the bridge is 25 feet.



a) Suppose the bridge is open to a 62° angle, what would be the distance from $\overline{AC}$ to the top of the bridge?

$\sin(62°) = \frac{BC}{43}$ $BC = 43\sin(62°)$

≈ 37.97 ft

b) Suppose the bridge is open to a 62° angle, what would be the tallest ship that could pass through the waterway?

$37.97 + 25 = 62.97$ ft

c) Suppose the bridge is open to a 14° angle, what would be the tallest ship that could pass through the waterway?

$\sin(14°) = \frac{BC}{43}$ $BC = 43\sin(14°) = 10.40$ ft $25 + 10.40 = 35.40$ ft

d) Suppose that you are operating the drawbridge and must decide what angle to open it based on the ship that is coming through. You do not want to open it all the way, because it is a waste of power, so you only open it to the angle you absolutely need. If a captain tells you that their ship extends 42 feet out of the water, to what angle will you have to open the drawbridge? Show work or explain how you got your answer.

$42 - 25 = 17$ ft

$\sin\theta = 17/43$

$\theta = \sin^{-1}(\frac{17}{43}) \approx 23.29°$

e) What if a ship comes through that is 33 feet tall? To what angle will you have to open the drawbridge?

$33 - 25 = 8$

$\sin\theta = 8/43$

$\theta = \sin^{-1}(\frac{8}{43}) \approx 10.72°$

f) What if a ship comes through that is $(x + 25)$ feet tall? To what angle y will you have to open the drawbridge?

$x + 25 - 25 = x$

$\sin y = \frac{x}{43}$

$y = \sin^{-1}(\frac{x}{43})$

In the equation you wrote in part f, what does the input x represent? What does the output y represent?

x represents the height of the ship above the bridge.

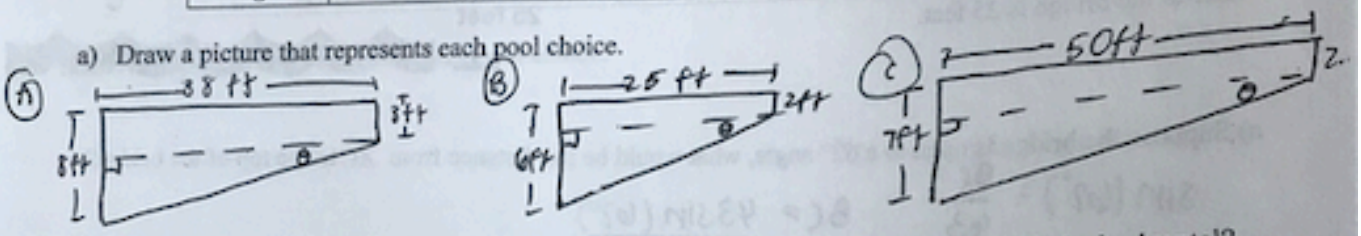
y represents the angle the drawbridge has to open.

2. The Pool Problem

The table below shows the dimensions of three pool styles offered by a construction company.

Pool Style	Length (ft)	Shallow-End Depth	Deep-End Depth
A	38	3	8
B	25	2	6
C	50	2.5	7

a) Draw a picture that represents each pool choice.



b) To the nearest tenth of a degree, what angle θ does the bottom of each pool make with the horizontal?

(A) $\tan\theta = \frac{5}{38}$

$\theta = \tan^{-1}\left(\frac{5}{38}\right)$

$\approx \boxed{7.5^\circ}$

(B) $\tan\theta = \frac{4}{25}$

$\theta = \tan^{-1}\left(\frac{4}{25}\right)$

$\approx \boxed{9.1^\circ}$

(C) $\tan\theta = \frac{4.5}{50}$

$\theta = \tan^{-1}\left(\frac{4.5}{50}\right)$

$\approx \boxed{5.1^\circ}$

c) Which pool's bottom has the steepest slope? Explain.

Pool B's bottom has the steepest slope, b/c θ is the largest degree measure. That means the rise/run is the largest proportion.

d) If the slope of the bottom of the pool can be no larger than $\frac{1}{6}$, what is the greatest angle θ that the bottom of the pool can make with the horizontal? Round your answer to the nearest tenth of a degree.

$\theta = \tan^{-1}\left(\frac{1}{6}\right) \approx \boxed{9.5^\circ}$

3. Road Signs Problem

a) A caution sign next to a roadway states that an upcoming hill has an 8% slope. An 8% slope means that there is an 8ft rise for every 100ft of horizontal distance. At approximately what angle does the roadway rise from the horizontal?

$\theta = \tan^{-1}\left(\frac{8}{100}\right) \approx \boxed{4.57^\circ}$

b) If the sign warns large trucks that there is a 6.3% slope ahead, at approximately what angle does the roadway rise from the horizontal?

$\theta = \tan^{-1}\left(\frac{6.3}{100}\right) \approx \boxed{3.60^\circ}$