Answers for Grade 11 Group Assignments - Quarter #1

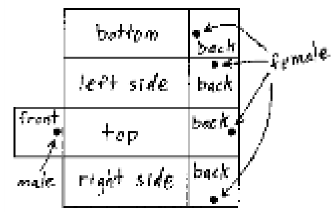
Notes:

- Answers for group assignment problems that are out of the workbook can be found in the "G11 – Workbook Answer Key".
- This answer key doesn't include all answers.

Week 4 Two-Ant Puzzle – Part I. 76.8cm

Week 5

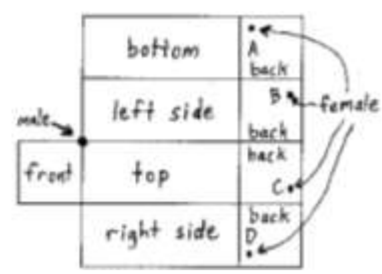
- Two-Ant Puzzle – Part II.



A) Following the above method, we first cut selected edges of the box, unfold it, and lay it out flat such that the male ant is seen closest to the top front edge of the box. The question then before us is: where is the best place to put the back face such that the shortest path becomes evident? The above drawing shows the four possibilities for the placement of the back face – each placement of the back face yielding a different path by connecting the two ants with a straight line. The path that most people first think of takes the ant straight across the top face and has a length of 84cm. Next, consider the path that results from having the back face in the lowest position, or having the back face two squares from the top. Both of these paths have a length of ≈81.4cm (calculated using the Pythagorean Theorem). The shortest path of all, which has a length of exactly 80cm, comes from placing the back face at the top-most square in the drawing. This path takes the ant across all but one of the faces of the box.

B) Given that the distance between two points is the shortest possible path between them, the two furthest points are the centers of the square faces, for a total length of exactly 84cm.

C) I begin with the hypothesis that in order to be as far as possible from the male ant, the female must be on the opposite square face, fairly close to the corner that is diametrically opposite from the male ant. There are several paths possible that go from the male to the female, but clearly, in this case, any path that crosses three of the rectangular faces cannot be the shortest path. That leaves us with four possible paths that might be the shortest.



With the drawing here, the back square wall is shown in the four possible different foldouts, but the female ant is shown, in each case, in the same location. Connecting the female to the male with a straight line shows the four different paths. If, for the moment, I only consider paths B and C, then I can see that as long as the female is somewhere along the diagonal line of the back square (the diagonal that passes through the right bottom back corner of the box) then paths B and C will have the same lengths. Likewise, at any point along this diagonal, paths A and D, will have the same lengths.

Now, imagining the female ant moving along this diagonal line, let's consider the lengths of paths A and B only. As it moves along this diagonal, the length of one of these two paths increases while the length of the other path decreases. The objective is to be at the location along this diagonal where the minimum path is the greatest. This location is where the lengths of these two paths (A and B) are equal. In fact, from this particular location, the lengths of all four of the paths (A, B, C and D) are equal. If the female ant strays from this location, in any direction, then the length of at least one of the paths will decrease, and therefore the minimum path length is also decreased. *Therefore, our goal is to find exactly where this location is such that the lengths of path and A and B are the same*.

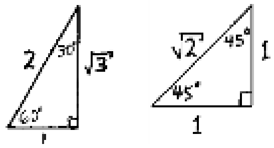
I assign x to the distance that the female is from the right back edge, and y to the distance that the female is up from the bottom back edge (i.e., the floor). (Note that with each back square in the drawing, these edges have been rotated, and that the box's dimensions are in inches instead of cm) The lengths are therefore:

Path A: $\sqrt{(4-x)^2 + (y+5)^2}$ Path B: $\sqrt{(7-x)^2 + (2-y)^2}$

Setting these equations equal, as well as setting x equal to y (since the location must be along the square's diagonal), yields:

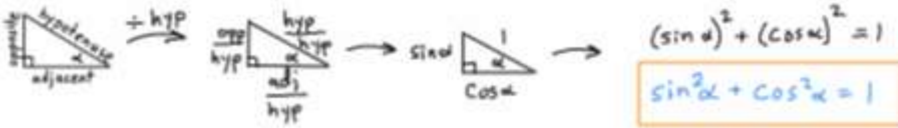
$x = y = {}^{3}/_{5}$, which means the female ant is located near the right bottom back corner of the box, 0.6 ft up from the floor and 0.6 ft away from the right wall. All four paths (A, B, C and D from the male ant to the female at this location) have a length of 6.551 ft.

Week 6

2) 

3)

θ	sin θ	cos θ	tan θ
0°	0	1	0
30°	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$
45°	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1
60°	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
90°	1	0	∞

4) 

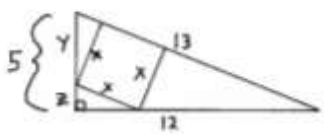
5) sin(90°) = 1; sin(120°) = sin(60°) = $\frac{\sqrt{3}}{2}$; sin(135°) = sin(45°) = $\frac{\sqrt{2}}{2}$;

sin(150°) = sin(30°) = ½ ; sin(180°) = sin(0°) = 0.

The useful identity is ***sin*(180° – α) = *sin*(α)**

6) a) 60° b) 73° c) 67° The useful identity is *sin*(90°–α) = *cos*(α)

7) tan α

8) 

All four Δs are similar

$Y = \frac{13}{12}x$; $Z = \frac{5}{13}x$

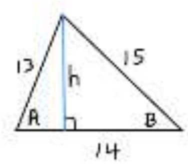
$5 = Y + Z \to 5 = \frac{13}{12}x + \frac{5}{13}x \to 5 = \frac{229}{156}x \to x = \frac{5 \cdot 156}{229}$

$\to x = \frac{780}{229} \to$ area ≈ 11.6

Week 7

1) Prob of rolling a 1 with two dice is $\frac{11}{36}$.

4) (See drawing at right.) I notice that it is easiest to use 14 as the base



Area = ½·B·h → 84 = ½·14·h → h = 12.

We can now work with two right triangles to get:

sin A = $\frac{12}{13}$ → A = 67.4° ; sin B = $\frac{12}{15}$ → B = 53.1° ; C = 59.5°

Week 8 No answers needed.