# Answers for Grade 11 Group Assignments - Quarter #3

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.

## Weeks 17-20

- No answers needed.

## Week 21

- A Trigonometric Table: See answer on the right.
- *Triangle & Square Pieces – Part I*. This puzzle will be continued next week.

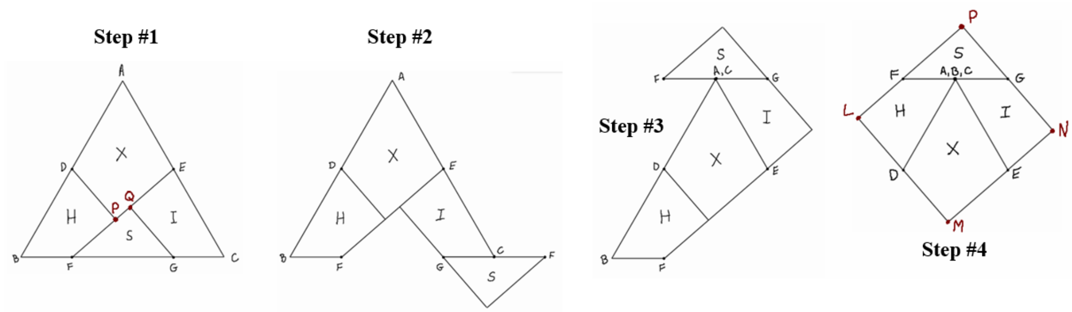
**A Trigonometric Table**

| θ | sin θ | cos θ | tan θ |
|---|---|---|---|
| 0 | 0 | 1 | 0 |
| 15° | 0.259 | 0.966 | 0.268 |
| 30° | 0.5 | 0.866 | 0.577 |
| 45° | 0.707 | 0.707 | 1 |
| 60° | 0.866 | 0.5 | 1.73 |
| 75° | 0.966 | 0.259 | 3.73 |
| 90° | 1 | 0 | ∞ |
| 105° | 0.966 | −0.259 | −3.73 |
| 120° | 0.866 | −0.5 | −1.73 |
| 135° | 0.707 | −0.707 | −1 |
| 150° | 0.5 | −0.866 | −0.577 |
| 165° | 0.259 | −0.966 | −0.268 |
| 180° | 0 | −1 | 0 |

## Week 22

1) $\sqrt{3}$

2) $\sqrt[4]{3}$

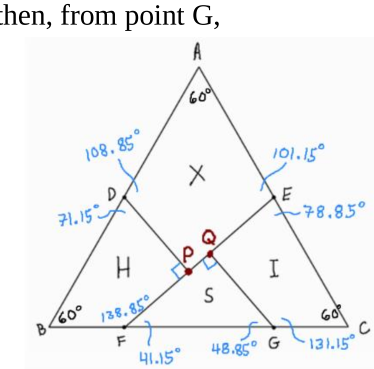



3) MN (from Step #4) equals FE (from Step #1). Since ΔABC has sides equal to 2, rectangle DEFG has sides of length 1 and $\sqrt{3}/2$. **FE is then $\sqrt{7/2} \approx 1.3229$**. LM (from Step #4) is twice DP (from Step #1).
$\Delta DEF \sim \Delta DEP$ (from Step #1) $DF : FE = \sqrt{3} : \sqrt{7} = DP : DE$
Since $DE = 1$, $DP = \sqrt{3}/\sqrt{7}$ then $\mathbf{LM = 2\sqrt{3}/\sqrt{7} \approx 1.3093}$. Therefore, the drawing in Step #4 is not a square!

4) F needs to move to the right because FE needs to become a bit shorter.

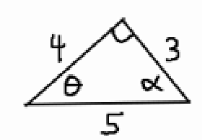
5) Since the altitude of the triangle is $\sqrt{3}$, we can get $\sqrt[4]{3}$ by square rooting $\sqrt{3}$. Following Descartes's instructions (and drawing), we create a horizontal line that has a length of DC plus EC (from the drawing in Step #1), and meets at point G (in Descartes's drawing). Now draw a semi-circle about that line, and then, from point G, construct a vertical line, which gives you $\sqrt[4]{3}$.

7) From the drawing in Step #1, we can use the Law of Sines with triangle FEC.
$\sin(\angle EFC) : \sin(60°) = 1 : \sqrt[4]{3}$. $\angle EFC \approx 41.15$. All other angles then follow.




- Further reading about this interesting puzzle, and others like it:
https://www.cutoutfoldup.com/109-turn-an-equilateral-triangle-into-a-square.php
https://mathworld.wolfram.com/Dissection.html

## Week 23




| | $\alpha \approx 53.1^\circ$ | $\theta \approx 37.9^\circ$ |
|---|---|---|
| sin | 4/5 | 3/5 |
| cos | 3/5 | 4/5 |
| tan | 4/3 | 3/4 |
| csc | 5/4 | 5/3 |
| sec | 5/3 | 5/4 |
| cot | 3/4 | 4/3 |

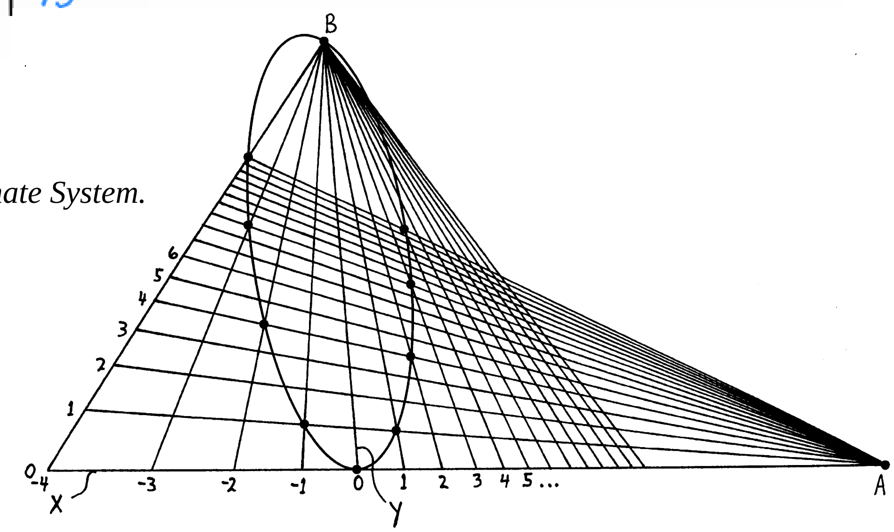
α and θ can be found in many ways.

$$\alpha = \sin^{-1}\left(\tfrac{4}{5}\right) = \cos^{-1}\left(\tfrac{3}{5}\right) = \tan^{-1}\left(\tfrac{4}{3}\right)$$

## Week 24

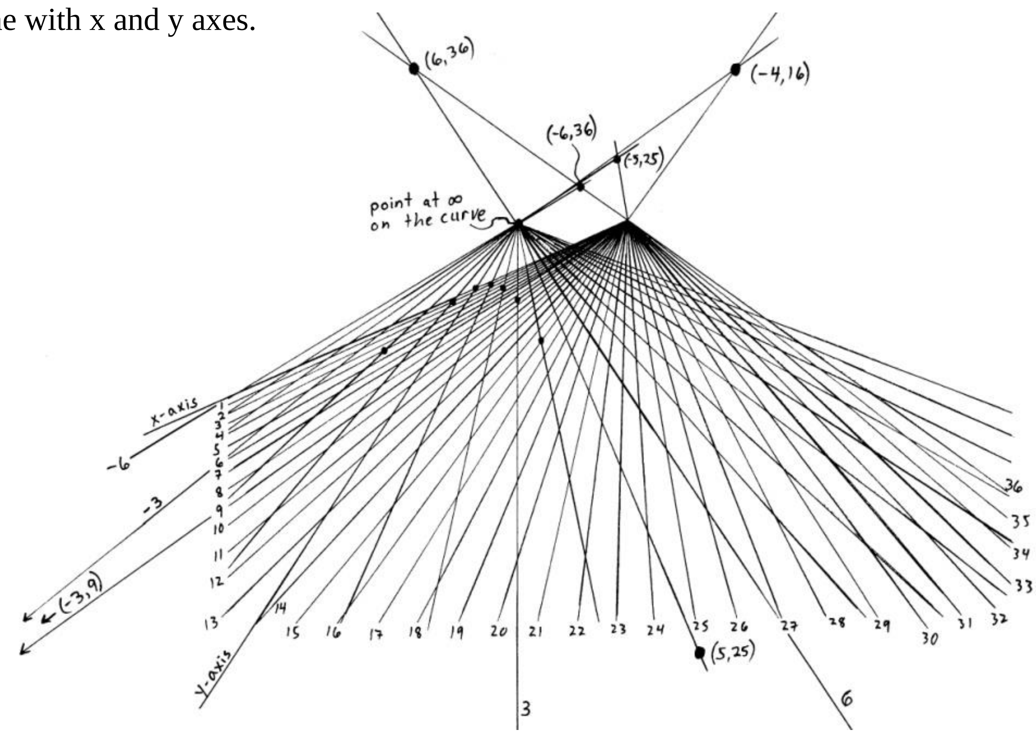
- *Using a Harmonic Net as a Coordinate System.*

  1) An Ellipse!




  2) The normal Cartesian plane with x and y axes.

  3) There are different possible ways to do this. One way would be to use the same coordinate system, but change the equation to $y = -x^2$. Another way would be to keep the equation as $y = x^2$, but change the coordinate system to what is shown here:




- *Let's make a Deal!*
  Switching is better! If you don't switch, you have a ⅓ chance of winning. If you do switch, you have a ⅔ chance of winning.