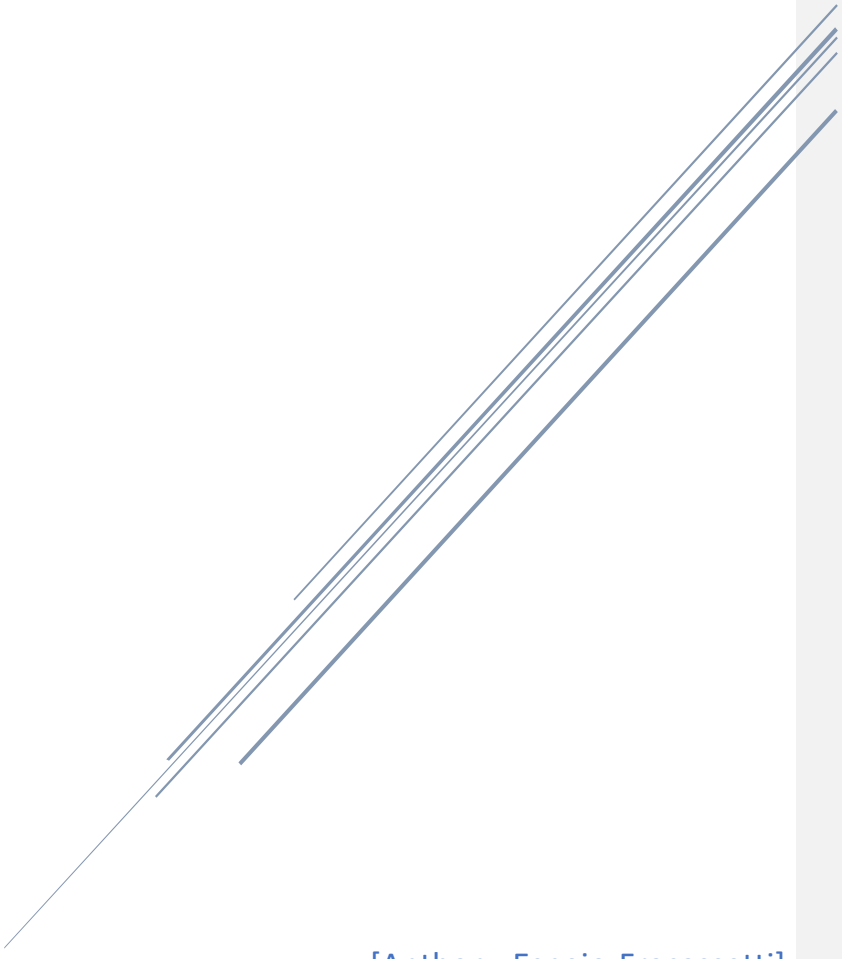
ANTHONY'S SOLARBEE PSMT

[Grade 9 Math Extension]



[Anthony Espejo-Fracassetti]
[44928]

Table of Contents

Commented [TC1]: Be sure to update the table of contents prior to submission

Introduction

I have been requested by a solar panel company to manufacture a logo which follows specific requirements, using my knowledge of linear relationships, coordinate geometry and half-planes. The logo should come with an explanation on how it will be used, its intended print size, and how these considerations have influenced your design. The final product will be completed model of the logo with all functions listed with corresponding domain and ranges.

Commented [TC2]: Check phrasing.
You should already be introducing which object your logo will be fitting onto.

Observations

Commented [TC3]: You will need to look into this again.

Observations	Justification (How will this be used to reach your solution? Explain the mathematical impact)
The design must consist solely of straight lines	This criterion signifies that the logo won't be including any curved edges and linear equations will be utilised to create and determine these straight lines using DESMOS.
It must include at least one square and one parallelogram	The inclusion of a square and a parallelogram into the logo
A line must cut the parallelogram in half by cutting through the midpoint of one side.	Thus, the usage of the midpoint in a line segment and the distance of two points will be needed to create this line.
The entire logo must be designed to fit on an object of your choice (e.g. t-shirt, cap, business card)	The proportions and dimensions of the logo must be designed in a way that will fit an object such as a t-shirt, cap, business card etc.

Commented [TC4]: Design requirements shouldn't be observations, they are part of your introduction.

Commented [TC5]: How will you be mathematically guaranteeing that there is a square and a parallelogram to your customer then? Explain.

Assumptions

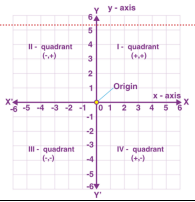
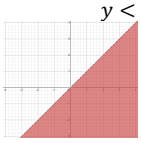
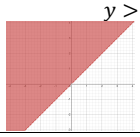
Assumptions	Justification *(Why is this assumption mathematically necessary to solve the task? How will this assumption impact your solution?)*
The logo will include various shape like squares, rectangles, triangle and parallelogram	We can assume this with the inclusion of various shapes will be included beside squares and parallelograms to add extra flair to the design.
The Business card that the logo will include will have dimensions of 90mm wide with 55mm in length	This is known as the average size of any business card and will be crucial in sizing up or down depending on the size of the design.
The Logo will be printed at the back of the business card instead of the front.	This assumes that no writing or anything related will be disrupting the design on the actual card.

Commented [TC6]: I'd say that these are the straight-edged shapes that you could consider?

Mathematical Translation

Concept	Technique	Justification of use

Commented [TC7]: Layout, never split table over pages.

Cardinal planes		The cardinal plane will be used as a blueprint for the logo, being able to be constructed propeller and get an imagine of the restrictions and proportions of the logo.
Linear relationships	$y = mx + c$ $m = \frac{y_1 - y_2}{x_1 - x_2}$ $C = y\ intercept$ Horizontal & Vertical lines: $x = k$ $K = x\ intercept$ $y = C$ $C = y\ intercept$	Linear relationships rules are incorporated into this project by constructing all the straight lines inside my logo.
Midpoints of a line segment Distance between two points	$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$ $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	The midpoints and the distance between the two lines will be used to determine the line need to pierce the parallelogram.
Domains (Restrictions)	Without restrictions: $2x + 3y = 5$ With restrictions: $2x + 3y = 5\{0 < x < 1\}$	Domains will be utilised as a type of restriction towards the linear equations, preventing them to go on towards infinity.
Half Planes	$y < mx + c$  $y > mx + c$ 	Colouring of the logo for different shapes will need to be identified using Half Planes where linear lines, will need to be converted in linear inequations.

Technology to be used

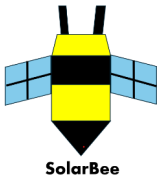
- Desmos will be a technological website that will be a great asset towards finishing to assignment as it will allow the access of dimensions in a virtual plane, which gives us the ability to modify any errors in the rough sketch

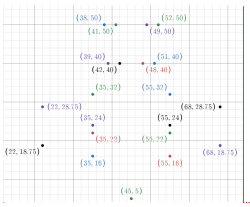
Mathematical Solution

Commented [TC8]: Are you sure this is the right word?

Commented [TC9]: Layout.

Rough Sketch



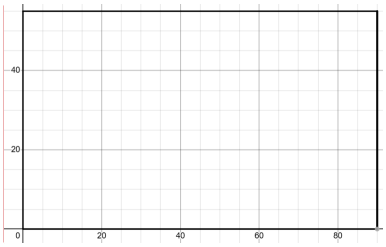


Commented [TC10]: Screenshots of graphs need to be visible at 100% view where the scales are readable. Be sure to label the axes

Shape's Gradient

Squares & Rectangles:	**Triangle:**	**Trapezium:**	**Parallelogram:**
Opposite sides Parallel = $m_1 = m_2$	Sides touching apex are Perpendicular = $m_1 \times m_2 = -1$	Top sides are parallel = $m_1 = m_2$ Sides are perpendicular = $m_1 \times m_2 = -1$	Opposite sides parallel = $m_1 = m_2$

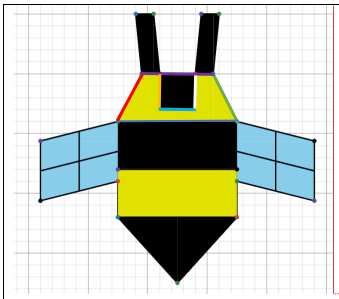
Border



This border seems to replicate what an average business card scaled up being 55cm x 99cm. This will act as a blueprint on where the bee will be placed.

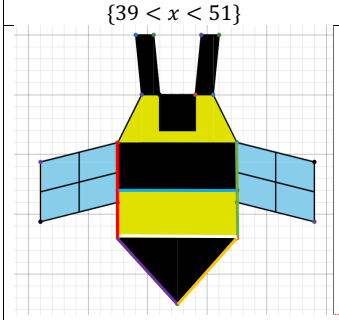
Commented [TC11]: Use a 2-column table to omit the blank space on the right.

Body



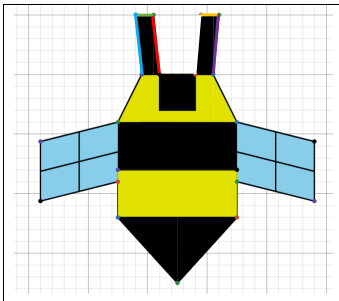
Red Line:	Green Line:	Blue Line:
$m = \frac{y_1 - y_2}{x_1 - x_2}$ $m = \frac{40 - 32}{39 - 35}$ $m = 2$ $y = 2x + c$ (sub in (39,40) into equation) $(40) = 2(39) + c$ $40 = 78 + c$ $c = -38$ $y = 2x - 38$ Restriction/s: $\{32 < y < 40\}$	$m = \frac{y_1 - y_2}{x_1 - x_2}$ $m = \frac{40 - 32}{51 - 55}$ $m = -2$ $y = -2x + c$ (sub in (39,40) into equation) $(40) = -2(51) + c$ $40 = -102 + c$ $c = 142$ $y = -2x + 142$ Restriction/s: $\{32 < y < 40\}$	$y = C$ $C = y\ interce$ $y = 32$ Restriction/s: $\{35 < x < 55\}$

Commented [TC12]: If this grid has no number scales, the calculations on the right cannot be deemed accurate, since there is no evidence that those are the values of the coordinates used.

Purple Line: $y = C$ $C = y\ intercept$ $y = 40$ Restriction/s: $\{39 < x < 51\}$	Orange Line: $x = k$ $K = x\ intercept$ $x = 42$ Restriction/s: $\{32 < y < 40\}$	White Line: $x = k$ $K = x\ intercept$ $x = 48$ Restriction/s: $\{32 < y < 40\}$	Cyan Line: $y = C$ $C = y\ intercept$ $y = 34$ Restriction/s: $\{42 < x < 48\}$
	Purple Line: $m = \frac{y_1 - y_2}{x_1 - x_2}$ $m = \frac{16 - 5}{35 - 45}$ $m = -1.1$ $y = -1.1x + c$ (sub in (16,35) into equation) $(16) = -1.1(35) + c$ $16 = -38.5 + c$ $c = 54.5$ $y = -1.1x + 54.5$ Restriction/s: $\{35 < x < 45\}$	Orange Line: $m = \frac{y_1 - y_2}{x_1 - x_2}$ $m = \frac{16 - 5}{55 - 45}$ $m = 1.1$ $y = 1.1x + c$ (sub in (55,16) into equation) $16 = 1.1(55) + c$ $16 = 60.5 + c$ $c = 44.5$ $y = -1.1x + 44.5$ Restriction/s: $\{45 < x < 55\}$	Cyan Line: $y = C$ $C = y\ intercept$ $y = 24$ Restriction/s: $\{35 < x < 55\}$
Red Line: $x = k$ $K = x\ intercept$ $x = 35$ Restriction/s: $\{16 < y < 32\}$	Green Line: $x = k$ $K = x\ intercept$ $x = 55$ Restriction/s: $\{16 < y < 32\}$	White Line: $y = C$ $C = y\ intercept$ $y = 16$ Restriction/s: $\{35 < x < 55\}$	

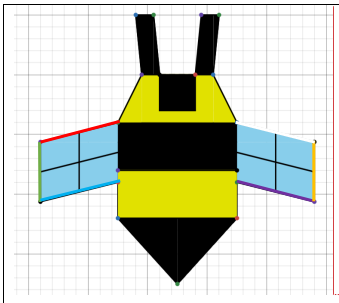
Commented [TC13]: Same feedback as the previous diagram.

Antenna

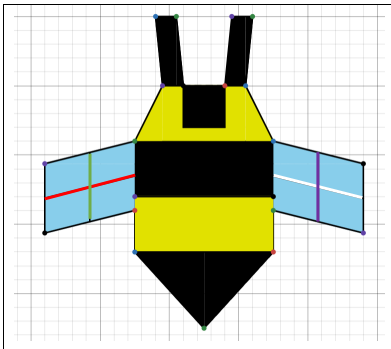
	Red Line: $m = \frac{y_1 - y_2}{x_1 - x_2}$ $m = \frac{50 - 40}{41 - 42}$ $m = -10$ $y = -10x + c$ (sub in (42,40) into equation) $(40) = -10(42) + c$ $40 = -420 + c$ $c = 460$ $y = -10x + 460$ Restriction/s: $\{40 < y < 50\}$	Cyan Line: $m = \frac{y_1 - y_2}{x_1 - x_2}$ $m = \frac{50 - 40}{38 - 39}$ $m = 1.1$ $y = -10x + c$ (sub in (39,40) into equation) $40 = -10(39) + c$ $40 = -390 + c$ $c = 430$ $y = 10x + 430$ Restriction/s: $\{40 < y < 50\}$	Green Line: $y = C$ $C = y\ intercept$ $y = 50$ Restriction/s: $\{38 < x < 41\}$
White Line: $m = \frac{y_1 - y_2}{x_1 - x_2}$ $m = \frac{50 - 40}{49 - 48}$ $m = 10$	Purple Line: $m = \frac{y_1 - y_2}{x_1 - x_2}$ $m = \frac{50 - 40}{52 - 51}$ $m = 10$	Orange Line: $y = C$ $C = y\ intercept$ $y = 50$ Restriction/s:	

$y = 10x + c$ (sub in (48,40) into equation) $(40) = 10(48) + c$ $40 = 480 + c$ $c = -440$ $y = 10x - 440$ Restriction/s: $\{40 < y < 50\}$	$y = 10x + c$ (sub in (52,50) into equation) $(50) = 10(52) + c$ $50 = -520 + c$ $c = 470$ $y = 10x + 470$ Restriction/s: $\{40 < y < 50\}$	$\{38 < x < 41\}$

Wings (Solar Panels)

	Red Line: $m = \frac{y_1 - y_2}{x_1 - x_2}$ $m = \frac{32 - 28.75}{35 - 22}$ $m = 0.25$ $y = 0.25x + c$ (sub in (35,32) into equation) $(32) = 0.25(35) + c$ $32 = 8.75 + c$ $c = 23.25$ $y = 0.25x + 23.25$ Restriction/s: $\{22 < x < 35\}$	Cyan Line: $m = \frac{y_1 - y_2}{x_1 - x_2}$ $m = \frac{22 - 18.75}{35 - 22}$ $m = 0.25$ $y = 0.25x + c$ (sub in (35,22) into equation) $22 = 0.25(35) + c$ $22 = 8.75 + c$ $c = 13.25$ $y = 0.25x + 13.25$ Restriction/s: $\{22 < x < 35\}$	Green Line: $x = k$ $K = x\ intercept$ $x = 22$ Restriction/s: $\{18.75 < y < 28.75\}$
White Line: $m = \frac{y_1 - y_2}{x_1 - x_2}$ $m = \frac{32 - 28.75}{55 - 68}$ $m = -0.25$ $y = -0.25x + c$ (sub in (55,32) into equation) $(32) = -0.25(55) + c$ $32 = -13.75 + c$ $c = 45.75$ $y = -0.25x + 45.75$ Restriction/s: $\{22 < x < 35\}$	Purple Line: $m = \frac{y_1 - y_2}{x_1 - x_2}$ $m = \frac{22 - 18.75}{55 - 68}$ $m = -0.25$ $y = -0.25x + c$ (sub in (55,22) into equation) $(22) = -0.25(55) + c$ $22 = -13.75 + c$ $c = 35.75$ $y = -0.25x + 35.75$ Restriction/s: $\{22 < x < 35\}$	Orange Line: $x = k$ $K = x\ intercept$ $x = 68$ Restriction/s: $\{18.75 < y < 28.75\}$	

Commented [TC14]: Same feedback as the previous diagram.



Midpoints:
Left Panel:
Top and Bottom:

$$M = \left(\frac{22+35}{2}, \frac{28.75+32}{2}\right)$$
$$M = (28.5, 30.375)$$

$$M = \left(\frac{22+35}{2}, \frac{18.75+22}{2}\right)$$
$$M = (28.5, 20.375)$$

Sides:

$$M = \left(\frac{35+35}{2}, \frac{22+32}{2}\right)$$
$$M = (35, 27)$$

$$M = \left(\frac{22+22}{2}, \frac{18.75+28.75}{2}\right)$$
$$M = (22, 23.75)$$

Midpoints:
Right Panel:
Top and Bottom:

$$M = \left(\frac{68+55}{2}, \frac{28.75+32}{2}\right)$$
$$M = (61.5, 30.375)$$

$$M = \left(\frac{68+55}{2}, \frac{18.75+22}{2}\right)$$
$$M = (61.5, 20.375)$$

Sides:

$$M = \left(\frac{55+55}{2}, \frac{22+32}{2}\right)$$
$$M = (55, 27)$$

$$M = \left(\frac{68+68}{2}, \frac{18.75+28.75}{2}\right)$$
$$M = (68, 23.75)$$

Red Line:

$$m = \frac{y_1 - y_2}{x_1 - x_2}$$
$$m = \frac{27 - 23.75}{35 - 22}$$
$$m = 0.25$$
$$y = 0.25x + c$$

(sub in (35,27) into equation)

$$(27) = 0.25(35) + c$$
$$27 = 8.75 + c$$
$$c = 18.25$$
$$y = 0.25x + 18.25$$

Restriction/s:

$$\{22 < x < 35\}$$

Green Line:

$$x = k$$
$$K = x\ intercept$$
$$x = 28.5$$

Restriction/s:

$$\{20.375 < y < 30.375\}$$

White Line:

$$m = \frac{y_1 - y_2}{x_1 - x_2}$$
$$m = \frac{27 - 23.75}{55 - 68}$$
$$m = -0.25$$
$$y = -0.25x + c$$

(sub in (55,27) into equation)

$$(27) = -0.25(55) + c$$
$$27 = -13.75 + c$$
$$c = 40.75$$
$$y = -0.25x + 40.75$$

Restriction/s:

$$\{55 < x < 68\}$$

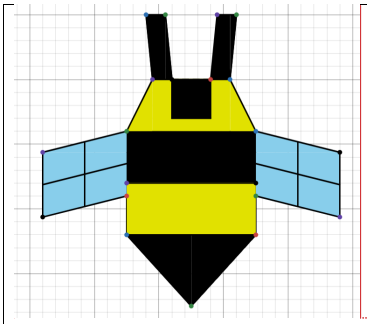
Purple Line:

$$x = k$$
$$K = x\ intercept$$
$$x = 68$$

Restriction/s:

$$\{20.375 < y < 30.375\}$$

Colouring



Stinger:
1)

$$y \geq -1.1x + 54.5$$

Restriction/s:

$$\{35 < x < 45\}$$
$$\{16 > y\}$$

2)

$$y \geq 1.1x - 44.5$$

Restriction/s:

$$\{45 < x < 55\}$$
$$\{16 > y\}$$

RGB = (0,0,0)

Bottom body:
1)

$$y \leq 24$$

Restriction/s:

$$\{35 < x < 55\}$$
$$\{16 > y\}$$

RGB = (225, 225,0)

Top Body:
1)

$$y \leq 32$$

Restriction/s:

$$\{35 < x < 55\}$$
$$\{16 > y\}$$

RGB = (0,0,0)

Head:
1)

Mouth:
1)

Left Antenna:
1)

Right Antenna:
1)

Commented [TC15]: The final solution also needs to show labels of key points, including the vertices of the square and parallelogram, and the midpoint bisecting the parallelogram.

Commented [TC16]: Honour the margins.

$y \leq 2x - 38$ Restriction/s: $\{32 < y < 40\}$ $\{39 < x\}$ 2) $y \leq 40$ Restriction/s: $\{39 < x < 51\}$ $\{32 < y\}$ 3) $y \leq -2x + 142$ Restriction/s: $\{32 < y < 40\}$ $\{39 < x\}$ RGB = (225, 225,0)	$y \leq 40$ Restriction/s: $\{42 < x < 48\}$ $\{34 < y\}$ RGB = (0,0,0)	$y \leq -10x + 460$ Restriction/s: $\{40 < y < 50\}$ $\{41 < x\}$ 2) $y \geq 10x + 430$ Restriction/s: $\{40 < y < 50\}$ $\{41 > x\}$ RGB = (0,0,0)	$y \leq 10x - 440$ Restriction/s: $\{40 < y < 50\}$ $\{51 > x\}$ 2) $y \geq 10x - 470$ Restriction/s: $\{40 < y < 50\}$ $\{51 > x\}$ RGB = (0,0,0)
Left Panel: 1) $y \leq 0.25x + 23.25$ Restriction/s: $\{22 < x < 35\}$ $\{28.75 < y < 32\}$ 2) $y \geq 0.25x + 13.25$ Restriction/s: $\{22 < x < 35\}$ $\{28.75 < y\}$ RGB = (136, 206,235)	Right Panel: 1) $y \leq -0.25x + 45.75$ Restriction/s: $\{28.75 < y < 32\}$ $\{x > 55\}$ 2) $y \geq -0.25x + 35.75$ Restriction/s: $\{55 < x < 68\}$ $\{28.75 < y\}$ RGB = (136, 206,235)		

Scaling

The way that the solar design was constructed means that the entire project would need to be shrunken to a tenth of its normal size as the border considering the border is a 55cmx90cm grid. This scale will end up leaving the design to a 55mmx90mm grid which is perfect for a normal business card.

Evaluation

Strengths and Limitations

Strengths	Limitations
• The design had no issue when being shrunken down to a smaller scale as it ultimately was perfectly able to fit inside a larger scaled business card.	• The thought of a bee being a design for a solar panel company can seem like a stretch to the point where people couldn't recognize immediately that it's representing one.
• Shapes such as triangles, rectangles and squares have all been incorporated into my design which helped add flair towards my final design.	• The colouring seemed as a limitation as achieving a similar to an exact replication of how the colour was achieved would be possible in fewer steps, leading to unneces calculations
• The Final design was an outstanding success as very little besides from stretching and or squeezing the main	• The inclusion of the square could have been execute better as the shape leaves people to wonder what it could

Commented [TC17]: Overall, you have done a lot of calculations, however you need to show verifications that these are the lines and the half-planes that will form exactly the same image as your draft sketch.

Alll in all, there needs to be a final DESMOS graph with screenshots of the linear equations and inequalities used.

Commented [TC18]: Shouldn't this be mentioned at the start of your development?

Commented [TC19]: Table needs to honour the margins.

Commented [TC20]: Reduced?

Commented [TC21]: Mathematically relevant?

Commented [TC22]: Why is it important to have these shapes? Consider context, design, etc?
Also, flair….isnt' really measurable, it is subjective, not mathematically relevant.

body to better the card was changed from the base design.	represent, as it seems to be placed randomly. However, it is supposed to imitate a mouth of some sort

Commented [TC23]: Mathematically relevant?

Reasonableness

According to the assumptions and observations listed above, the reasonableness of my solution has been extremely successful. The design successfully fits my criteria as the straight-lined bee include at least one square and one parallelogram along with other shapes like triangles and trapeziums with the parallelogram being cut through its midpoint. As well the design can be shrunk to fit on a average business card properly without and drastic measures being made. Overall, this design seems to prove itself to be extremely successful following the guidelines provided.

Commented [TC24]: The evaluation made must refer to the solution and how it is affected by the assumption/observation,
consider the solution found; consider how it is affected by the observation or assumption; consider how the solution might be different if the observation or assumption was altered (often with some mathematical working included).

Conclusion

The task to make any design for a solar panel company and create it so that it becomes able to fit into a business card ultimately ended up succeeding greatly. 'SolarBee' ending up being a humongous success as it was able to fit into the task's criteria extremely well. The solar panels as wings and the bee's connection to nature and the sun similar to a solar panel were able to combine into a magnificent design fitting the overall arching theme. To conclude I'm extremely happy with the final result and the choice made to get there.

Word count:

Bibliography

Appendix

(Each appendix must be labelled with a letter (A, B, C, etc.) according to where it appears in your report. Make sure you include the URL. Repeated calculations can be included here. This section is not marked.)