

Thu. 11/13 Agenda:

- Platonic Solids Wrap-up
 - Models and Euler Formula for 5.5.5 and 3.3.3.3.3
 - Duals, and relationship with Schlafli symbols.
- Taxicab Geometry
(HW #2, 3, 4*, 6, 7 on p. 86 of the Handout)
 - *nevermind the part about conic sections
- We'll end with 20 to 30 minutes to discuss your group presentations.

Nov 13-12:53 PM

http://www.mathsisfun.com/platonic_solids.html

Platonic Solids
There are five platonic solids

Below are the five platonic solids (or regular polyhedra). For each solid there is a printable net. These nets can be printed onto a piece of card. You can then make your own platonic solids. Cut them out and tape the edges together.

Solid	Properties	Link
	Tetrahedron <ul style="list-style-type: none">• 4 Faces• 4 Vertices• 6 EdgesPrintable NetDownload ModelMore on Tetrahedron	http://www.mathsisfun.com/geometry/tetrahedron.html
	Cube <ul style="list-style-type: none">• 6 Faces• 8 Vertices• 12 EdgesPrintable NetDownload ModelMore on Cube	http://www.mathsisfun.com/geometry/hexahedron.html
	Octahedron <ul style="list-style-type: none">• 8 Faces• 6 Vertices• 12 EdgesPrintable NetDownload ModelMore on Octahedron	http://www.mathsisfun.com/geometry/octahedron.html
	Dodecahedron <ul style="list-style-type: none">• 12 Faces• 20 Vertices• 30 EdgesPrintable NetDownload ModelMore on Dodecahedron	http://www.mathsisfun.com/geometry/dodecahedron.html
	Icosahedron <ul style="list-style-type: none">• 20 Faces• 12 Vertices• 30 EdgesPrintable NetDownload ModelMore on Icosahedron	http://www.mathsisfun.com/geometry/icosahedron.html

Nov 13-9:29 AM

Complete the table below:

$$v - e + f = 2$$

Polyhedron	Face Type	Schlaflf Symbol	v	e	f
Tetrahedron ...tetrahedron.html	Equilateral Triangles	3.3.3	4	6	4
Cube ...hexahedron.html	Squares	4.4.4	8	12	6
Octahedron ...octahedron.html	equi triangles	3.3.3.3	6	12	8
Dodecahedron ...dodecahedron.html	reg. pent.	5.5.5	20	30	12
Icosahedron ...icosahedron.html	reg. triangles	3.3.3.3.3	12	30	20




Nov 11-1:56 PM

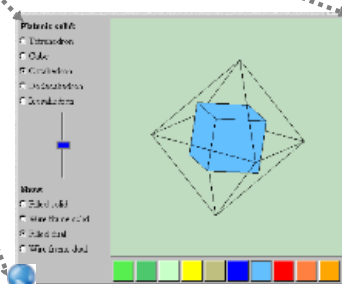
http://nlvm.usu.edu/en/nav/category_g_4_t_3.html



Geometry (Grades 9 - 12)

Virtual manipulatives related to the NCTM Geometry standard for grades 9 - 12.

-  **Platonic Solids** - Identify characteristics of the Platonic Solids.
-  **Platonic Solids - Duals** - Identify the duals of the platonic solids.
-  **Platonic Solids - Slicing** - Discover shapes and relationships between slices of the platonic solids.



What is the dual of the figure with Schlaflf symbol:

- 3.3.3 <--> 3.3.3
- 4.4.4 <--> 3.3.3.3
- 5.5.5 <--> 3.3.3.3.3

Nov 13-10:34 AM

Models of polyhedra:

- Nets (with or without tabs)
- Pipe-cleaner and Straws

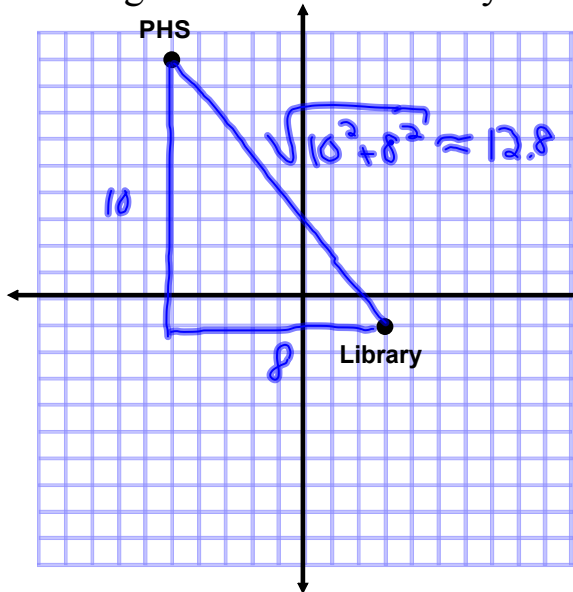
Packet -- Nets of Platonic Solids

Pipe-cleaner model of one of the Platonic solids.

Nov 13-10:31 AM

Taxicab Geometry

Begin with Class Activity 13 - *Life in a taxicab world.*



Library: 3rd St. E. & 1st Ave. S
PHS: 5th St. W & 9th Ave. N

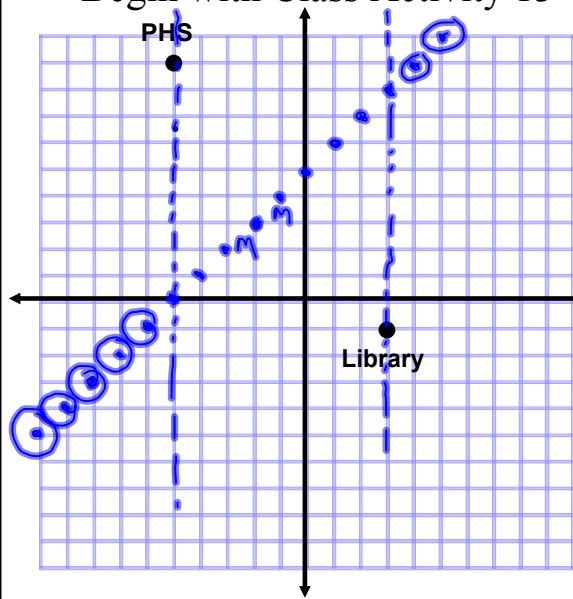
1. How far apart are these points...
...as the crow flies? *12.8 blocks*
...if she stays on the streets? *18 blocks*
- How many days can she walk a different (shortest) route?

Hw

Nov 13-11:01 AM

Taxicab Geometry

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PHS: 5th St. W & 9th Ave. N

1. How far apart are these points...
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...if she stays on the streets?

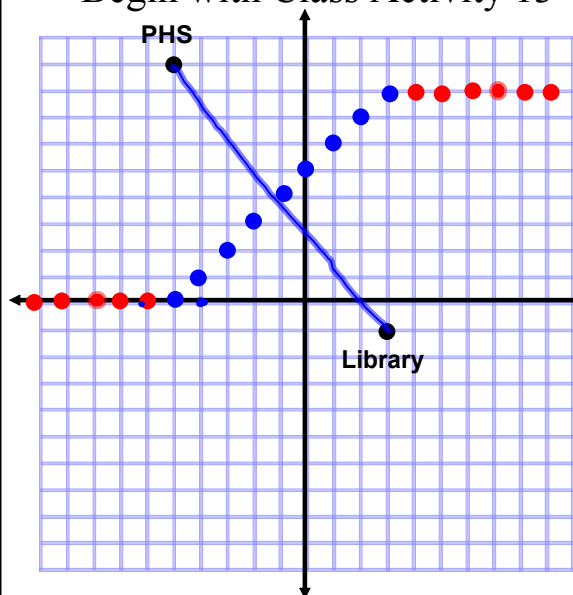
How many days can she walk a different (shortest) route?

2. Where is the halfway point? Mark with "M".
* Mark other "equidistant" points with "P".

Nov 13-11:01 AM

Taxicab Geometry

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Nov 13-11:01 AM

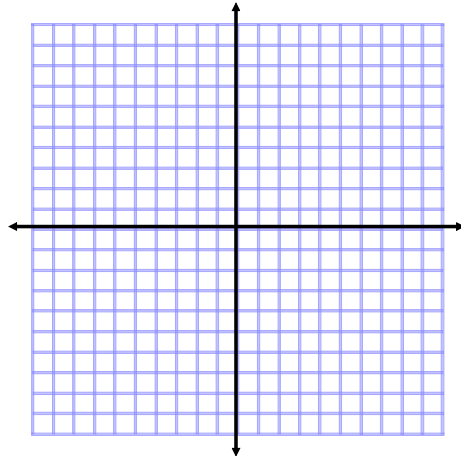
Taxicab Geometry:

- Take the Euclidean definition of *distance* and replace it with the "taxicab" definition. Let (x,y) and (u,v) be two points. Then:

$$d_E = \sqrt{(x-u)^2 + (y-v)^2} \quad (\text{Euclidean distance formula})$$

$$d_T = |x-u| + |y-v| \quad (\text{Taxicab distance formula})$$

Example: Calculate the distance between $(2,5)$ and $(4,1)$ using each definition of distance.



$$\begin{aligned} d_E &= \sqrt{(4-2)^2 + (1-5)^2} \\ &= \sqrt{4+16} \\ &= \sqrt{20} = 2\sqrt{5} \\ d_T &= |4-2| + |1-5| \\ &= 2+4 = 6 \end{aligned}$$

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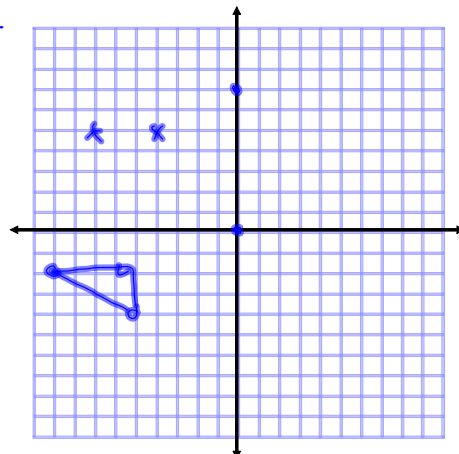
Taxicab Geometry:

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Are there pairs of points whose Taxicab distance is the same as their Euclidean distance? If so, generalize the relationship between such points.



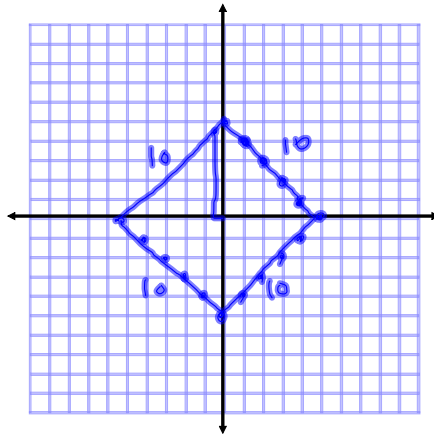
Nov 13-11:39 AM

Taxicab Geometry:

The definition of a circle in Taxicab space is the same as that in Euclidean space:

The circle (with radius r centered at P) consists of the set of all points that are a distance of r units away from P .

1. Draw the Taxicab circle with radius 5 centered at the origin.
2. What is the circumference of this Taxicab circle? 40



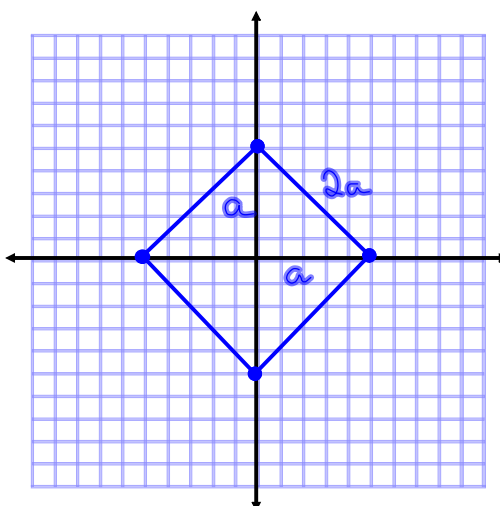
$$\sqrt{5^2 + 5^2} = \sqrt{50} = \sqrt{25 \cdot 2} = 5\sqrt{2}$$

$$20\sqrt{2} \leftarrow \begin{matrix} \times 4 \end{matrix}$$

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Taxicab Geometry:

3. Recall that π is the ratio of a circle's circumference to its diameter. What is the value of π for the taxicab circle with radius 5?
4. In Euclidean geometry, π is constant 3.1415... . Is the value of π constant in the Taxicab geometry?



$$\pi_T = \frac{C}{d} = \frac{40}{10} = 4.$$

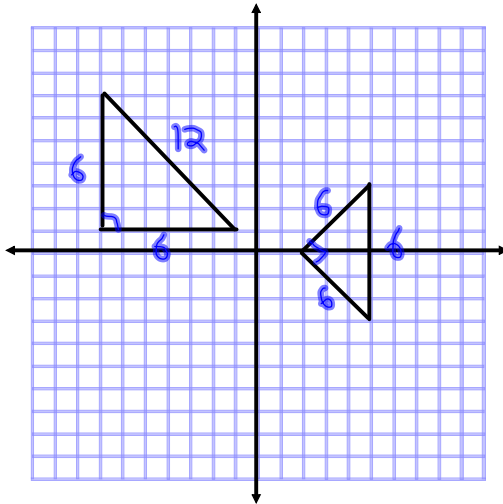
$$\pi_T = \frac{4(2a)}{2a} = 4$$

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Taxicab Geometry:

5. Consider the (Euclidean) triangle congruence theorem known as Side-Angle-Side (SAS). Is the SAS theorem true in Taxicab geometry?

It will help to consider the following pair of triangles.



6. In Euclidean geometry, an equilateral triangle has three 60° angles. Is this also true in Taxicab geometry?

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Taxicab Geometry:

The Taxicab geometry is a simple example of a non-Euclidean geometry.

If we start with a careful definition of a "line," we can show that Taxicab geometry does not satisfy Euclid's fifth postulate (the parallel postulate) which can be stated:

Given any line and any point P not on that line, there is exactly one line through P that is parallel to the given line.

Nov 13-2:07 PM