

Creating a Critical Thinkers' Classroom

Independent Inquiry Project

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Providence Day School
2010-2011

I have been a teacher for twenty-five years, and I have taught math to 7th grade students for every one of those years. Things have changed and evolved for me over the course of this time, but I have to say that I have basically taught the material in much the same way. I have gone from chalk boards to overhead projectors to white boards to Smartboards, but the presentation has been consistent: I have all the information, and I give it all to my students. This workshop has been a spark for me to truly try something different with my classes, but within a framework that fits my style and curriculum. The following is documentation of the work done by students in my Advanced Pre-Algebra (APA) classes.

Despite being a pre-algebra course, a big part of the curriculum of APA includes the study of geometry. For many of the students, geometry is the most difficult part of the course. It is common for the abstract figures and diagrams to be quite perplexing. Students who are successful with a number of algebraic concepts often have trouble “seeing” the two and three dimensional objects. There is also a lot of memorizing that has to be done. I have a list of more than one hundred vocabulary words and formulas that they have to know. Students have always had a difficult time dealing with all this material, and so my goal in this project was to come up with something that will help students to master this enormous amount of material.

The idea of a daybook seemed to be the perfect way for students to organize their ideas, thoughts, vocabulary, and formulas. My goal with these daybooks was for students to create a volume that they can use not only this year, but for the many years of geometry study they will have in the years to come. At the very least, they will have everything together for the semester exam in May.

I have organized the pictures into groups. First I am showing some intro pages where I asked students to write or draw what they think of when I say geometry. I then asked them to give quick commentary about how they have liked geometry in the past. I got some interesting responses. The next section displays examples of the math work they did and how they organized the material. After this, I show some examples of art that some students created. What follows this are some poems and stories written by my students when I gave them the opportunity to do some free writing. I end the presentation with pictures of the wonderful kids that I get to work with every day.



Geometry
BIBLE

GEOMETRY

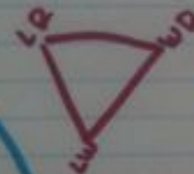
AA

Math 7

Geometry
Survival
GUIDE

Katherine

GEOMETRY GURU GUIDE



SA = ?

Good Grades



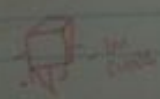
Not Fun

$$C = \pi d$$

Volume

Angles

ZOE



Go Cubs Go!

Everything
Geomet

Christina

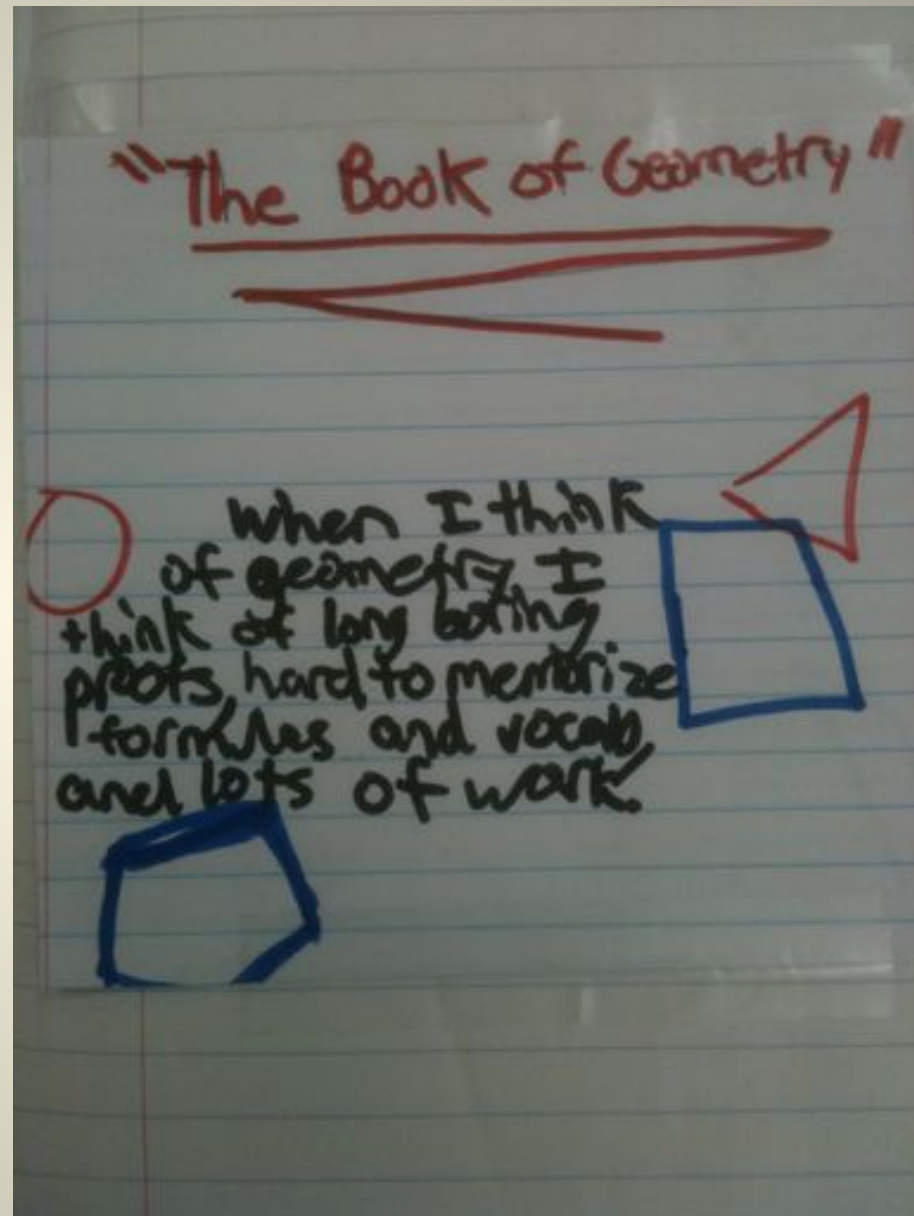
What do you think of
when I say geometry?

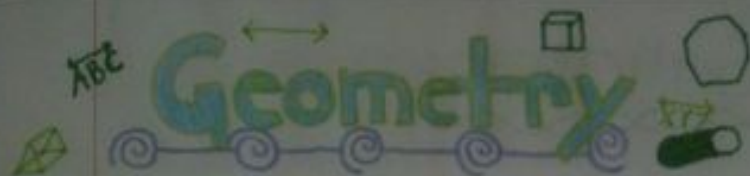


⑤ Parallelograms

⑥ Fancy words

⑦ Planes





When I hear geometry, I think of shapes
lines.

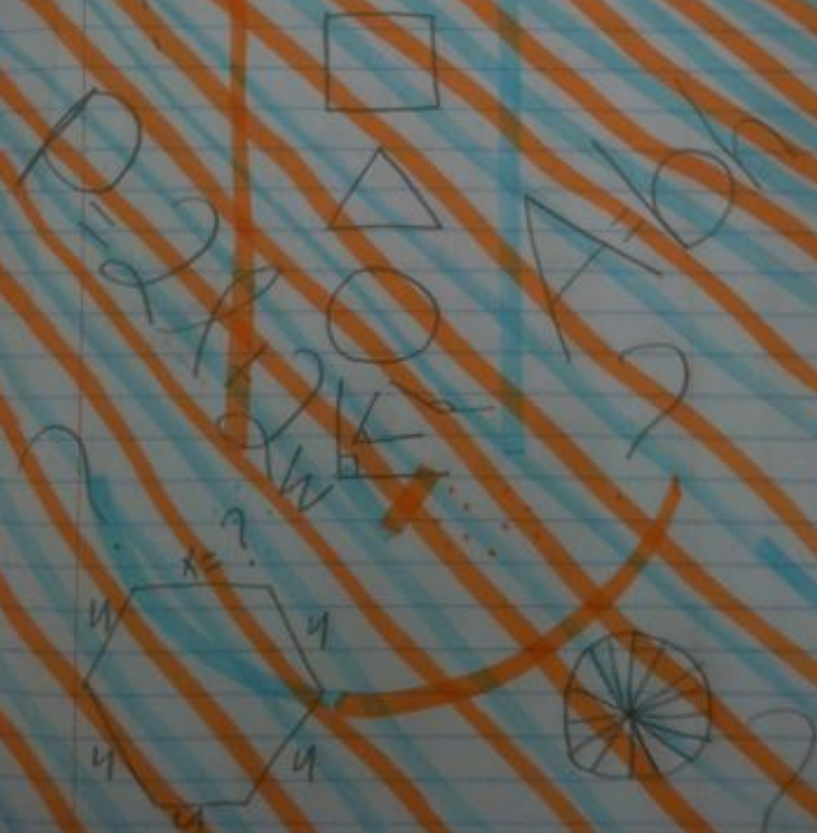
Caroline

G.

Barani

Geometry is OK but not great.

Dear Geometry Book,
when I hear your name, I
think of...



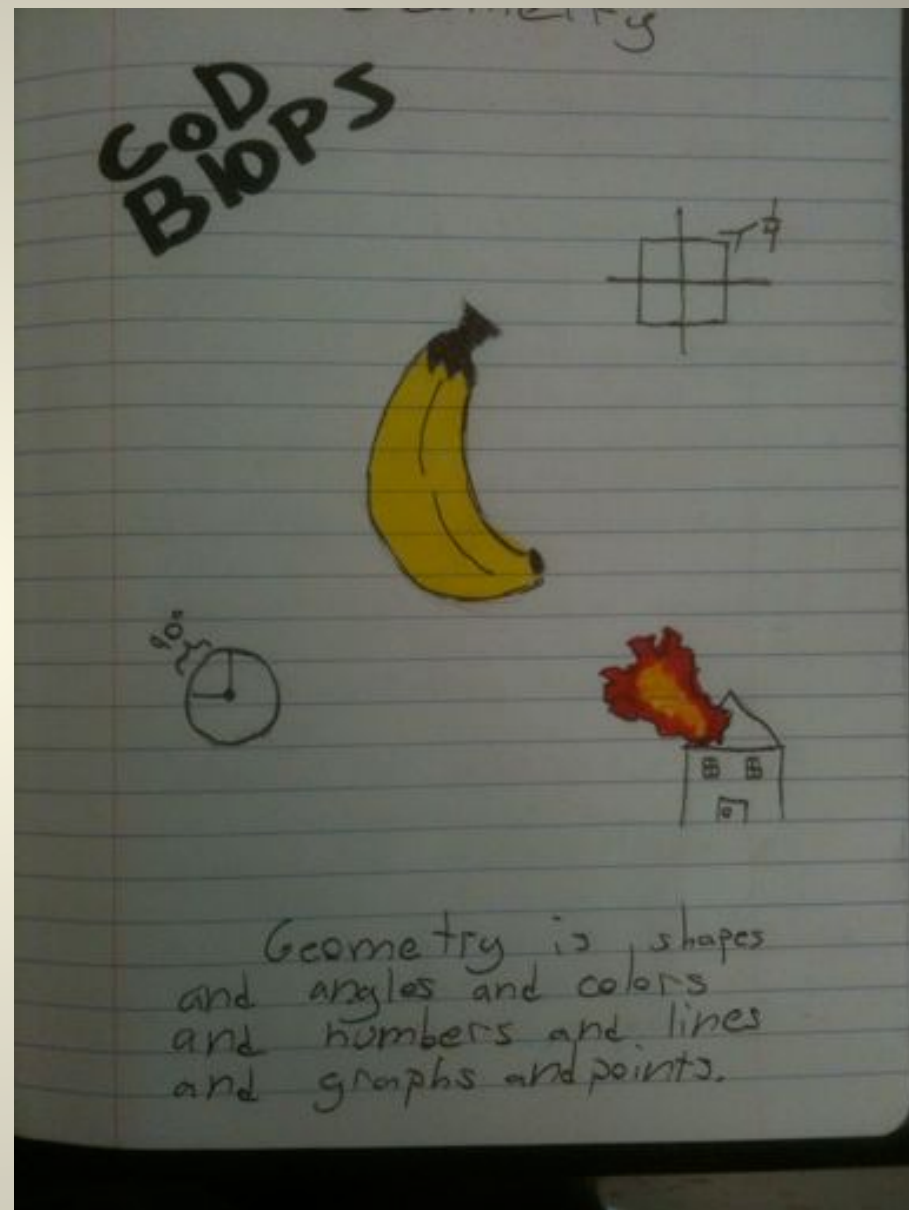
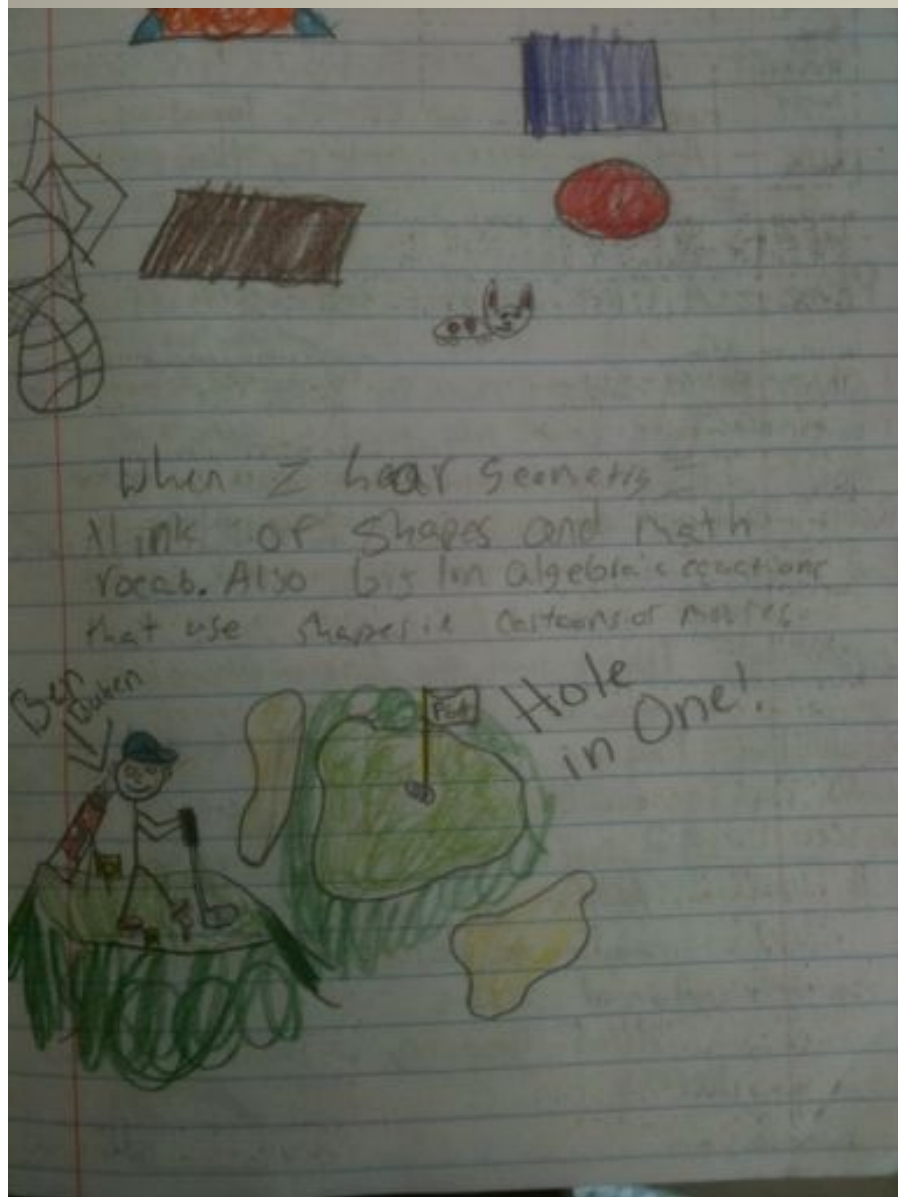
When I think of Geometry I think
Shapes, lines, and time consuming work



☆ When I hear GeOMtry I think ☆
of SHAPES

Geometry is finding the size of
shapes. Geometry has been boring in the past.
But I am looking forward to it.





Rosie



Rea Madan



What I think of when I think of Geometry

① Shapes

② Circles

③ Triangles

④ Angles

⑤ Parallelograms

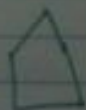
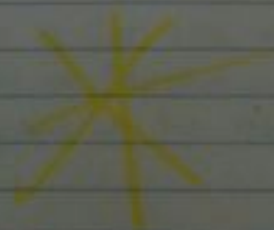
⑥ Fancy words

⑦ Planes

GEOMETRY

Geometry

Geometry



Claudia Westwood

When I think of Geometry;

* Angles



* Shapes

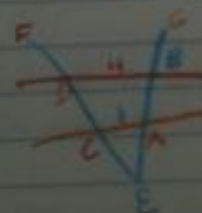


* Triangles

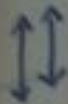


* Vocabulary

* Pi



ABC Maddie Gorelick



Shapes

Rulers



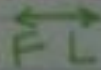
Intersect

Lines

Arcute

Line Segments

Equilateral



Angles

ΔC

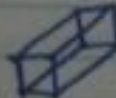
Polygons



Figures

Degrees

Obtuse



Rays

Parallel

Perpendicular

Quadrilateral

Triangles

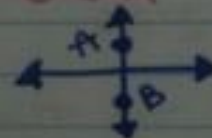
Prisms

90°

Points



Right Angle



G
E
O
M
E
T
R
Y

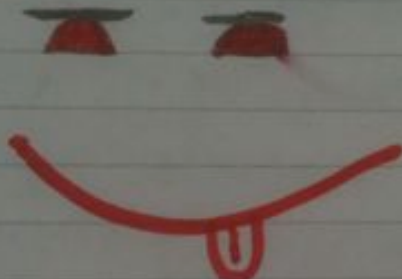
Have you enjoyed Geometry
when you have studied it in
the past?



Stephanie B. Burt!

Geometry:

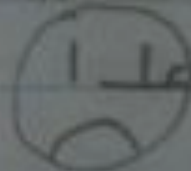
- shapes and formulas
- I don't like geometry! :c
- Area, Circumfrance, and vo
- Different types of a shape



I do not like Geometry.
It is a lot to remember.
I think of drawlgs of shapes.

Andrew D. Swann

$$\pi r^2 = A$$



Geometry was allful; I hate it. I think of circles and shapes, equations, and I get a general bad feeling. I also became a kind of expert on the shapes in nature is something I love.

- I dislike geometry!

Kyra

- Confusing
- boring
- irritating
- changes frequently
- too many formulas
- too much stuff to organize and memorize

Celine Ives

When I think of Geometry, I think of...

- Writing Notes
- Teachers

- Shapes
- Lines

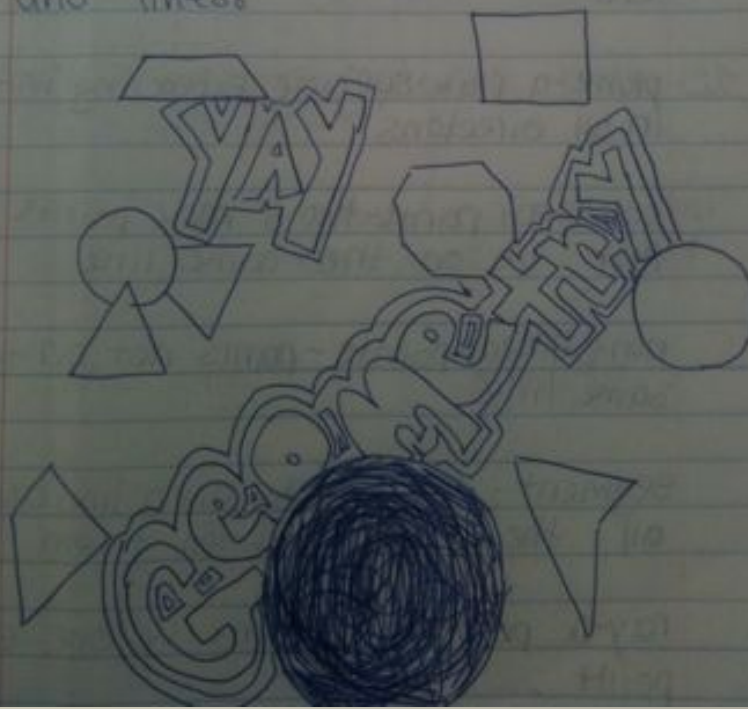
- Complicated words
- Letters

Do I like Geometry?

NO!

Foster

I haven't really liked Geometry too much in the past. I couldn't tell you too much about geometry. When I think of geometry, I think of shapes and lines.



The following pages are examples of how students have organized their work. Most pasted the syllabus and worksheets that I gave them into the daybook. I gave each student a list of the vocabulary that they needed to know, and I let them use a number of sources to find definitions. They used textbooks, the internet, and each other to gain an understanding of what they needed to know. My goal was to have them take ownership of the words and to perhaps add some context to the concepts. I was excited to see how well they did to keep organized. Students who have had a terrible time keeping things together have done a wonderful job. Some have had remarkable improvement with their organization.

Syllabus

Date	Topic	Homework
Mon 3/7 P	Points, Lines, Planes	Vocabulary
Tues 3/8 A	Points, Lines, Planes	p. 167/168/1-20
Wed 3/9 B	Points, Lines, Planes	p. 168/21-32
Thurs 3/10 C	Midpoint	WS: Midpoint
Fri 3/11 D	Pi-Day	None
Mon 3/21 E	Angles	p. 176/9-14, 19-22 WS: Angles
Tues 3/22 F	Special Angle Pairs	WS: Special Angle Pairs
Wed 3/23 A	Triangles	p. 181-182/1-16, 19-26 WS: Special Angle Pairs and Triangles
Thurs 3/24 B	Polygons	p. 186/9-21 odd, 22-24 all
Fri 3/25 C	Polygons	Vocabulary
Mon 3/28 D	Circles	p. 190-191/1-17 odd
Tues 3/29 E	Circles	p. 191/24-29

APA Geometry Vocabulary

Undefined terms: terms that have more than one meaning.

Point- The simplest figure in geometry, representing an exact location.

Line- A figure determined by two points, extending in both directions without end.

Plane- A flat surface extending infinitely in both directions, named with 3 non-collinear points.

Collinear Points- Three or more points that lie on the same line.

Non-collinear Points- Points not on the same line.

Segment- Two points on a line and all points between them.

Ray- A part of a line with one endpoint.

Endpoint- The point at the end of a segment or ray.

Coplanar- A way of describing points that lie on the same plane, or share a common plane.

APA Geometry Vocabulary

①

3/7/11

Undefined terms: terms that have more than one meaning

Point- The simplest figure in geometry representing an exact location.

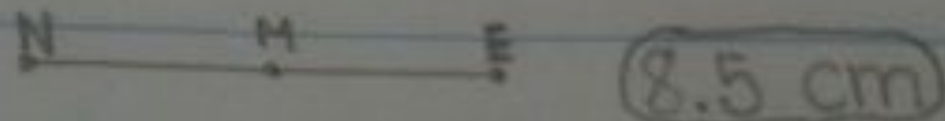
Line- A figure determined by two points and extending in both directions without end.

Plane- A flat surface extending infinitely in both directions. Named with 3 non-collinear points.

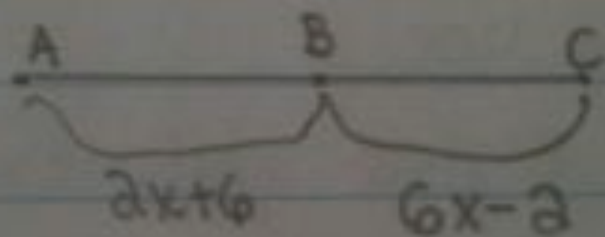
Collinear Points- Three or more points that lie



if $NE = 17 \text{ cm}$



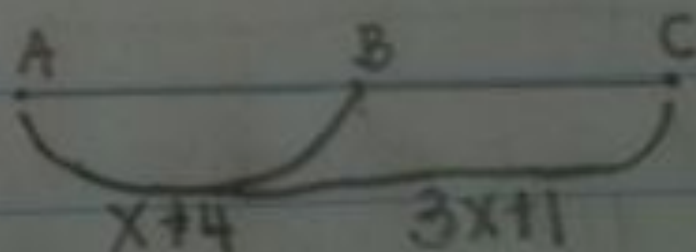
B is the midpoint of \overline{AC} . Find x if $AB = 2x + 6$ and $BC = 6x - 2$.



$$2x + 6 = 6x - 2$$

$$-4x = -8$$

$$(x = 2)$$

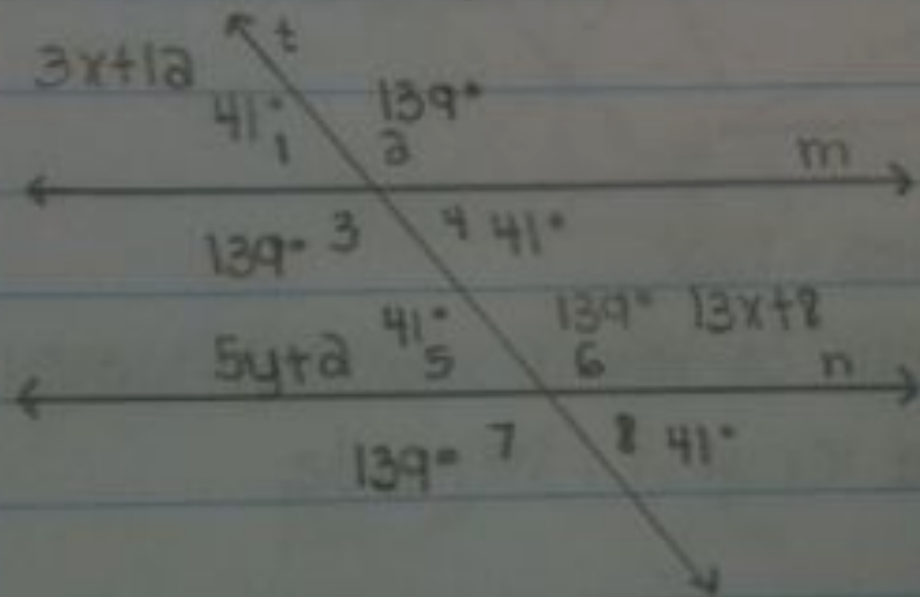
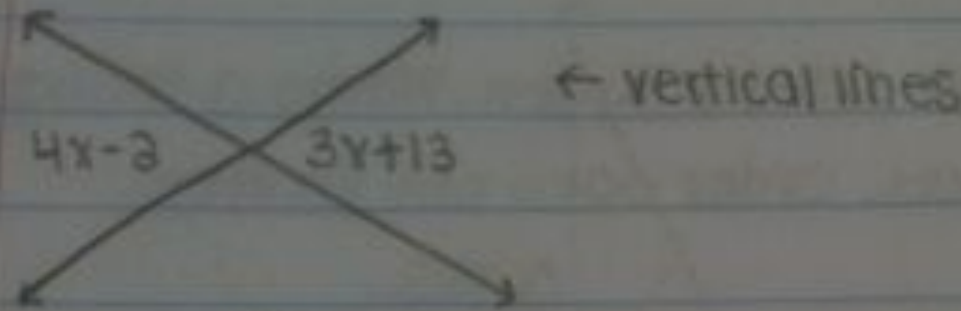


$$x + 4 = 3x + 1 \div 2$$

$$2x + 8 = 3x + 1$$

Notes 7 Special Angle Pairs

Caroline



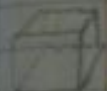
Transversal- a line that intersects with 2 or

Christina Adams

Day 1 3-7-11 #1-12 vocabulary

1) Point - The simplest figure in geometry representing an exact location.

2) Line - A figure determined by two points and extending in both directions.



3) Plane - A flat surface extending infinitely in all directions.

4) Collinear Points - Three or more points that lie on the same line.

5) Non-collinear points - points not on the same line.

6) Segment - The set of points consisting of two distinct points and all in between them.

7) Ray - A part of a line with one endpoint.

8) Endpoint - The point at the end of a line segment or ray.

9) Coplanar - being or operating in the same plane.

10) Parallel Lines - lines in the same plane that don't intersect.

11) Parallel Planes - planes that don't intersect.

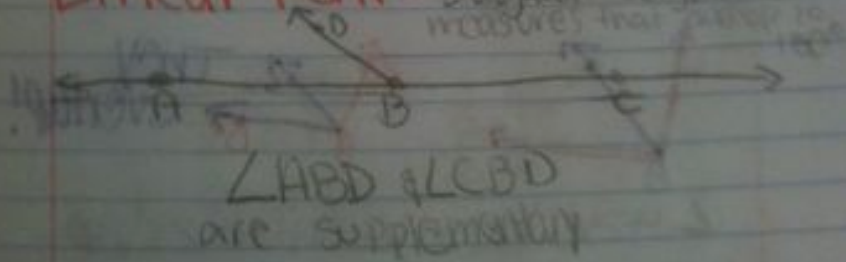
12) Skew lines - two non-parallel lines that do not intersect. or Lines not in the same plane that don't intersect.

Complimentary Angles - 2 angles with measures that add up to 90°
 $30^\circ + 60^\circ$
 $81^\circ + 9^\circ$

Supplementary Angles - 2 angles with measures that add up to 180°

$120^\circ + 60^\circ$
 $23^\circ + 157^\circ$

Linear Pair - 2 adjacent angles w/ measures that add up to 180°



Find the measure of the missing angle

$46\frac{1}{2}^\circ$ 133.5
 $2x + 4$ $6x + 6$
 $2x + 4 + 6x + 6 = 180$
 $8x + 10 = 180$
 $8x = 170$
 $x = 21.25$

WS-Midpoint 3-10-11

M is the midpoint of \overline{AB} and N is the midpoint of \overline{MB} .

✓ If $AM = 10$, then $AB = \underline{20}$ and $MB = \underline{10}$.

✓ If $AM = 4x - 4$ and $MB = 2x + 10$, solve for x and find the length of \overline{AB} .

$4x - 4 = 2x + 10$
 $2x = 14$
 $x = 7$
 $AM = 4(7) - 4 = 24$
 $MB = 2(7) + 10 = 24$
 $AB = 24 + 24 = 48$

✓ If $AM = 2x - 2$ and $MB = 3x$, find x .

$2x - 2 = 3x$
 $-2 = x$
 $x = -2$

✓ If $AM = 5x + 2$ and $MB = 24 - 3x$, then solve for x and find the length of \overline{AB} .

$5x + 2 = 24 - 3x$
 $8x = 22$
 $x = 2.75$

✓ If $AB = 21 - x$ and $AM = 2x + 3$, then solve for x and find the length of \overline{AB} .

$2(2x + 3) = 21 - x$
 $4x + 6 = 21 - x$
 $5x = 15$
 $x = 3$
 $AB = 21 - 3 = 18$



X is the midpoint of \overline{AB} .

Y is the midpoint of \overline{XB} .

✓ If $\overline{AX} = 12$, $\overline{XB} = \underline{12}$, and $\overline{XY} = \underline{6}$.

✓ If $\overline{AX} = 3x - 3$ and $\overline{XB} = 3x + 5$, then $x = \underline{4}$.

$3x - 3 = 3x + 5$
 $-3 = 5$
 $-8 = 0$

✓ If $\overline{AB} = x + 3$, and $\overline{BX} = 7$, then $x = \underline{11}$.

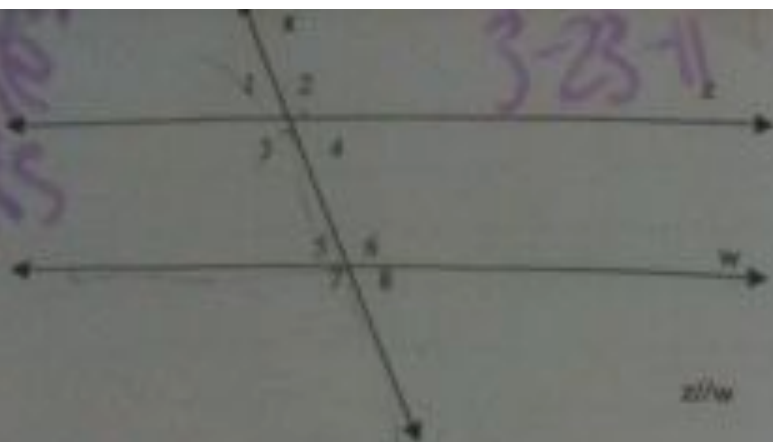
$x + 3 = 2(7)$
 $x + 3 = 14$
 $x = 11$

✓ If $\overline{XB} = 23 - 2x$, $\overline{XY} = 2x + 3$, then $\overline{XB} = \underline{26}$ and $\overline{AB} = \underline{52}$.

$23 - 2x = 2(2x + 3)$
 $23 - 2x = 4x + 6$
 $17 = 6x$
 $x = 2.83$

✓ If $\overline{AB} = x + 3$, and $\overline{AX} = 3x - 1$, then $x = \underline{1}$, and $\overline{AB} = \underline{4}$.

$2(3x - 1) = x + 3$
 $6x - 2 = x + 3$
 $5x = 5$
 $x = 1$



Name the alternate interior match to $\angle 4$.

$\angle 5$

Name the angle that corresponds to $\angle 8$.

$\angle 4$

Name the alternate exterior match to $\angle 2$.

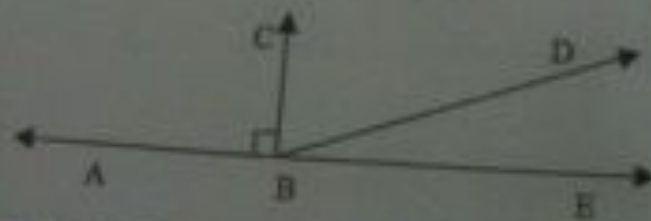
$\angle 7$

Name an angle that is adjacent to $\angle 7$.

$\angle 5$ & $\angle 8$

If $m\angle 4 = 38^\circ$, find $m\angle 7$.

142°

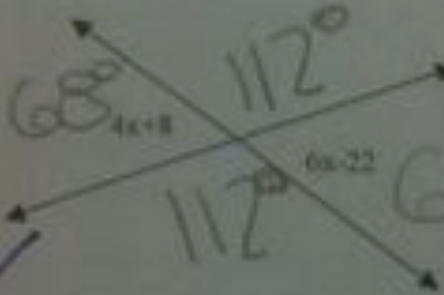


Measure of $\angle CHD$ is two more than three times the measure of $\angle DBE$. Write on and find the measure of both angles.



Solve for x and find the measure of all the angles.

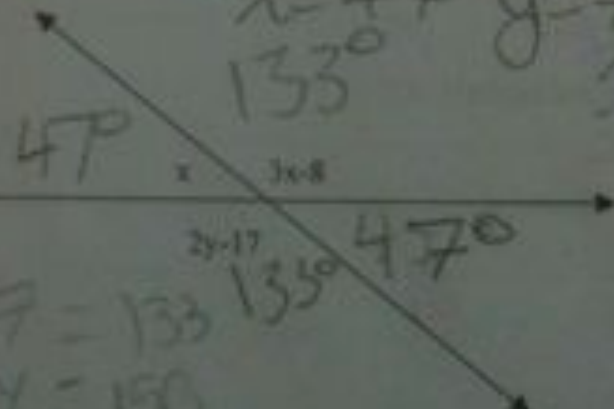
$x = 20$



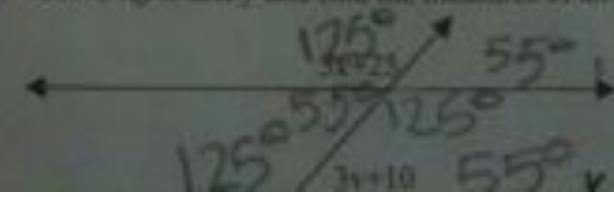
9) Solve for x and y and find the measures of all the angles.

$x = 47$

$y = 75$



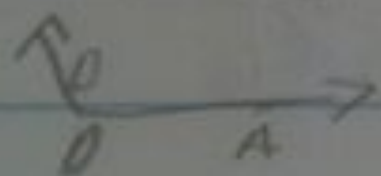
Solve for x and y and find the measures of all the angles.



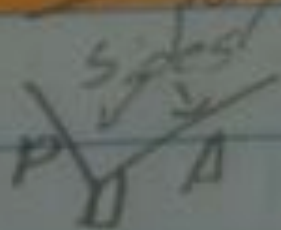
Notes 6 Angles

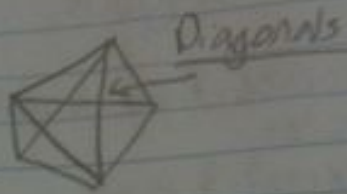
3-21

Angle - a figure formed from 2 rays that share the same endpoint



vertex - the common endpoint shared by the 2 rays of an angle





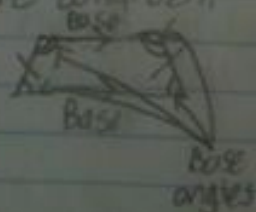
Quadrilaterals have 4 sides and 4 angles
The sum of the angles add up to 360°

Special Quadrilaterals

Isosceles Trapezoid
only one pair of parallel sides

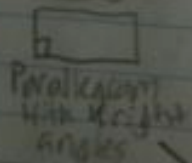
Isosceles Trapezoid

non-parallel sides are congruent



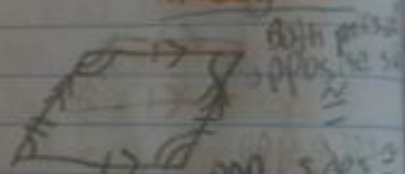
non-parallel sides \cong means base angles \cong

Rectangle



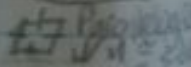
Parallelogram with right angles

Parallelogram



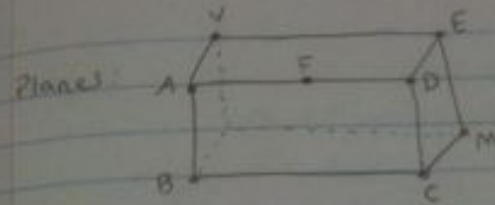
opp. sides \cong
means
opp. angles \cong
consecutive angles are supplementary

Rhombus



Parallelogram with all sides \cong

4 right angles or 4 90° angles

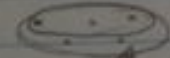


Plane EDC

Collinear Points - 3 or more points on same line

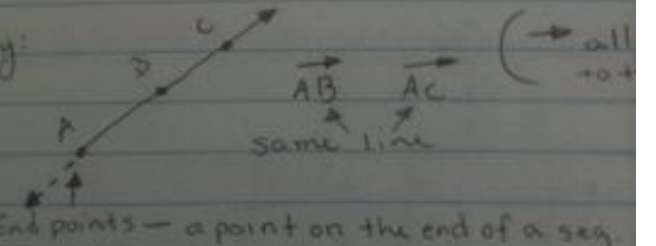


Non-Collinear Points - 3 or more points not on same line



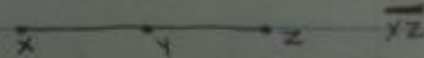
$S = NCP$ 3 $2 = CP$

Ray:



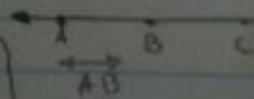
End points - a point on the end of a seg.

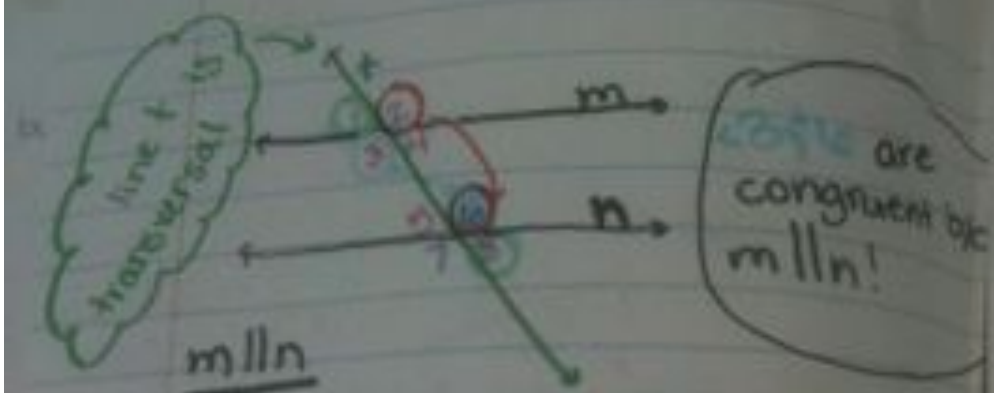
Segment:



Lines + Ray + Segments:

Similarity:





$m \parallel n$

Alternate Interior Angles - the following angle pairs:

$\angle 3 \angle 6$ $\angle 4 \angle 5$

Alternate Exterior Angles - following angle pairs:

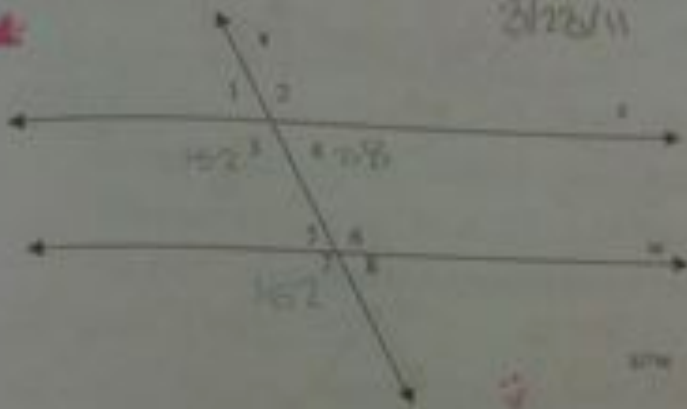
$\angle 1 \angle 8$ $\angle 2 \angle 7$

Corresponding Angles - the following pairs:

$\angle 1 \angle 5$ $\angle 2 \angle 6$ $\angle 3 \angle 7$ $\angle 4 \angle 8$ | still correspond even if not ||

APA
Special Angle Pairs

Name THOMAS WILSON
3/28/11



1) Name the alternate interior match to $\angle 4$.

$\angle 5$

2) Name the angle that corresponds to $\angle 8$.

$\angle 4$

3) Name the alternate exterior match to $\angle 2$.

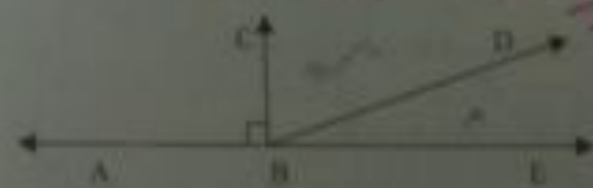
$\angle 7$

4) Name an angle that is adjacent to $\angle 3$.

$\angle 3$, $\angle 6$, $\angle 2$, $\angle 5$, $\angle 8$

5) If $m\angle 4 = 38^\circ$, find $m\angle 7$.

162° 142° 180° NOT 100°



The measure of $\angle CBD$ is two more than three times the measure of $\angle DBE$. Write an equation and find the measure of both angles.

$22^\circ = m\angle DBE$

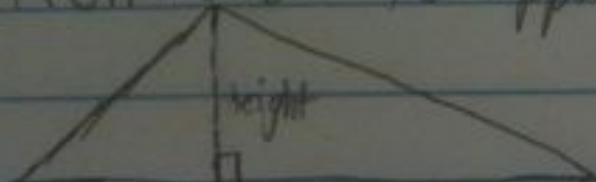
Notes 2 Area of Triangles and

$$\text{Area of Triangle} = A = \frac{1}{2}bh$$

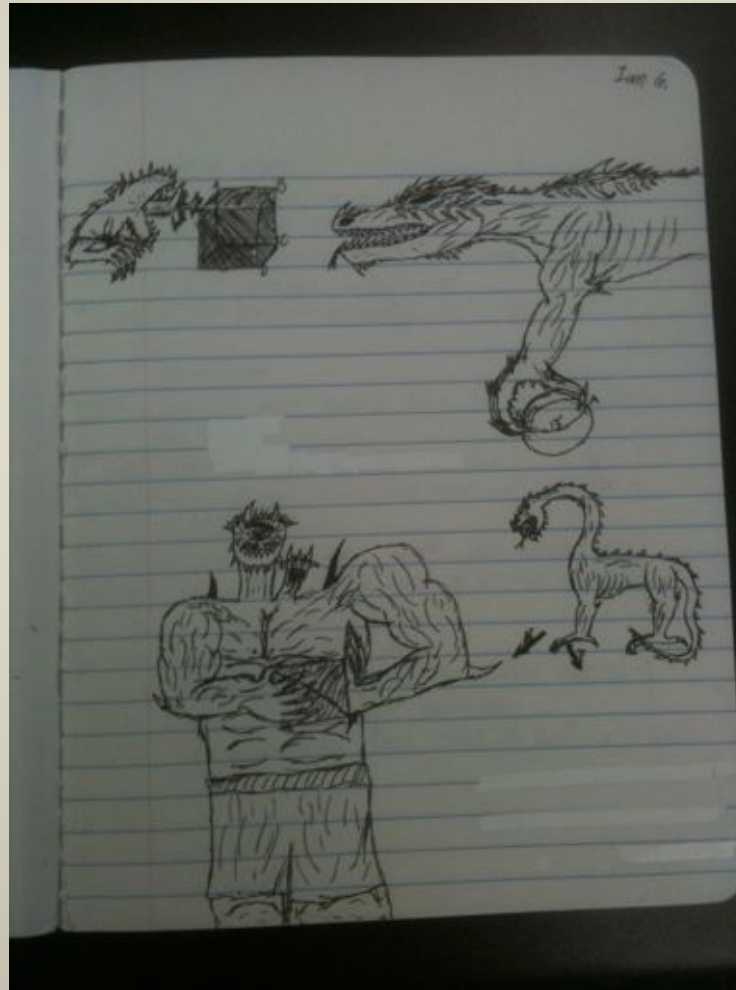


Base of a triangle - any of the sides

Height of a triangle - the perpendicular distance from base to opposite vertex



Some examples of free time
doodling and artistry.

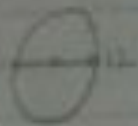


Find Circumference

$$C = \pi d$$

$$\pi = 3.14 \quad C = 3.14(12)$$

$$C = 37.68$$



$$= \frac{22}{7}$$

$$C = \pi r$$

$$C = \frac{22}{7}(21)$$

$$C = 132$$

Find the radius

$$3.14 \quad C = \pi d$$

$$15.7 = 3.14d$$

$$5 = d$$

$$2.5 = \text{radius}$$

Find the diameter

$$C = \pi d$$

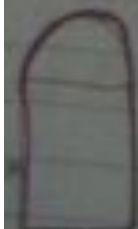
$$\text{diameter} = 14\text{cm}$$

$$44 = \frac{22}{7}d$$

$$14 = d$$

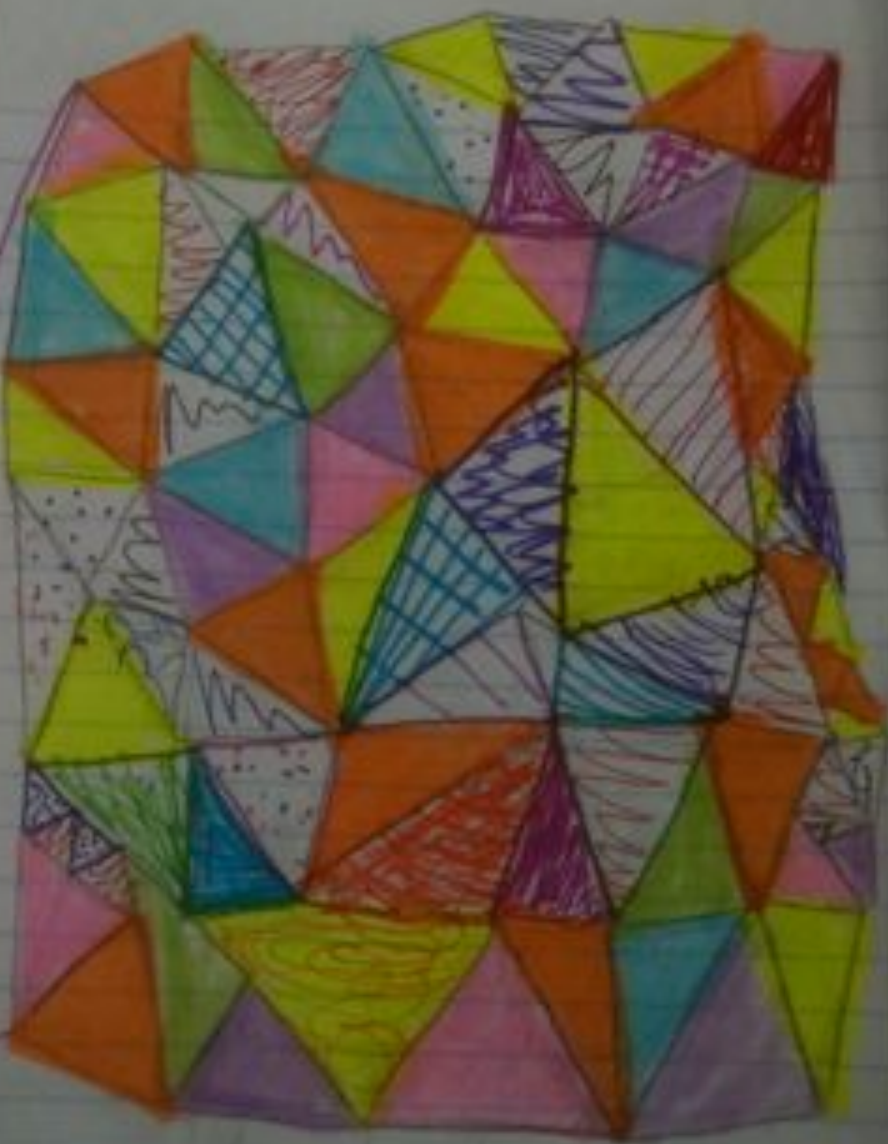
Find the perimeter

leave in terms of π

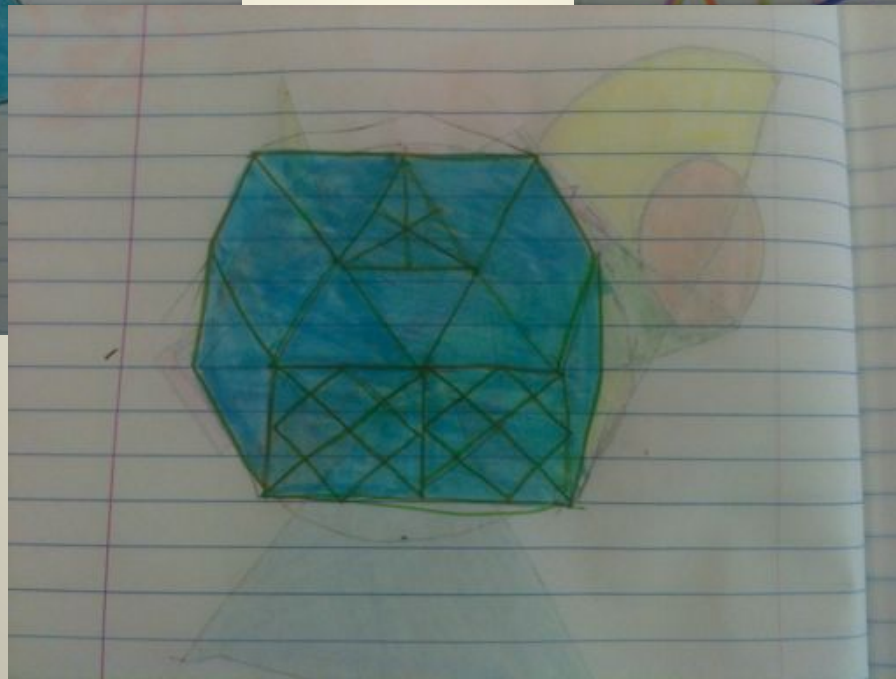
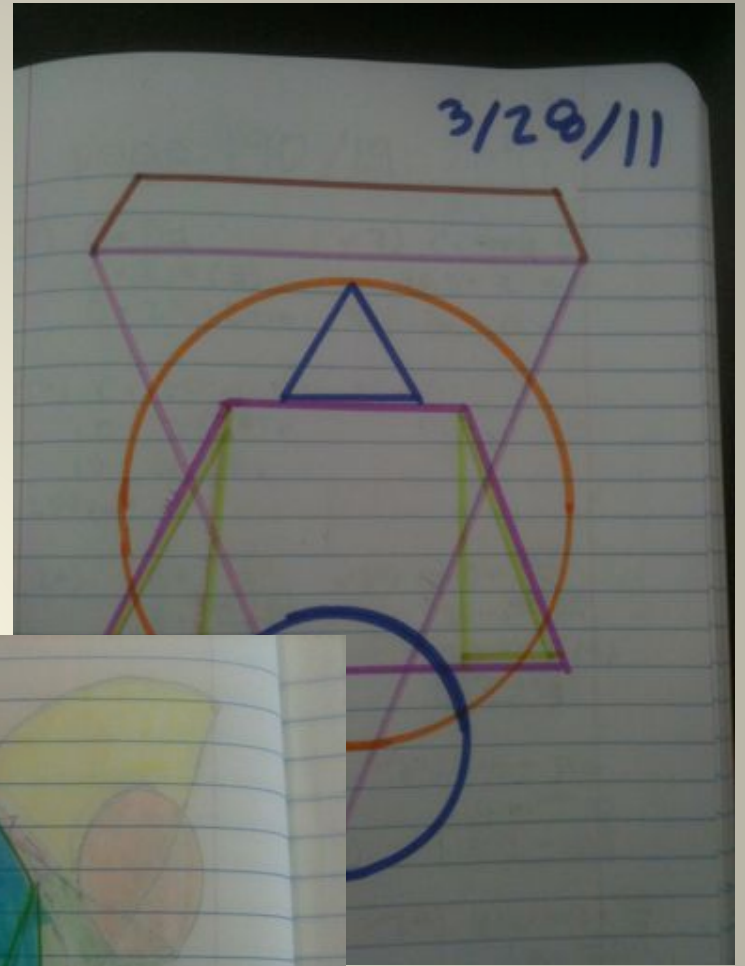
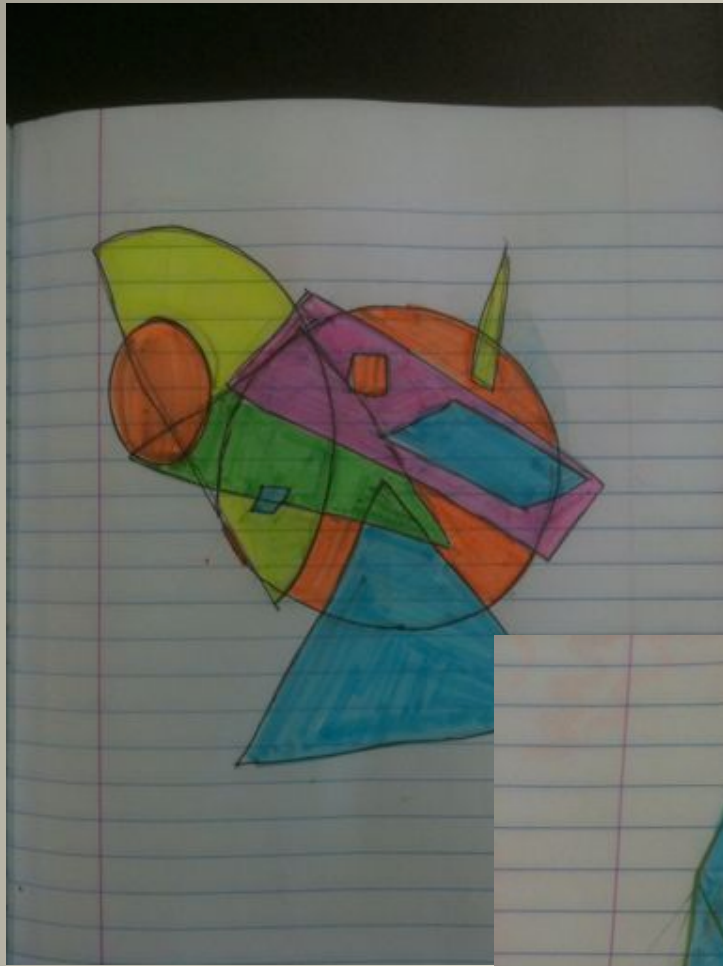


$$14\text{cm} \quad 14 + 10 + 14 + \frac{\pi d}{2}$$

$$38 + \pi(14)$$







Some examples of free time
writing and prose.



but he is a lowly shapeless mass
when squares have their
the triangle is sad

The square will stare
at the circle with despair
Smooth lines are his desire
all he dreams about are tires
but he is okay with his cray box
as long as he has Bejangles

The Polygon Poem

Once an obtuse triangle
wished to be right
The problem worried
her, kept her up at night
She admitted "I have angle problems"
Then cried "Oh, I just can't solve 'em!"
Oh, how her heart would freeze,
when a polygon passed, flaunting 90 degrees
So boldly she embarked on a quest,
Declaring that half of 180 was best.
Along the way she picked up
a square,
Who ever so sadly was
missing his hair.

Next they found a parallelogram
who wished to ~~like~~ his alligator to him
Finally, a lovely trapezoid
who ~~circle~~ she would rather avoid
And off to the Mathematician
the scared
Glad they would no longer
be boared.



My triangle is an equilateral

It contains no diagonals

It is most certainly not a quadrilateral

My triangle is the cousin of the pentagon

Not to forget the hexagon, heptagon, and octagon
or any of the other polygons

It adds up to 180 degrees

If it got that hot in life, there would be no breeze
or any trees or bumblebees

Well, this is the last moment of my time

and yet, do not forget, that it is only made of 3 lines
~~and~~, and that it is, in fact, a beautiful triangle



My cat has many angles
And lots of vertices
Squares circles and triangles
So don't erase it please

It has no obtuse triangles
Its cords give it nine lives
So complement its angles
Don't bisect them with knives

Notes 10 can.

The Polygon Poem

(At his lala, even geeks were confused:
And even the longest numbers, abused!)
Dolby, our triangle stepped forth
and said:

Please make me a right, sir, or else make
me dead!

Don't be a fool, he said, turning green.
Right triangles are nasty, ugly, and
mean.

He then turned to the bald square,
saying: Silly quadrilateral, you shouldn't have hair!
Then to the parallelogram he spoke,
after having a sip of his Diet Coke,

Dear Sir! I'm amazed that a shape can eat!
Why waste such power on disgusting meat?

And you! Circles are nothing to fear!

They won't hurt you, no more than a sphere

Then he took out a sword, and
that was the end,

of our imperfectly strange
triangle friend.

Students have earned some of the highest scores on the first test that I have seen in a while. Not everyone did well, but the overall average from last year on the same test was 9% higher. This is obviously a small sample size, and we still have another geometry test to take, but I like what we have done with the daybooks, and we will use them again next year.

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-2

are this.

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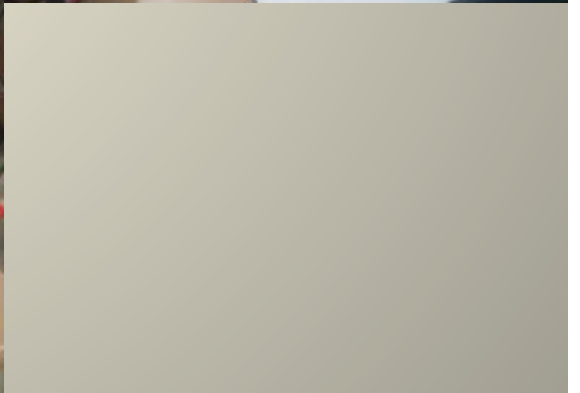
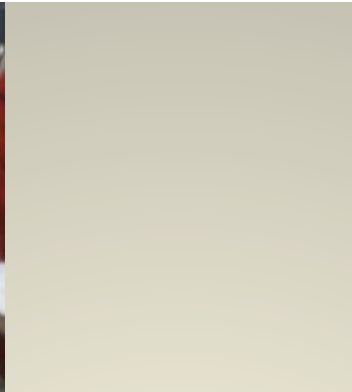
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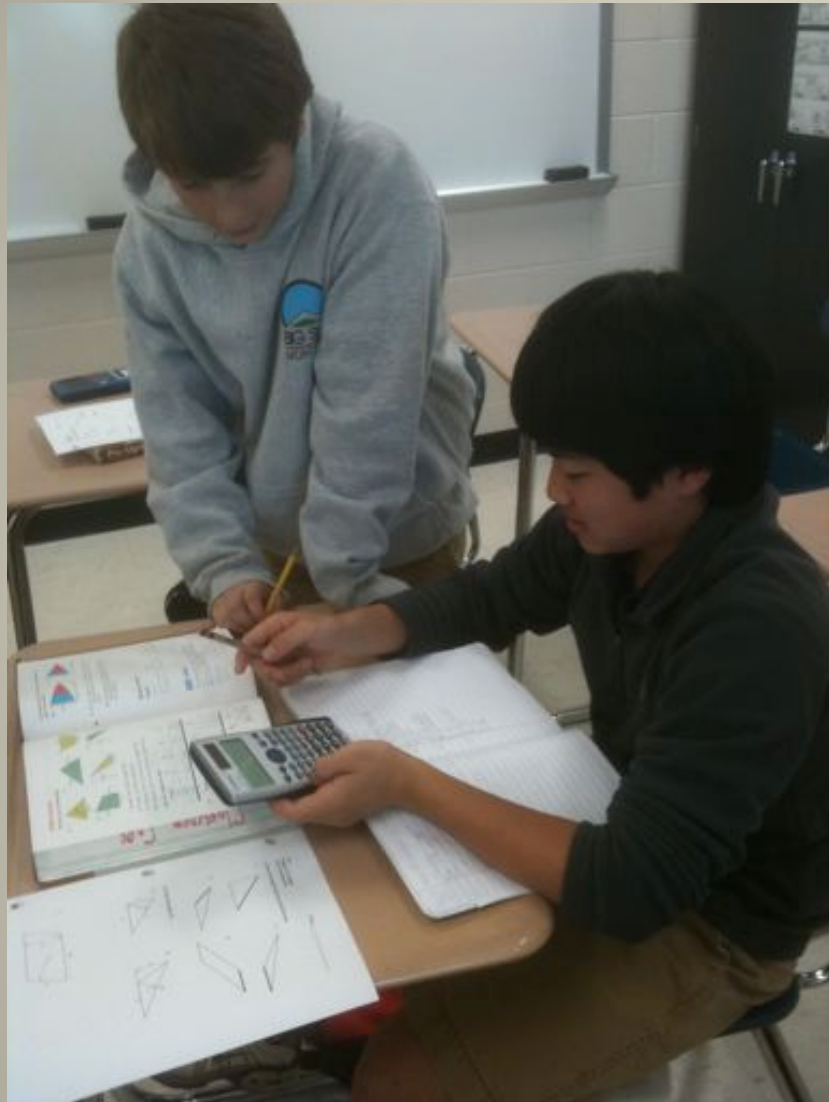
s are called this.

Great!

rcle

ect.





Thanks to all the students in my APA classes!

