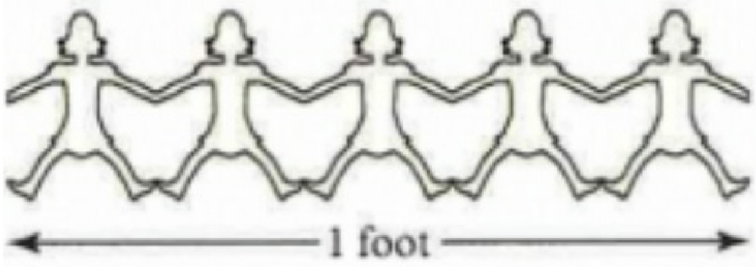
1. The children in Mrs. Watson's class made chains of small paper dolls, as pictured in Figure 11.18. A chain of 5 dolls is 1 foot long. How long would the following chains of dolls be? In each case, give your answer in either feet or miles, depending on which answer is easiest to understand.

1mile = 5280 ft.

$* \ \frac{10 \text{ dolls}}{5 \text{ dolls}} = 2 \text{ ft}$

a) 100 dolls
b) 1000 dolls
c) 100,000 dolls
d) 1 million dolls
e) 1 billion dolls



a) $100 \text{ dolls} * \frac{1 \text{ ft}}{5 \text{ dolls}} = 20 \text{ ft}$

b) $\frac{1000 \text{ dolls}}{5 \text{ dolls}} = 200 \text{ ft}$

c) $\frac{100000 \text{ dolls}}{5 \text{ dolls}} = 20000 \text{ ft} \rightarrow 3.78 \text{ miles}$

$\frac{20{,}000 \text{ ft}}{5280 \text{ ft}}$

d) $\frac{1{,}000{,}000 \text{ dolls}}{5 \text{ dolls}} = 200{,}000 \text{ ft} = 37.87 \text{ miles}$

$\frac{200{,}000 \text{ ft}}{5280 \text{ ft}}$

e) $1{,}000{,}000{,}000/5$

$200{,}000{,}000 \text{ ft}$ $\div 5280 \text{ ft}$

$= 37878.87 \text{ ft}$.

2. Solve the following conversion problems, using the basic fact $\boxed{1 \text{ inch} = 2.54 \text{ cm}}$ in each case:

a) A track is 100 meters long. How long is it in feet? (4 pts) $m \to ft.$

b) If the speed limit is 70 miles per hour, what is it in kilometers per hour? (4pts)

c) A man is 1.88 meters tall. How tall is he in feet? (3pts)

(a) $$100\,\cancel{m} * \frac{100\,\cancel{cm}}{1\,\cancel{m}} * \frac{1\,\cancel{in}}{2.54\,\cancel{cm}} * \frac{1\,ft}{12\,\cancel{in}} = \frac{(100 \cdot 100)\,ft}{(2.54 \cdot 12)} = 328.08\,ft.$$

(b) $$70\,\frac{\cancel{miles}}{hour} * \frac{5280\,\cancel{ft}}{1\,\cancel{mile}} * \frac{12\,\cancel{in}}{1\,\cancel{ft}} * \frac{2.54\,\cancel{cm}}{1\,\cancel{in}} * \frac{1\,km}{100{,}000\,\cancel{cm}} = \frac{70 \cdot 5280 \cdot 12 \cdot 2.54}{100{,}000}\,\frac{km}{hr}$$

$$= \boxed{112.65\ km/hr}$$

(c) $$1.88\,\cancel{m} * \frac{100\,\cancel{cm}}{1\,\cancel{m}} * \frac{1\,\cancel{in}}{2.54\,\cancel{cm}} * \frac{1\,ft}{12\,\cancel{in}} = \frac{1.88 \times 100}{2.54 \times 12} = 6.167979\,ft.$$

6 ft, 6.17 ft

3. A house has a floor area of 800 square meters. What is the floor area of this house in square feet? use the fact that 1 in. = 2.54 cm.

w/ Area square each conversion.

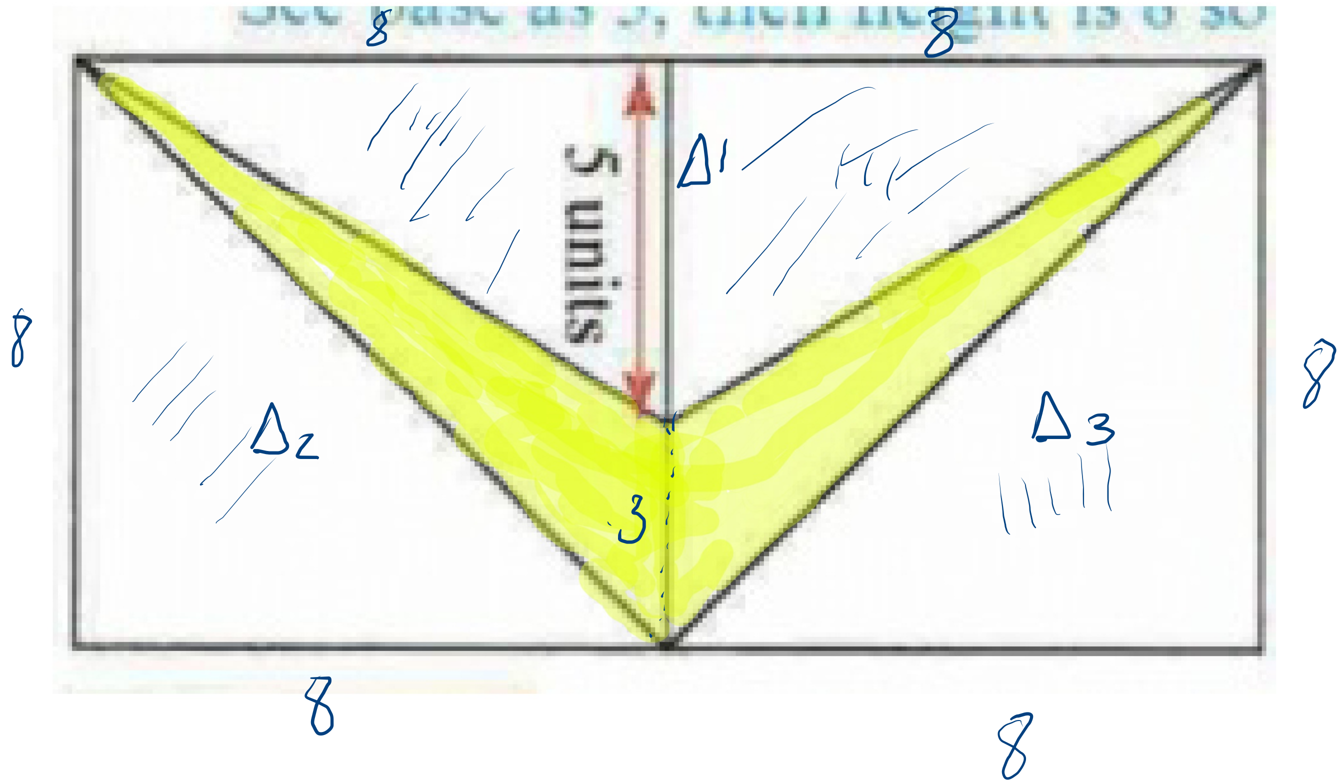
w/ volume you cube each conversion

$$800\ m^2 * \left(\frac{100\ cm}{1\ m}\right)^2 * \left(\frac{1\ in}{2.54\ cm}\right)^2 * \left(\frac{1\ ft}{12\ in}\right)^2$$

$$800\ \cancel{m^2} * \frac{10000\ \cancel{cm^2}}{1\ \cancel{m^2}} * \frac{1\ \cancel{in^2}}{6.4516\ \cancel{cm^2}} * \frac{1\ ft^2}{144\ \cancel{in^2}} = \frac{800 \cdot 10000}{6.4516 \cdot 144} = 8611.13\ ft^2$$

8611.13 ft²

4. Determine the area of the shaded shape in Figure 12.37 in *two different ways*. The entire figure consists of two 8-unit-by-8-unit squares. Explain your reasoning in each case.



1st way

Double the Area of Δ.

Area $= \frac{1}{2}bh$

$= \frac{1}{2}(3)(8)$

$= \frac{1}{2}(24)$

$= 12 \text{ unit}^2$.

Since we have symmetry,

$2(12 \text{ units}^2) = \boxed{24 \text{ units}^2}$

2nd way

$\Delta_1 = \frac{1}{2}(16)(5) = 8 \cdot 5$

$= 40 \text{ unit}^2$

$\Delta_2 = \frac{1}{2}(8)(8) = \frac{1}{2}(64) = 32 \text{ unit}$

$\Delta_3 = 32 \text{ unit}^2$.

Total $= 16 \cdot 8 = 128 \text{ units}^2$

$128 - 32 - 32 - 40 = 128 - 64 - 40$

$= 128 - 104 = 24 \text{ unit}^2$

5. Figure 12.49 shows a trapezoid. This problem will help you find a formula for the area of the trapezoid and explain in several different ways why this formula is valid.

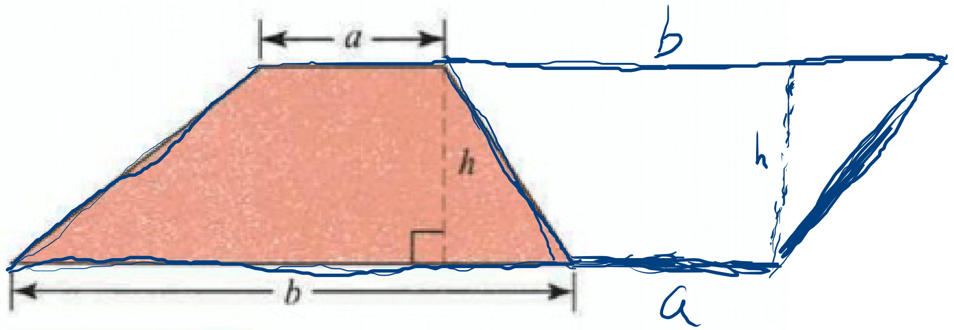
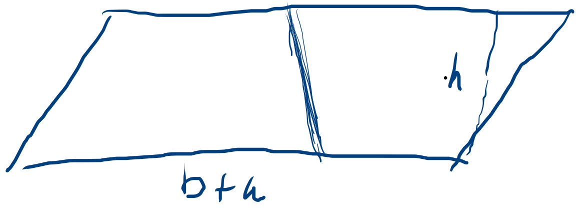


Figure 12.49 A trapezoid.

Show how to combine two copies of the trapezoid in Figure 12.49 to make a parallelogram. Then use the formula for the area of a parallelogram to deduce a formula for the area of the trapezoid. Explain your reasoning.



$A = (b+a)h$.

$\boxed{A_{trap} = \frac{1}{2}(b+a)h} = \frac{b+a}{2} \cdot h$

Area of Parallelogram

$A = (a+b)h$.

But since it is made of 2 Trapezoid, take half

So Area of Trapezoid

$A = \frac{1}{2}(a+b)h$

6. By subdividing the trapezoid into two triangles, as shown in Figure 12.50, find a formula in terms of a, b, and h for the area of the trapezoid, and explain why your formula is valid.

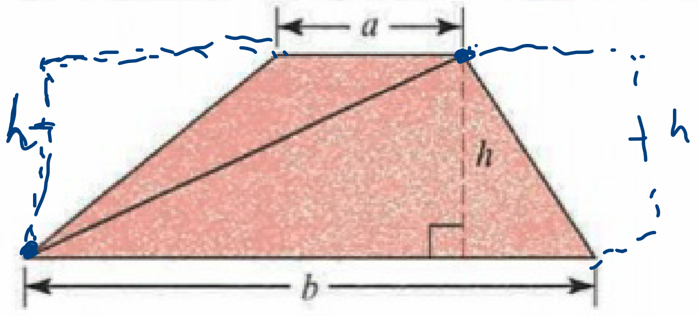


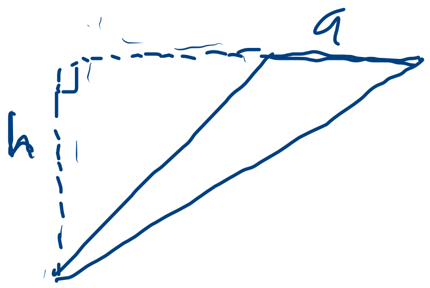
Figure 12.50 A subdivided trapezoid.

add

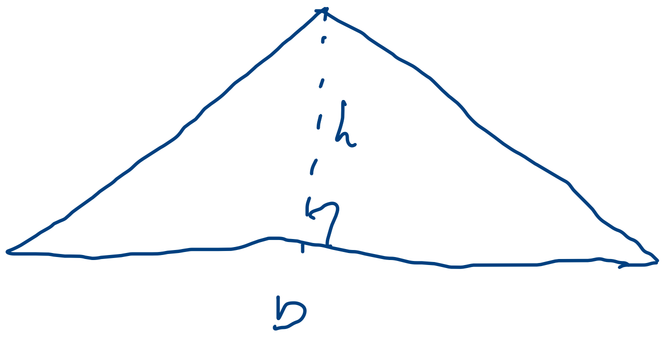
$\frac{1}{2}ah + \frac{1}{2}bh$

$\boxed{\frac{1}{2}(a+b)h}$

Two Triangles



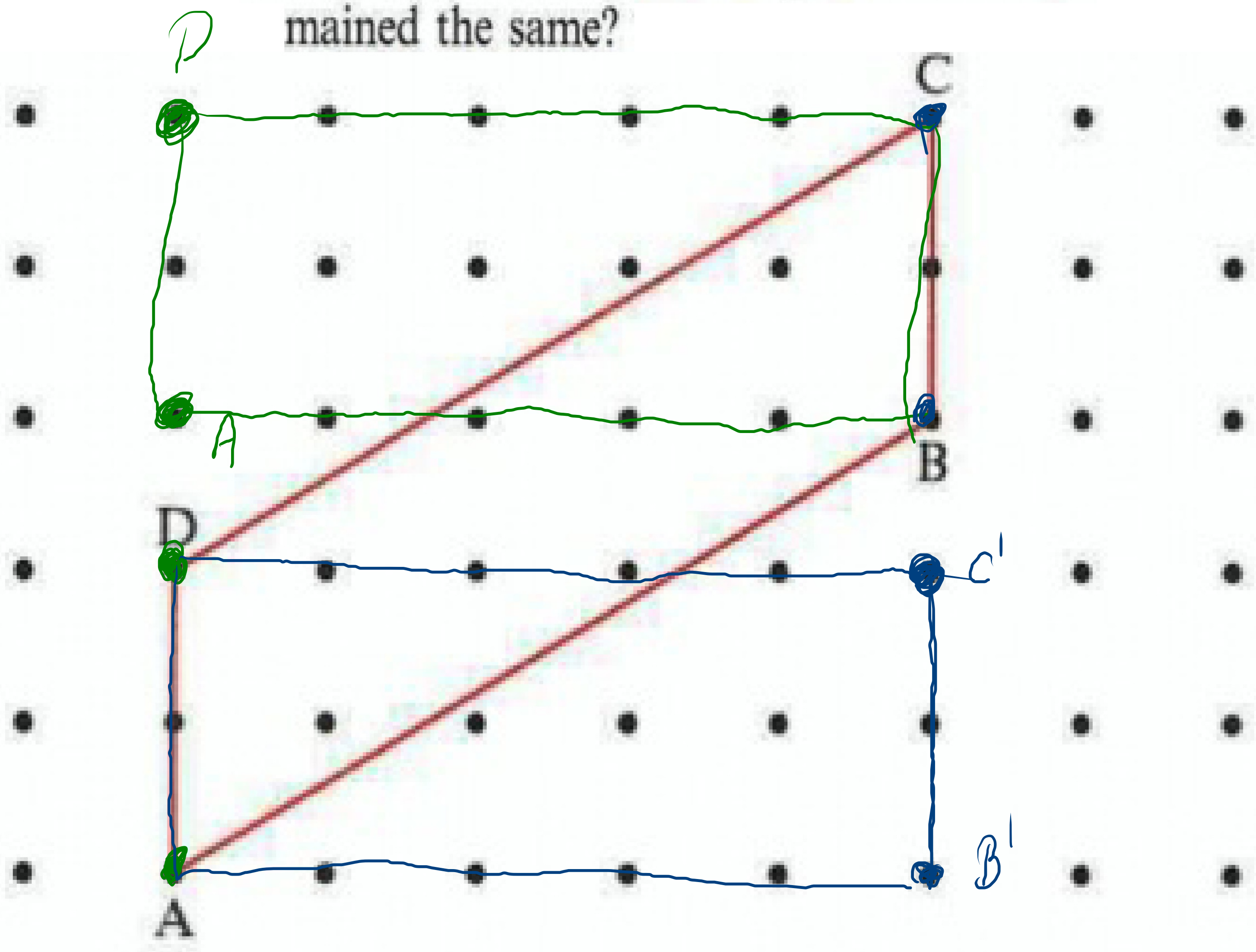
$A = \frac{1}{2}ah$



$A = \frac{1}{2}bh$

7. a. Make a drawing to show the result of shearing the parallelogram in the figure below into a rectangle. Explain how you know you have sheared the parallelogram correctly.

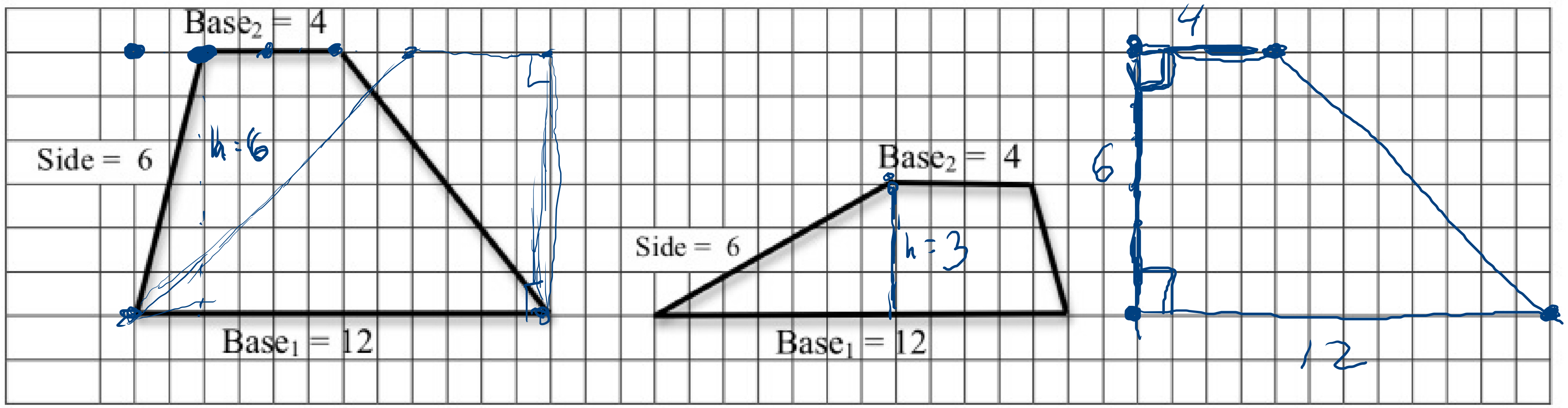
b. During shearing, what changed and what remained the same?



(b) Perimeter and ∡ change.

Area stayed the same.

8. A student brings the following diagram to his teacher to show how he used Cavalieri's Principle to shear the trapezoid on the left into the one on the right. Notice how the student carefully preserves the lengths of the three sides as marked. [4p each]



a) How would you explain to the student what he has done in context of the shearing process? Is his shearing correct?

- The Shearing is NOT Correct. The Student squished the trapezoid rather than moving it from Side to Side. Height must remain the Same.

b) In the space on the grid to the right, show a shearing of the first trapezoid on the left so that three of the sides meet at right angles.

c) What is the area of that trapezoid?

$\frac{1}{2}(4+12)(6) = \frac{1}{2}(16)(6) = (8)(6) = 48 \text{ unit}^2$

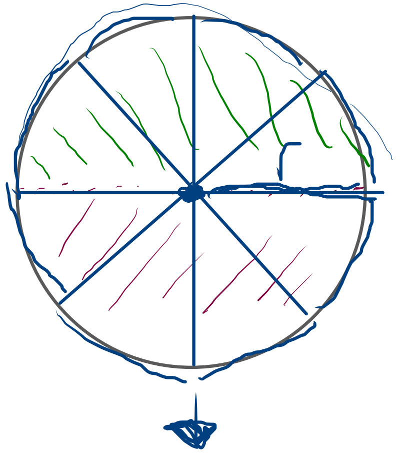
9. For the next problems you may only solve one of them. You may do both for extra credit.

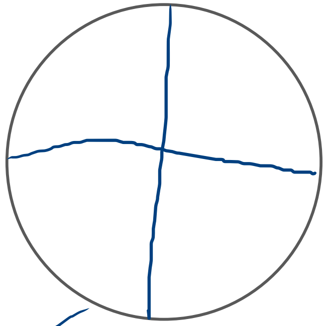
a)Given that the circumference of a circle is 2•π•r, show by the class method that the area of a circle is π•r². First color the top half of the perimeter of a circle a different color from the bottom half. Then divide the circle into 4 parts and rearrange the parts; then divide the circle into a billion parts and show the rearrangement. Labelling is everything in this demonstration!

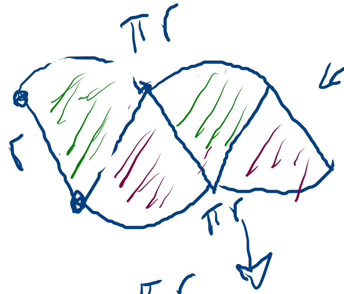
b) Find the formula for the area of a Rhombus in terms of the distance between the opposite verticies. Be sure to explain why your formula is valid and labelling is everything in this demostration!

Circle

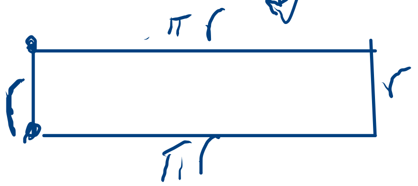
$C = 2\pi r$







but if we cut it up more, it becomes a rectangle



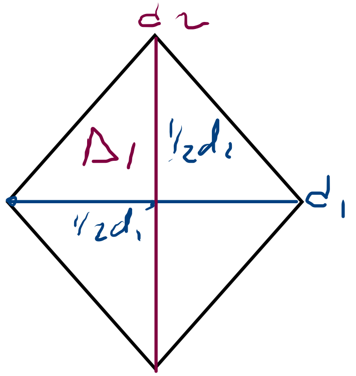
$= A = L \cdot W = \pi r \cdot r$

$A = \pi r^2$

Rhombus.

Area of Δ

$\frac{1}{2} b h$



$\text{Area of Rhombus} = 4\Delta_1$

$= 4 \cdot \frac{1}{2}\left(\frac{1}{2}d_1\right)\left(\frac{1}{2}d_2\right)$

$= 4 \cdot \frac{1}{8} d_1 d_2 = \frac{4}{8} d_1 d_2$

$\text{Area of Rhombus} = \frac{1}{2} d_1 d_2$