

Show all work.

- 1) (3 pts) Write the complex number  $-1 - \sqrt{3}i$  in polar form.

The length is

$$r = \sqrt{(-1)^2 + (-\sqrt{3})^2} = \sqrt{4} = 2.$$

The angle is

$$\theta = \tan^{-1}\left(\frac{-\sqrt{3}}{-1}\right) = \tan^{-1}(\sqrt{3}) = \frac{\pi}{3},$$

but there is a catch. This angle is in quadrant 1 and the original point is in quadrant 3. This is because the inverse trig functions are not one-to-one and have range restrictions. To get the correct angle, we need to add or subtract  $\pi$  from  $\frac{\pi}{3}$ ;

$$\theta = \frac{\pi}{3} + \pi = \frac{4\pi}{3},$$

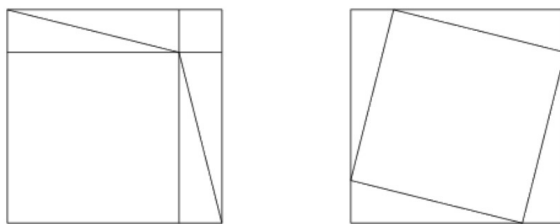
so

$$-1 - \sqrt{3}i = 2e^{\frac{4\pi i}{3}}.$$

Remember this problem because we will come back to it later.

- 2) (2 pts) Assume that the two figures below are scale drawings. What important theorem do the figures prove?

The pythagorean theorem. The 4 small triangles cover the same area of each image. This means that the sum of the areas of the 2 small interior squares in the first image equal the sum of the area of the interior square in the second image.



- 3) (3 pts) Suppose 1 inch of rain falls onto a 1 square mile area. How many gallons of water is this? First, compute the total area in square feet;

$$1 \text{ m}^2 = (5280)^2 \text{ ft}^2 = 27,878,400 \text{ ft}^2.$$

Divide this by 12 to get the total amount of cubic feet;

$$27,878,400 \text{ ft}^2 \cdot \frac{1}{12} \text{ ft} = 2,323,200 \text{ ft}^3$$

Multiply this by 7.48 for the conversion from cubic feet to gallons;

$$2,323,200 \text{ ft}^3 \cdot 7.48 \frac{\text{gal}}{\text{ft}^3} = 17,377,536 \text{ gal}.$$

- 4) (1 pt) The answers to the questions below are bad jokes.

- a)  $10^{12}$  bulls = 1 terabull
- b)  $10^{18}$  mples = 1 example
- c)  $10^{-18}$  boys = 1 attoboy

- d)  $10^6$  phones = 1 megaphone  
e)  $10^{-3}$  pedes = 1 millipede
- 5) (1 pts) The answers to the questions below are old-school memes from back when the word meme was known only by professional writers.
- a) What color is Patrick Tribett's face?  
Gold. Patrick has been arrested many times for huffing gold spray paint
- b) Where does Debra Jackson shop when she has to get all dressed up? Where does she shop when she doesn't have to get all dressed up? Try an image search for this one.  
Walmart when she has to get dressed up, Dollar Palace when she doesn't.
- c) What word would you use to describe Paula Bean (spelling counts)?  
Brillant.
- 6) (1 pt) When traveling at a subsonic speed during the last one hour of hypersleep, which vector of the Romulan Nebula will suffer the wrath of the impenetrable quickening? And, for extra points, how many wraths to the nearest molton? Be specific. This is a real question.  
The Backstreet Boys.