Math 213 Exam 3A Fall 2018

Name_____

1. a. Malikah measures Tamera's height with a non-standard unit of measurement, blocks from their building center. She finds that Tamera is 15 blocks tall. Another student uses pipe cleaners to measure Tamera's height. She notices that 2 pipe cleaners are the same length as 5 blocks. How many pipe cleaners long is Tamera? Show work so your thinking is clear.

15 blocks * (2 pipes/ 5 blocks) = 15*2/5 pipes = 6 pipes

b. Another student, Madison, joins in the measurement game. Madison gets upset with her peers and says that Tamera is only 13 blocks long when she measures her. Provide a possible explanation for the difference in Malikah and Madison's measurements. Include a drawing in your response.

2. Convert 125 square feet to square meters. Show all work. Use the fact 1 inch = 2.54 cm in your calculations.

125 sq ft = 125 (ft)^2 = 125 (12 in)^2 = 125* (12)^2 * in^2 = 18,000 in^2

18,000 (in)^2 = 18,000 (2.54 cm)^2 = 18,000 * (2.54)^2 * cm^2 = 116128.8 (cm)^2

116128.8 (cm)^2 = 116128.8 (1/100 m)^2 = 116128.8 (1/100)^2 m^2 = 11.61 m^2

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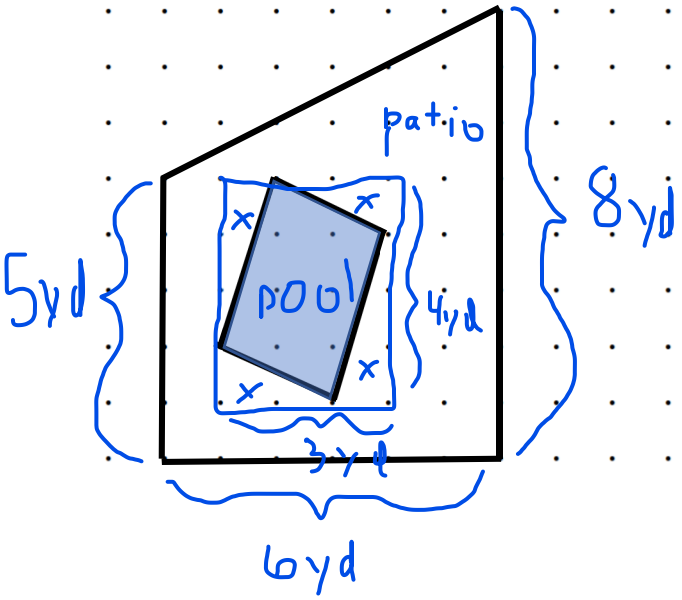
3. Below is the outline of Khalil's new yard. The scale is 1 square = 1 square yard.

(a) He is going to make the yard into a stone patio, with space for a pool (shaded portion). What is the area of the patio? Find the exact area using basic area concepts (# square units) and strategies such as subdivide or surround-and-subtract. Show all work. Annotate the diagram so your thinking process is clear.



Trapezoid area (Patio + Pool) = (a+b)/2 *h = (5 yd + 8 yd)/2 * 6 yd

= 13 yd * 3 yd

= 39 yd^2

Pool Area (use surround and subtract):

Area of rectangle surrounding pool - (4) extra triangles
= 3 yd * 4 yd - 1/2 (2 yd * 1 yd) - 1/2 (2 yd * 1 yd) - 1/2(1 yd * 3 yd) - 1/2 (1 yd * 3 yd)
= 12 yd^2 - 1 yd^2 - 1 yd^2 - 3/2 yd^2 - 3/2 yd^2

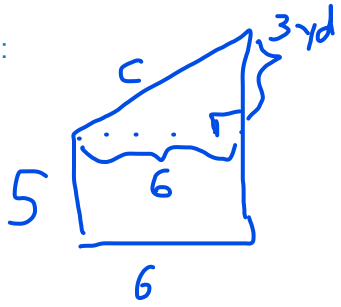
= 7 yd^2

Patio area = Trapezoid area - Pool area = 39 yd^2 - 7 yd^2

= 32 yd^2

(b) Khalil wants to build a fence around the outside of the patio. How many yards of fencing should he buy? Round your final answer to the nearest tenth.

Need to calculate perimeter, so we need the diagonal length c:



Use the Pythagorean Theorem for sides of a right triangle:

c^2 = 3^2 + 6^2
-> c^2 = 45
-> c= sqrt(45) ~ 6.7

Then:

P = 5 + 6 + 8 + c yds
= 5+6+8+6.7 yds

= 25.7 yds

4. A prism has an octagon base.

How many faces does it have? 8 + 2 =10

Look at triangular and rectangular prisms to find the pattern. (n+2 faces for a n-gon prism (n-gon = polygon with n sides))

How many edges does it have? 3*8 =24

Look at triangular and rectangular prisms to find the pattern. (3n edges for a n-gon prism (n-gon = polygon with n sides))

How many vertices does it have? 2*8 =16

Look at triangular and rectangular prisms to find the pattern. (2n vertices for a n-gon prism (n-gon = polygon with n sides))

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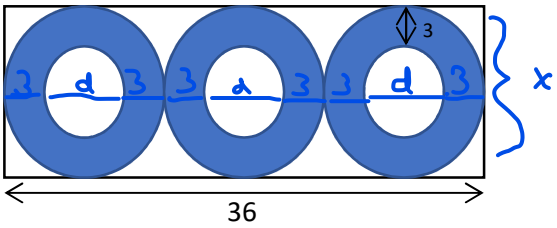
5. Grandma Bess is making a quilt for her grandchild with the pattern shown below (dimensions are in inches). The shaded portions are identical circles with the centers cut out.



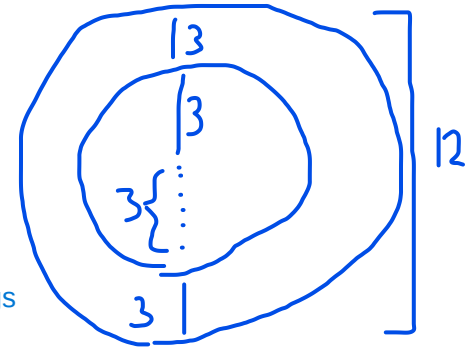
Grandma Bess plans to repeat the pattern so that it is 72 inches by 72 inches.

a. How many square inches of the finished, entire, quilt will be made from the **shaded** fabric? Show work. Round your final answer to the nearest whole number.

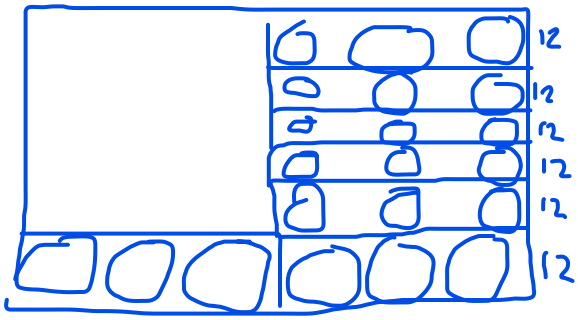
We need the height of the pattern. Let d be the diameter of the inner circles. Then 36 = 3d + 6*3, so 18= 3d --> d= 6 in.

Thus the inner circles have radius r = 6 in / 2 = 3 in.

Therefore, the height of Grandma Bess' pattern is 12 in. →



Then, in the (square) 72 in x 72 in quilt, we can fit 2 patterns side by side, with 6 up and down since 12 in * 6 = 72 in:



In total, we will have 6*6 = 36 rings on the quilt.

Once we calculate the area of one ring, we just multiply by 36 to get the total shaded area.

Area of 1 ring: $\pi 6^2 - \pi 3^2 = 27\pi$ (in^2)

Multiply by 36: $36 \cdot 27 \cdot \pi =$ ~ 3054 in^2

b. The shaded fabric costs $5.20 per square **yard**. What will the shaded fabric cost Grandma Bess to make the quilt? (Just use your calculation from part b. Do not include extra fabric for margins or waste.) Round your final answer to two decimal places.

We convert units to calculate the area of the quilt in square yards:

3054 in^2 = 3054 (1/12 ft)^2 = 3054 (1/12)^2 ft^2 = 21.2 ft^2

21.2 ft^2 = 21.2 (1/3 yd)^2 = 2.36 yd^2

Now we multiply this area by ($5.20)/ (1 yd^2) to find the total cost:

2.36 ~~yd^2~~ * ($5.20)/ (1 ~~yd^2~~) = $12.27

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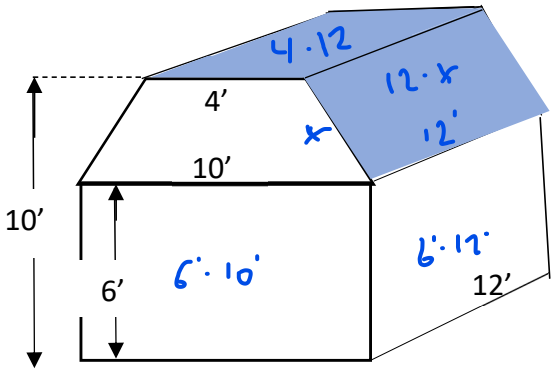
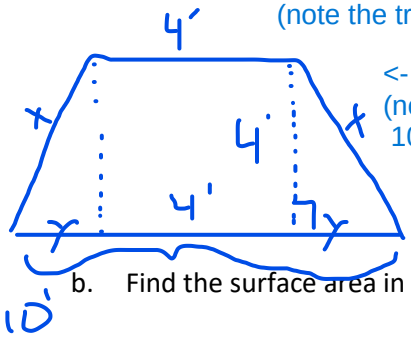
6. Consider the shed pictured at right. The top is a trapezoidal prism (the trapezoid is isosceles), and the main part of the structure is a rectangular prism. The horizontal and slanted portions of the trapezoidal prism will be covered with shingles; all of the vertical surfaces will be covered with aluminum siding.



a. Find the surface area in square feet that will be covered with shingles. Show all work.

1. We need the (pythagorean) dimension of the sides of the roof, hence the length of the trapezoid slants:



(note the trapezoid has height 4'):

<- 2. Dissect the trapezoid as in the picture:
(note x^2 = 4^2 + y^2 with Pythagoras) then, finding y,
10' = 4' + 2y ---> y= 3'

3. Then x^2 = 4^2 + 3^2 = 25 by the Pythagorean Theorem
-> x= 5'

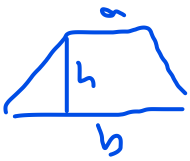
4. The top of the prism area: 4' * 12' = 48 sq ft

5. One of the sides: 12' * 5' = 60 sq ft

6. In total: 48 sq ft + 2*60 sq ft =168 sq ft.

b. Find the surface area in square feet that will be covered with aluminum siding. Show all work.

The two trapezoidal faces of the prism each have area (a+b)/2 *h = (4'+10')/2 * 4' = 28 sq ft



Now we calculate the vertical rectangular prism faces:
(there's two in front and two on the sides)

$2(6' \cdot 10' + 6' \cdot 12') =$ 264 sq ft

c. Find the volume of the shed in cubic feet. Show all work.

We find the vol of the trapezoidal prism + vol of the rectangular prism:

Trapezoidal prism:

(Area of trapezoid)* 12'

= 28 (ft)^2 (found above) * 12 ft

= 336 ft^3

Rectangular prism:
l*w*h= 12' *10' * 6' = 720 ft^3

In total: 336 + 720 ft^3

= 1056 ft^3

d. Convert the volume of the shed to cubic yards. Show work. Round to two decimal places if necessary.

1 ft^3 = (1 ft)^3 = (1/3 yd)^3 = 1/27 yd^3

Thus, divide 1056 ft^3 by 27 to get cubic yard units:

1056 ft^3 = 1056 (1/27) yd^3 = 39.11 yd^3

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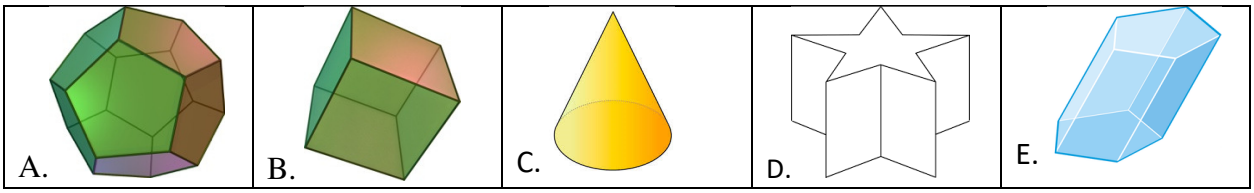
7. Consider the shapes below:



a. Which of the shapes above are polyhedra?

A, B, D, E

b. Which of the shapes above are prisms?

B, D, E

c. Which of the shapes above are Platonic solids?

A, B

d. Which of the shapes above are convex?

All of them

Please copy and sign: I pledge on my honor that I have not given or received any unauthorized assistance on this exam. [signed]