CP Key

NCM3 Unit D: Modeling with Geometry Review Name: Key # D12

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Part One: Equations of a Circle

1. I can find the center and radius of a circle given its equation. D1

$(x-h)^2+(y-k)^2=r^2$

a. $(x+2)^2+(y-3)^2=25$

(-2, 3) $r=5$

b. $(x-1)^2+y^2=40$

(1, 0) $r=\sqrt{40}$

2. I can write an equation for a circle given key characteristics. D3-D4

a. Center: (-2, 5); Radius: 7

$(x-h)^2+(y-k)^2=r^2$

$(x--2)^2+(y-5)^2=7^2$

$(x+2)^2+(y-5)^2=49$

b. Center: (7, 0); Circumference: 24π

$(x-h)^2+(y-k)^2=r^2$ $C=2\pi r$

$(x-7)^2+(y-0)^2=12^2$ $\frac{24\pi}{2\pi}=\frac{2\pi r}{2\pi}$

$(x-7)^2+y^2=144$ $12=r$

c. Center: (-2,7); Point on Circle: (6,-5)

$r=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$r=\sqrt{(6--2)^2+(-5-7)^2}$

$r=\sqrt{8^2+(-12)^2}$

$r=\sqrt{64+144}$

$r=\sqrt{208}$

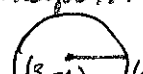
$(x-h)^2+(y-k)^2=r^2$

$(x--2)^2+(y-7)^2=(\sqrt{208})^2$

$(x+2)^2+(y-7)^2=208$

d. Ends of a diameter: (2, -2) and (4,-6)

Center is midpoint $\left(\frac{2+4}{2}, \frac{-2+-6}{2}\right)$



$\left(\frac{6}{2}, \frac{-8}{2}\right)$ $(3,-4)$

radius

$r=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$r=\sqrt{(4-3)^2+(-6+4)^2}$

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

$r=\sqrt{1+4}=\sqrt{5}$

$(x-h)^2+(y-k)^2=r^2$

$(x-3)^2+(y--4)^2=(\sqrt{5})^2$

$(x-3)^2+(y+4)^2=5$

3. I can complete the square to write an equation for a circle in standard form and use it to find its center and radius. D2-D3

a. $y^2+x^2=-12x+2y+27$

$+12x-2y \quad +12x \quad -2y$

$y^2+x^2+12x-2y=27$

$(x^2+12x+\underline{36})+(y^2-2y+\underline{1})=27+\underline{36}+\underline{1}$

$\frac{12}{2}=6 \quad 6^2=36 \quad \frac{-2}{2}=-1 \quad (-1)^2=1$

$(x+6)^2+(y-1)^2=64$

Center (-6, 1) $r=8$

b. $14x+6y+22=-x^2-y^2$

$+x^2+y^2 \quad -22 \quad +x^2+y^2 \quad -22$

$x^2+y^2+14x+6y=22$

$(x^2+14x+\underline{49})+(y^2+6y+\underline{9})=22+\underline{49}+\underline{9}$

$\frac{14}{2}=7 \quad 7^2=49 \quad \frac{6}{2}=3 \quad 3^2=9$

$(x+7)^2+(y+3)^2=36$

Center (-7, -3) $r=6$

c. ~~$5x^2+5y^2-30x+55y+16.25=0$~~

$\frac{5}{5} \quad \frac{5}{5} \quad \frac{5}{5} \quad \frac{5}{5} \quad \frac{5}{5} \quad \frac{5}{5}$

$x^2+y^2-6x+11y+3.25=0$

$-3.25 \quad -3.25$

$(x^2-6x+\underline{9})+(y^2+11y+\underline{30.25})=-3.25+\underline{9}+\underline{30.25}$

$\frac{-6}{2}=(-3) \quad (-3)^2=9 \quad \frac{11}{2}=5.5 \quad (5.5)^2=30.25$

$(x-3)^2+(y+5.5)^2=36$

Center (3, -5.5) $r=6$

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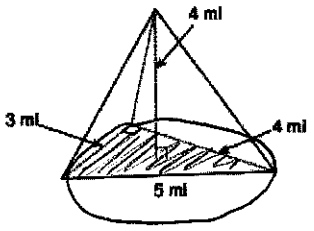
Part Two: Three Dimensional Solids

4. I can use multiple volume formulas together to find the volume of composite shapes. D5-D7

a. Find the volume of the pyramid to the right. Show your work.



V = Area of Base · height

$V = \frac{1}{3}\left(\frac{1}{2} b \cdot h \cdot l\right)$

$V = \frac{1}{3}\left(\frac{1}{2}(3)(4)(4)\right) = \frac{1}{3}(24)$

$V = 8 \text{ mi}^3$

b. Suppose a cone was constructed around the pyramid in such a way that the base of the pyramid was inscribed in the base of the cone and the cone had a height of 4.5 mi. Find the volume of the cone. Show your work.

The hypotenuse of the triangle is the diameter of the circle

So $r = 2.5$ mi.

V = Area of Base · height

$V = \frac{1}{3}\pi r^2 \cdot h$

$V = \frac{1}{3}\pi (2.5)^2 (4.5)$

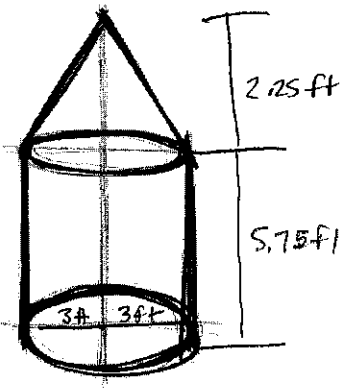
$V = \frac{1}{3} 28.125\pi \text{ mi}^3$

$V \approx 29.45 \text{ mi}^3$

c. Ms. Pace had a special dog house built for her dog, Franklin. Find the volume (living area) of this house if the diameter of the base is 6 feet and the total height is 8 feet. The distance from the floor to the lowest part of the roof is 5.75 feet.

$r = 3$ ft

$8 - 5.75 = 2.25$



Vol Cone + Vol Cylinder

$V = \frac{1}{3}\pi r^2 h + \pi r^2 h$

$V = \frac{1}{3}\pi (3)^2 (2.25) + \pi (3)^2 (5.75)$

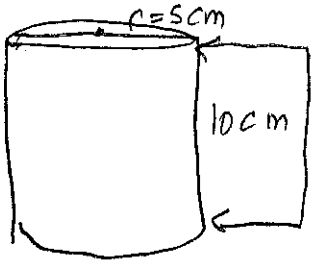
$V = 6.75\pi + 51.75\pi$

$V = 58.5\pi \text{ ft}^3$

$V = \approx 183.78 \text{ ft}^3$

5. I can compare volumes of the same shape with different dimensions to determine which dimension has a greater effect. D6

A cylinder has a diameter of 10 cm and a height of 10 cm. Which would have a greater effect on the volume, doubling the diameter or doubling the height? Explain your reasoning.



Doubling the diameter because the radius is squared in the volume formula

Original volume: $\pi r^2 h$ $\pi (5)^2 (10) = 250\pi \text{ cm}^3$

Double Radius: $\pi (10)^2 (10) = 1000\pi \text{ cm}^3$

Double Height: $\pi (5)^2 (20) = 500\pi \text{ cm}^3$

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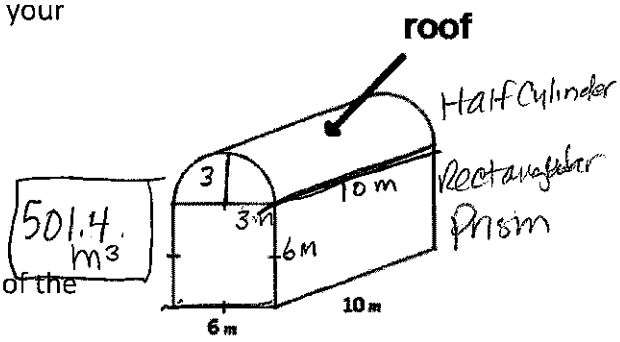
6. I can use volume and surface area to solve contextual problems. D8

a. Find the total volume of the storage barn on the right. Round your answer to the nearest tenth. Show your work.



$V = \frac{1}{2}$ Cylinder + Rectangular Prism

$V = \frac{\pi r^2 h}{2} + l \cdot w \cdot h$

$V = \frac{\pi(3)^2(10)}{2} + (6)(6)(10) = 45\pi + 360 \approx$ 501.4 m^3

b. Suppose the owner wanted to paint the roof red and the rest of the building black. Find the cost of the minimimum amount of paint needed to put two coats on the roof and a single coat of paint on the building. One gallon of exterior paint covers about 30 square meters. Each gallon cost $16.03 with taxes included. Show your work.

(Hint: Surface Area of a Cylinder = $2\pi rh + 2\pi r^2$)

2 coats of Red on Roof

2 coats would be like painting 1 Cylinder since this is a half cylinder

$2\pi rh + 2\pi r^2$

$2\pi(3)(10) + 2\pi(3)^2$

$60\pi + 18\pi$

78π

$\approx 245.04\ m^2$

$\div 30\ m = 8.16$ | 9 gallons of red

1 Coat of black on building

2 long sides + 2 short sides

$2(6 \times 10) + 2(6 \times 6)$

$120m^2 + 72m^2$

$192m^2$

$192 \div 30 = 6.4$

7 gallons of black

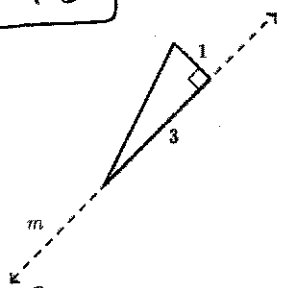
9 + 7 = 16 gallons total

$\times \$16.03$

$256.48

7. I can find 3D solids from rotating 2D figures. ~~D9~~ D10

a. What 3D object is formed by rotating this triangle around line m? Describe any known characteristics of the 3D shape.



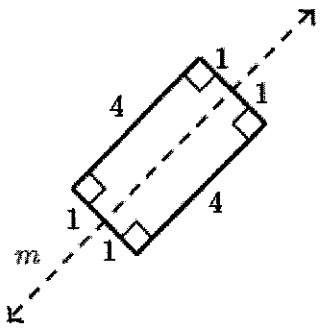
A cone is formed

The radius is 1

The height is 3

Volume $= \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(1)^2(3) = \pi$ units^3

b. What 3D object is formed by rotating this rectangle around line m? Describe any known characteristics of the 3D shape.



A cylinder is formed.

The radius is 1

The height is 4.

Volume $= \pi r^2 h = \pi(1)^2(4) = 4\pi$ units^3

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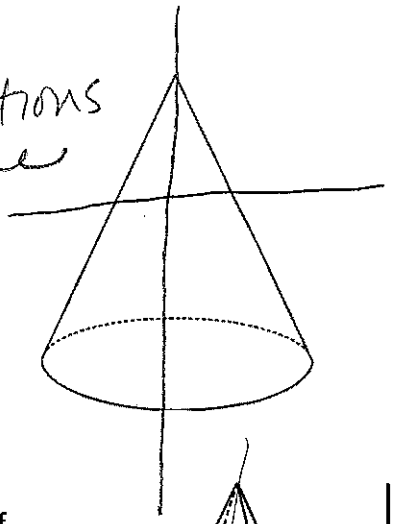
8. I can determine cross sections of 3D solids. D11

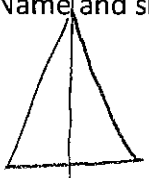
a. What 2D figure can we create by taking a horizontal cross-section of a cone? Name and sketch.

A circle 

Horizontal cross sections ALWAYS match the base

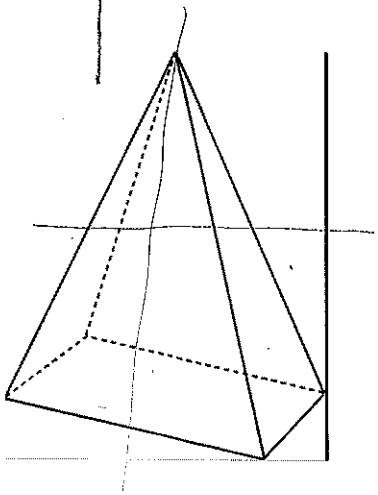


b. What 2D figure can we create by taking a vertical cross-section through the apex of a cone? Name and sketch.

A triangle 

c. What 2D figure can we create by taking a horizontal cross-section of this rectangular pyramid? Name and sketch.

A rectangle 



d. What 2D figure can we create by taking a vertical cross-section of this rectangular pyramid? Name and sketch.

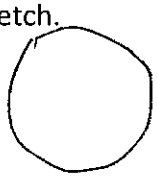
Through apex: A triangle 

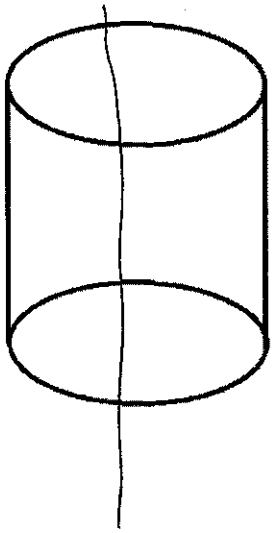
Through side:  A trapezoid

e. What is the greatest possible number of edges of a cross section created from a rectangular pyramid?

5 edges because there are 5 faces. The cross section cannot have more edges than the solid has faces.

f. What 2D figure can we create by taking a horizontal cross-section of a cylinder? Name and sketch.

A circle 



g. What 2D figure can we create by taking a vertical cross-section of a cylinder? Name and sketch.

A rectangle