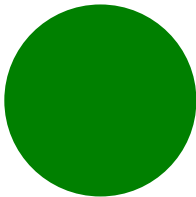


## Crop Circles – Teacher’s Reference Sheet

### Notes:

- The Crop Circle activity is meant to be completed in conjunction with Google Earth and so no student worksheet was made. Have your students write their work and answers on another sheet of paper as you want it to appear.
- Stress the importance of including units with answers. Metric and customary measuring units are used in different problems. Some answers are areas, some circumferences, and some are dollar amounts.
- Review the steps for measuring with Google Earth’s ruler tool, especially with changing the units of measure. The number icon for each placemark is the approximate location of the circles’ centers. I found that most of the shapes I used were rarely completely circular.
- Cover how you want students to deal with the value of pi; that is, if you want students to use the pi key on their calculators, 3.14, or state the answers in terms of pi.
- Finally, allow a margin of acceptable values for each answer. Answers may vary somewhat from student to student, depending on how the ruler tool was used and how they dealt with pi in their work.

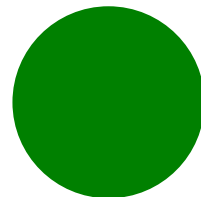
1. This farm in southwestern Colorado uses central pivot irrigation to water its crops. With this system, a line of sprinklers is suspended by a series of pipes, trusses, and wheel towers and rotated around the field. The center point is where the water is pumped into from a well or other source. Find the area of this field in square miles. Consider the number icon as the center of the circle. Be sure to set the ruler tool to the correct units. ( $r=0.25$  mi)



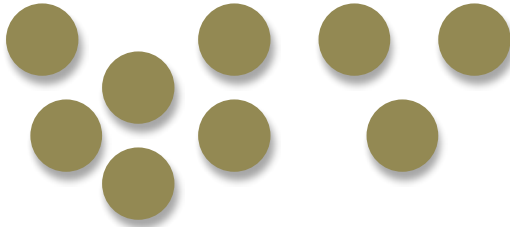
$$A = \pi r^2$$
$$A = \pi(0.25)^2$$
$$A \approx 0.2 \text{ mi}^2$$

2. The outer wheels of a central pivot irrigation system travel the greatest distance. If this unit in Australia makes 3 complete rotations in one day, how many kilometers did its outer wheels travel?  
( $r=0.34$  km)

$$C = 2\pi r$$
$$C = 2\pi (0.34)$$
$$C \approx 2 \text{ km}$$



3. Saudi Arabia uses fossil water from beneath the desert to irrigate alfalfa crops. Pumping water here is like drilling in an oil field; once the aquifer in this location is empty of water, there is no more. Find the total area that needs to be irrigated in square kilometers, assuming all nine circles are equal in size. ( $r = 0.36 \text{ km}$ )



$$A = \pi r^2$$

$$A = \pi(0.36)^2$$

$$A = 0.41 \text{ km}^2$$

$$9A \approx 3.7 \text{ km}^2$$

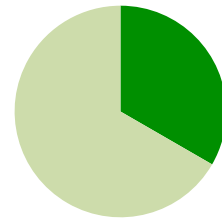
4. Farmer Walton is trying out a hybrid potato in  $1/3$  of his field. How much land does this crop cover in square miles? ( $r=0.25\text{mi}$ )

$$A = \pi r^2$$

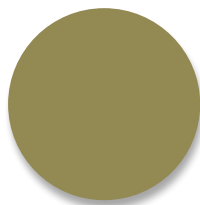
$$A = \pi(0.25)^2$$

$$A = 0.2 \text{ km}^2$$

$$1/3A \approx 0.07 \text{ mi}^2$$



5. A mountain climber has plans to climb Mount Dama Ali in Ethiopia. Once he's reached the summit of this extinct volcano, he plans on circling the rim. Approximately how many miles would this be? ( $r = 0.6 \text{ mi.}$ )

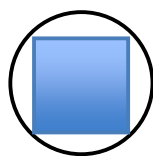


$$C = 2\pi r$$

$$C = 2\pi (0.6)$$

$$C \approx 3.8 \text{ mi}$$

6. A skyscraper in Tokyo has a helicopter pad on its roof. If anyone on the roof has to step off the blue helo pad whenever a helicopter takes off or lands, how much space do they have to stand in square feet? ( $r = 59 \text{ ft}$  ;square  $s = 76 \text{ ft.}$ )



$$A_1 = \pi r^2$$

$$A_1 = \pi(59)^2$$

$$A_1 = 10,930 \text{ ft}^2$$

$$A_2 = s^2$$

$$A_2 = 76^2$$

$$A_2 = 5776 \text{ ft}^2$$

$$A_1 - A_2 \approx 5,154 \text{ ft}^2$$

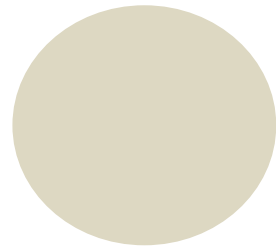
7. The Louisiana Superdome is the largest dome in the world and has hosted the Super Bowl, concerts, conventions, and the Pope. Find the circumference of the dome in feet.

$(r = 370 \text{ ft})$

$$C = 2\pi r$$

$$C = 2\pi (370)$$

$$C \approx 2,324 \text{ ft}$$



8. West of Naples, Italy lays this field of extinct volcanoes. Compare the area in square miles of the smaller Monte Nuovo crater with the large Astroni crater.

$(r_1 = 0.12 \text{ mi}, r_2 = 0.5 \text{ mi})$

$$A_1 = \pi r^2$$

$$A_1 = \pi(0.12)^2$$

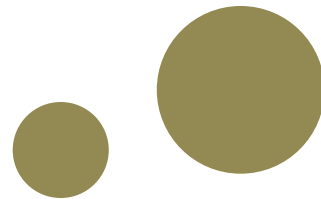
$$A_1 = 0.05 \text{ mi}^2$$

$$A_2 = \pi r^2$$

$$A_2 = \pi(0.5)^2$$

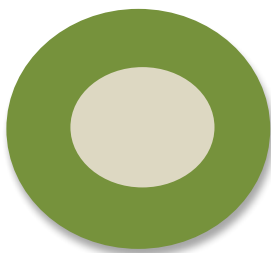
$$A_2 = 0.79 \text{ mi}^2$$

$$A_2 - A_1 \approx 0.74 \text{ mi}^2$$



9. Only the outer band of this field in Saudi Arabia has been planted for seed corn. What is the area of the outer band in square kilometers?

$(r = 0.39 \text{ km})$



$$A_1 = \pi r^2$$

$$A_1 = \pi(0.19)^2$$

$$A_1 = 0.11 \text{ km}^2$$

$$A_2 = \pi r^2$$

$$A_2 = \pi(0.39)^2$$

$$A_2 = 0.48 \text{ km}^2$$

$$A_2 - A_1 \approx 0.37 \text{ km}^2$$

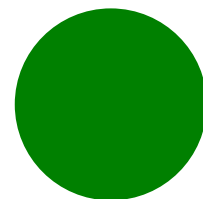
10. A jogger runs 3 miles around the Lincoln Memorial every morning. If she stays on the sidewalk about how many times would she circle the memorial?  $(r = 0.06 \text{ mi})$

$$C = 2\pi r$$

$$C = 2\pi (0.06)$$

$$C = 0.38 \text{ mi}$$

$$\approx 8 \text{ times}$$



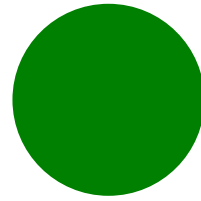
11. Carlos's job is to mow the grass at this park in Sao Paulo, Brazil. If he gets paid 40 pesos for every 100 square meters he mows, how much would he get paid for this circular field? ( $r=87\text{m}$ )

$$A = \pi r^2$$

$$A = \pi(87)^2$$

$$A = 23,767 \text{ m}^2$$

$$(23,767/100) \times 40 \approx \mathbf{9,507 \text{ pesos}}$$



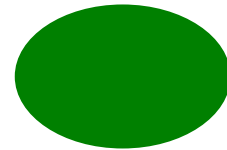
12. The Brisbane Cricket Grounds, or The Gabba, uses Legend turf grass on its playing field. Australian Rules Football, Cricket, and Rugby are played here, so they need a resilient grass. If this field is oval ( $\pi ab$ ), how much is the grass worth if the cost is AUD \$10 per square meter? ( $A=\pi ab$ ;  $a=85\text{m}$ ,  $b=70\text{m}$ )

$$A = \pi ab$$

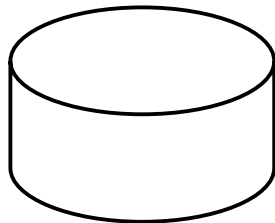
$$A = \pi(85)(70)$$

$$A = 18,683 \text{ m}^2$$

$$18,683 \times \text{AUD}\$10 \approx \mathbf{\text{AUD}\$ 186,830}$$



13. A tank near Boston holds crude oil worth \$21 per cubic foot. If the tank is 60 ft. tall and full, what is the value of the oil inside? ( $r=80 \text{ ft}$ )



$$V = Bh$$

$$V = (\pi r^2)h$$

$$V = \pi(80)^2 \times 60$$

$$V = 1,205,760 \text{ ft}^3$$

$$1,205,760 \times 21 \approx \mathbf{\$25,320,960}$$

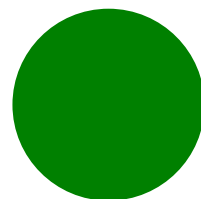
14. The city of St. Paul installed astro turf on a softball field at one of their parks. If the cost of astro turf is \$15 per square yard how much would it cost to cover this field? ( $r=60 \text{ yds}$ )

$$A = \pi r^2$$

$$A = \pi(60)^2$$

$$A = 11,304 \text{ yd}^2$$

$$11,304 \times \$15 \approx \mathbf{\$169,560}$$

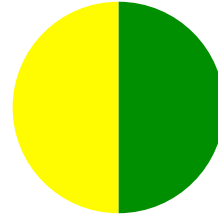


15. A Colorado farmer has divided his field into two crops: corn and wheat. If the price of corn seed is \$48,640 per square mile and the price of wheat seed is \$17,280 per square mile, what was his total cost for seed? ( $r = 0.25$  mi)

$$A = \pi r^2$$

$$A = \pi(0.25)^2$$

$$A = 0.2/2 \approx 0.1 \text{ mi}^2$$



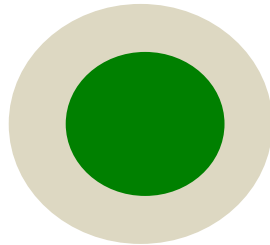
$$(0.1)(\$48,640)$$

**Corn  $\approx$  \$4,864**

$$(0.1)(\$17,280)$$

**Wheat  $\approx$  \$1,728**

16. The city of Washington D.C. is planning on paving an additional layer of asphalt to Dupont Circle. Find the area of the roadway and the cost if asphalt is priced at \$1.80 per square foot. - ( $r_1 = 237$  ft,  $r_2 = 180$  ft)



$$A_1 = \pi r^2$$

$$A_1 = \pi(237)^2$$

$$A_1 = 176,371 \text{ ft}^2$$

$$A_2 = \pi r^2$$

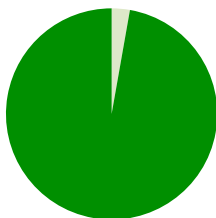
$$A_2 = \pi(180)^2$$

$$A_2 = 101,736 \text{ ft}^2$$

$$A_1 - A_2 \approx 74,635 \text{ ft}^2$$

$$74,635 \times \$1.80 \approx \mathbf{\$134,343}$$

17. The location of Farmer John's house keeps his irrigation system from making a full rotation. If the measure of the central angle is 10 degrees, how much of the land is not planted in square feet? ( $r = 1,348$  ft)



$$A = \pi r^2$$

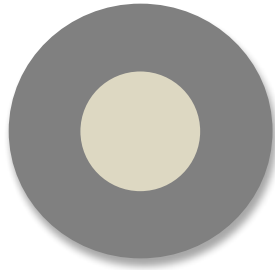
$$A = \pi(1,348)^2$$

$$A = 5,705,707 \text{ ft}^2$$

$$A = 10/360 \times 5,705,707$$

$$A \approx \mathbf{158,492 \text{ ft}^2}$$

18. Driving around the Arc de Triomphe in Paris can be hectic because there are no marked lanes. Drivers need to negotiate their entrance and exits as needed. How much further would you drive in meters if you made a complete circle on the outside of the traffic circle compared to the inside? ( $r_1 = 45\text{m}$ ,  $r_2 = 80\text{m}$ )



$$C_1 = 2\pi r$$

$$C_1 = 2\pi(45)$$

$$C_1 = 283 \text{ m}$$

$$C_2 = 2\pi r$$

$$C_2 = 2\pi(80)$$

$$C_2 = 502 \text{ m}$$

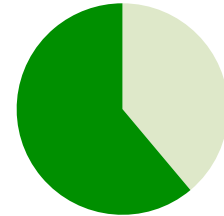
$$C_2 - C_1 \approx 219 \text{ m}$$

19. Farmer Dell in Kansas could not afford to plant his entire field this year. The yearly cost of fuel for his farm machinery has risen from \$5,408 to \$7072 for each square mile. If Farmer Walton only planted  $5/8$  of his field this year, how much did it cost him for the fuel? How much did the fuel cost for the entire field at last year's price? ( $r = 0.49 \text{ mi}$ )

$$A = \pi r^2$$

$$A = \pi(0.49)^2$$

$$A = 0.75 \text{ mi}^2$$



$$\text{This year: } [5/8(0.75)](\$7,072) \approx \$3,135$$

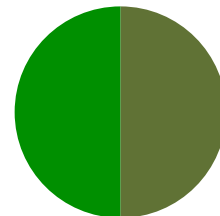
$$\text{Last year: } (0.75)(\$5,408) \approx \$4,056$$

20. A North Texas farmer has planted two crops. The cost of fertilizer for one crop is \$28,160/sq. mile and the other is \$35,840/sq. mile. How much will he spend to fertilize this field? ( $r = 0.39 \text{ mi}$ )

$$A = \pi r^2$$

$$A = \pi(0.39)^2$$

$$A = 0.48 \text{ mi}^2$$



$$A_1: [(0.48/2)](\$28,160) \approx \$6,758.40$$

$$A_2: [(0.48/2)](\$35,840) \approx \$8,601.60$$