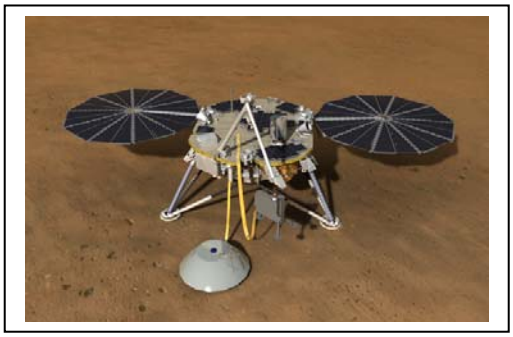

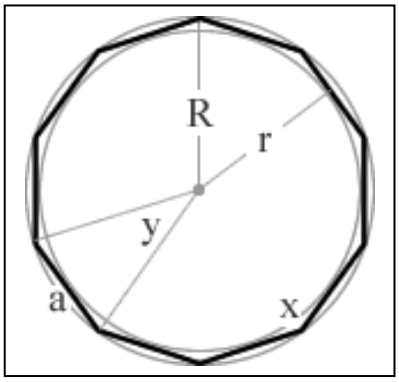

NASA's new mission to Mars called InSight will be launched in March, 2016. It will land on September 20, 2016 in a region of Mars located near the equator and deploy a seismographic station to study the interior of Mars.

To provide the electricity it needs, the lander will deploy two solar panels, each shaped like a regular, 10-sided polygon called a decagon.

In a regular decagon, the lengths of each of the 10 sides, a, are equal. For the two InSight lander solar panels:

a = 0.62 meters,
r = 0.95 meters,
R = 1.0 meters.

Problem 1 – What is the measure of the interior angle, y for a regular decagon?

Problem 2 – An isosceles triangle is formed by the base a and side length R. What is the length, r, in terms of a and R?

Problem 3 – What is the area of the isosceles triangle in Problem 2?

Problem 4 – What is the area of the regular decagon in terms of a and r?

Problem 5 - Calculate the area of one InSight solar panel in meter^2.

Problem 6 - What is the estimated area of one solar panel by using the inscribed circle with a radius of r and the circumscribed circle with a radius R?

Problem 7 – To two significant figures, if the solar panels produce 75 watts/m^2 of electricity at the distance of Mars from the sun, what is the total power produced by the two solar panels using either area method?

Problem 1 – What is the measure of the interior angle, y for a regular decagon?

Answer: y = 360/10 = **36^{o}**.

Problem 2 – An isosceles triangle is formed by the base a and side length R. What is the length, r, in terms of a and R?

Answer: The segment with the length, r, is called the apothem and is the perpendicular bisector of the side with the length a, so from the Pythagorean Theorem we get **$r = (R^2 - (a/2)^2)^{1/2}$**.

Note for the InSight dimensions: $0.95 = (1 - 0.096)^{1/2}$

Problem 3 – What is the area of the isosceles triangle in Problem 2?

Answer: A = 2 x ½ (a/2) x r so **A = ar/2**

For the InSight solar panel: A = 0.62 x 0.95/2 = 0.29 m^2.

Problem 4 – What is the area of the regular decagon in terms of a and r?

Answer: A = 10 x (ar/2) so **A = 5ar**.

Problem 5 - Calculate the area of one InSight solar panel in $meter^2$.

Answer: For the Insight solar panel, A = 5 (0.62)(0.95) = **2.95 m^2**.

Problem 6 - What is the estimated area of one solar panel by using the inscribed circle with a radius of r and the circumscribed circle with a radius R?

Answer: Take the average areas of the inscribed and circumscribed circles to get $A = 0.5 \pi (R^2 + r^2)$. For Insight, A = 0.5 x 3.141 x (1 + 0.90) = **2.98 m^2**.

Problem 7 – To two significant figures, if the solar panels produce 75 watts/m^2 of electricity at Mars, what is the total power produced by the two solar panels using either area method?

Answer: To 2 SF, the areas are both 3.0 m^2, so P = 2 panels x 75 w/m^2 x 3.0 m^2 = **450 watts**.