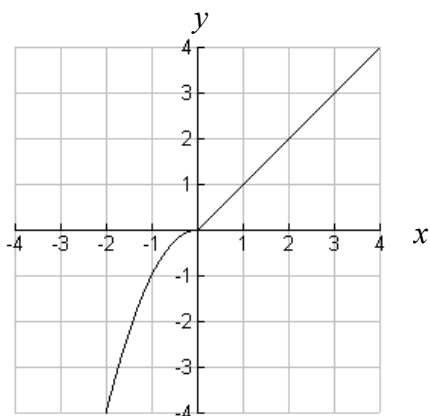


Part 1 NO CALCULATOR SECTION

1. Sketch the graph of the piece-wise function $f(x) = \begin{cases} x^2, & \text{if } x < 0 \\ \sqrt{x}, & \text{if } x \geq 0 \end{cases}$.

2. Look at the graph of the piecewise function below.



Which of the following functions is represented by the graph?

A $f(x) = \begin{cases} x^2, & \text{if } x \leq 0 \\ x, & \text{if } x > 0 \end{cases}$

B $f(x) = \begin{cases} -x^2, & \text{if } x \leq 0 \\ x, & \text{if } x > 0 \end{cases}$

C $f(x) = \begin{cases} x, & \text{if } x \leq 0 \\ -x^2, & \text{if } x > 0 \end{cases}$

D $f(x) = \begin{cases} -x, & \text{if } x \leq 0 \\ x^2, & \text{if } x > 0 \end{cases}$

3. Which of the following is true about the function $f(x) = \frac{x^2 - 9}{x - 3}$?

- A The function is continuous for all real numbers.
- B The function is discontinuous at $x = -3$ only.
- C The function is discontinuous at $x = 3$ only.
- D The function is discontinuous at both $x = 3$ and $x = -3$.

4. Determine whether each function below is even, odd, or neither even nor odd. Justify your answers algebraically.

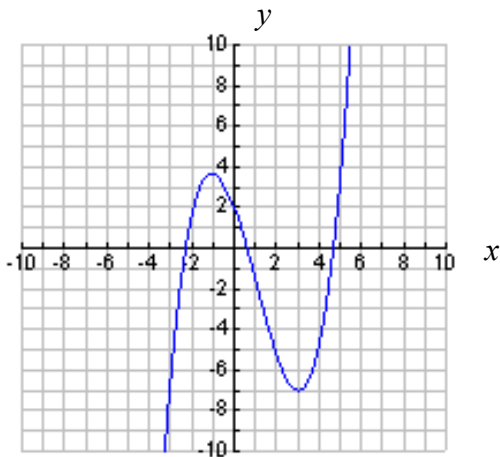
a. $g(x) = \sin x + x^3$

b. $h(x) = x^2 - 4$

c. $p(x) = x^3 - x + 7$

d. $r(x) = \cos x + x^2$

5. Look at the graph of the function below.



- a. What is the domain of this function? _____
- b. What is the range of this function? _____
- c. On what interval of x -values is the function increasing? _____
- d. For what value of x does the function have a local minimum? _____

6. For each function below, find a formula for $f^{-1}(x)$ and state any restrictions on the domain.

a. $f(x) = \sqrt{x+2}$

b. $f(x) = x^3 + 4$

7. If $f(x) = x^{\frac{2}{3}}$, Which of the following statements is NOT true?

- A** The graph of $f(x)$ is symmetric with respect to the y -axis.
B $f(x)$ is an even function.
C The range of $f(x)$ is all real numbers.
D If x approaches infinity, then $f(x)$ approaches infinity.

8. Suppose that y varies inversely as the cube root of x . Which of the following describes the function $y = f(x)$?

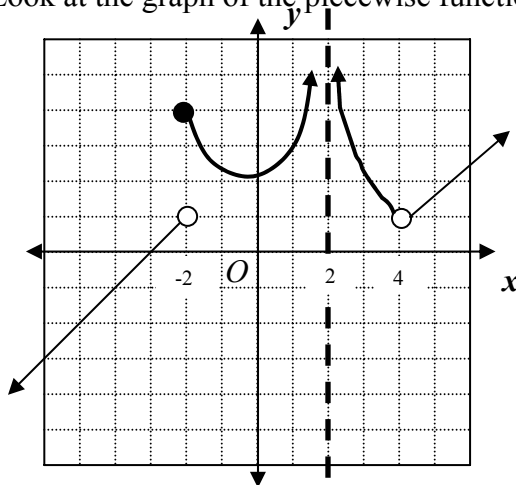
A $f(x) = kx^{-3}$

B $f(x) = kx^{-\frac{1}{3}}$

C $f(x) = kx^{\frac{1}{3}}$

D $f(x) = kx^3$

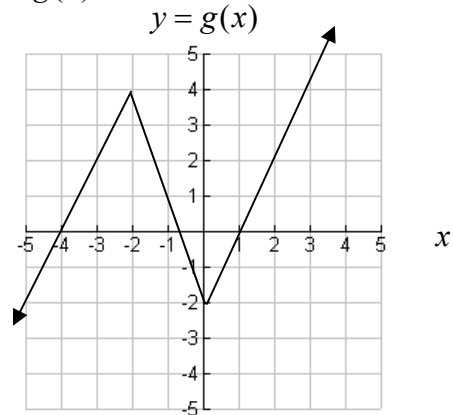
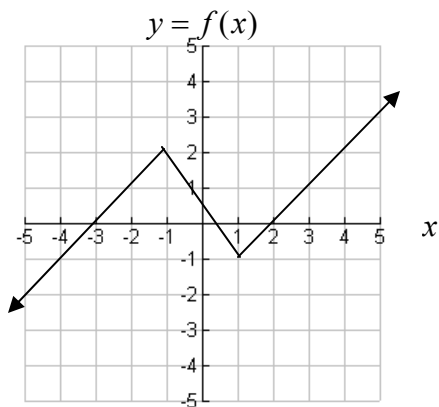
9. Look at the graph of the piecewise function below.



What type of discontinuity does the graph have at the following x values?

- a. $x = -2$
 b. $x = 2$
 c. $x = 4$

Problems 10 and 11 use the graphs of $f(x)$ and $g(x)$ below



10. Which of the following represents the relationship between $f(x)$ and $g(x)$?

- A $g(x) = 2f(x+1)$
- B $g(x) = \frac{1}{2}f(x-1)$
- C $g(x) = f(2x) - 1$
- D $g(x) = f\left(\frac{1}{2}x\right) + 1$

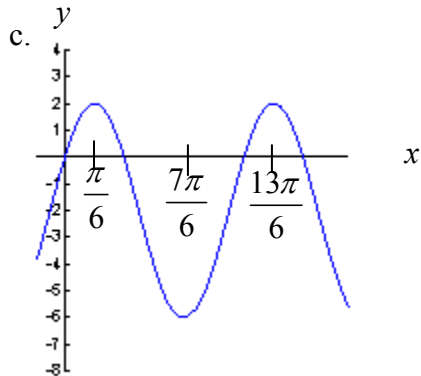
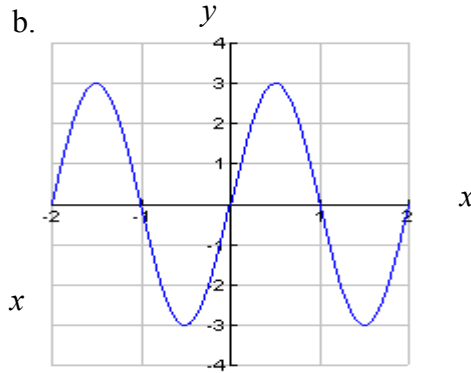
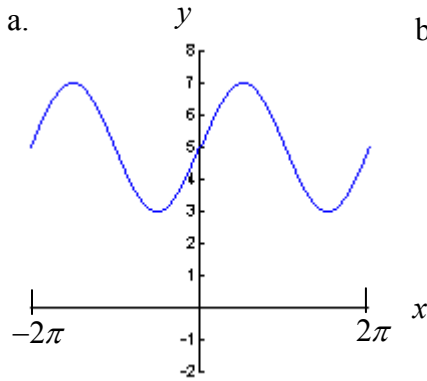
11. Sketch the graph of $y = |f(x)|$

12. True or false.

- a. The function $y = 5f(x) - 2$ represents a vertical stretch of the graph of $f(x)$ by a factor of 5, followed by a vertical translation down of 2 units.
- b. The function $y = f(4x)$ represents a horizontal shrinking of the graph of $f(x)$ by a factor of 4.

13. The power function $s(d) = 4\sqrt{d}$ models the speed of an object (in meters per second) as a function of the distance (in meters) that the object has fallen.
- Write a sentence that describes this model as a variation.
 - When the object hits the ground, it has traveled 64 meters. What speed is the object traveling at the moment the object hits the ground?
14. State the amplitude, period, the phase shift and vertical translation of the sinusoid relative to the basic function $f(x) = \sin x$ or $f(x) = \cos x$.
- $f(x) = 3 \sin 2\left(x - \frac{\pi}{3}\right) + 5$
 - $f(x) = 4 \cos \frac{1}{2}\left(x + \frac{\pi}{12}\right)$
15. Determine the equation that best describes a sine curve with amplitude 3, period of 6, and a phase shift of $\frac{\pi}{2}$
16. If $\sin \theta = \frac{4}{5}$ with θ in quadrant II, what are the values of the other five trigonometric functions?
17. Which of the following functions does NOT have a period of 2π ?
- $f(x) = \sin x$
 - $f(x) = \tan x$
 - $f(x) = \sec x$
 - $f(x) = \csc x$
18. For each of the following, write the quadrant in which the terminal side of θ lies.
- $\sin \theta > 0, \tan \theta < 0$
 - $\cos \theta < 0, \tan \theta > 0$
 - $\sec \theta < 0, \csc \theta < 0$

19. Write the sinusoidal equation for the following graphs



20. Describe the transformations that the equation represents below relative to its parent function.

a. $y = 3 \sin 4(x - \pi) + 2$

b. $y = -3 \cos \pi(x + 3) - 1$

21. Write the definitions of the six circular functions in terms of x , y , and r .

22. Sketch the graphs of the six circular functions on the interval $-2\pi \leq x \leq 2\pi$

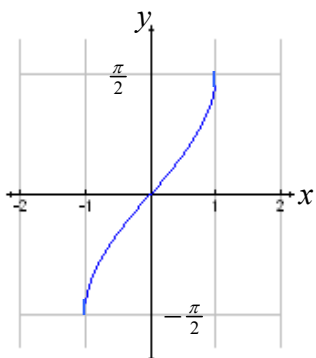
23. Convert to radian measure. Leave your answer in terms of pi.

a. 40°

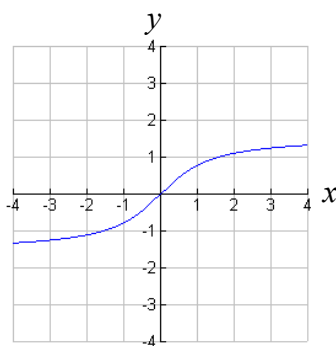
b. 165°

24. Look at the graphs of three inverse functions (a-c) and some intervals below (d-h).

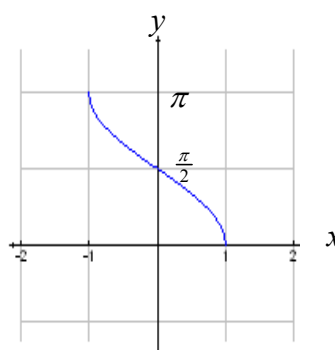
a.



b.



c.



d. $[-1, 1]$

e. $(-\infty, \infty)$

f. $[0, \pi]$

g. $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

h. $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

Complete the table with the correct letter for each inverse trig function with its graph, domain and range:

	$\text{Cos}^{-1}x$	$\text{Sin}^{-1}x$	$\text{Tan}^{-1}x$
Graph			
Domain			
Range			

25. Find the exact value of the following.

a. $\sin \frac{\pi}{6}$

b. $\cos \frac{5\pi}{4}$

c. $\tan \frac{5\pi}{3}$

d. $\sin \frac{3\pi}{2}$

e. $\cos \pi$

f. $\tan \frac{\pi}{2}$

g. $\tan\left(-\frac{7\pi}{4}\right)$

h. $\cos\left(-\frac{4\pi}{3}\right)$

i. $\sin\left(-\frac{11\pi}{6}\right)$

j. $\sin \frac{\pi}{4}$

k. $\cos \frac{5\pi}{6}$

l. $\tan \frac{7\pi}{6}$

m. $\sec\left(-\frac{5\pi}{4}\right)$

26. Find the exact value of the following.

a. $\text{Sin}^{-1}\left(\frac{1}{2}\right)$

b. $\text{Cos}^{-1}\left(-\frac{1}{\sqrt{2}}\right)$

c. $\text{Tan}^{-1}(\sqrt{3})$

d. $\text{Sin}^{-1}(-1)$

e. $\text{Cos}^{-1}(0)$

f. $\text{Tan}^{-1}(-1)$

27. Find the exact value of the following.

a. $\cos\left(\text{Sin}^{-1}\frac{\sqrt{3}}{2}\right)$

b. $\sin(\text{Tan}^{-1}-1)$

c. $\tan\left(\text{Cos}^{-1}-\frac{1}{\sqrt{2}}\right)$

28. Find the exact value of the following.

a. $\sin\left(\text{Csc}^{-1}\frac{8}{5}\right)$

b. $\tan\left(\text{Sin}^{-1}\frac{12}{13}\right)$

c. $\text{Cos}^{-1}\left(\cos\frac{11\pi}{6}\right)$

d. $\sin\left(\text{Tan}^{-1}-\frac{4}{3}\right)$

29. Prove the following identities.

a. $\sin \theta \cot \theta = \cos \theta$

b. $(\sin x + \cos x)^2 = 1 + \sin 2x$

c. $\frac{1 - \sin^2 x}{\cos x} = \cos x$

d. $\frac{\csc x}{1 + \cot^2 x} = \sin x$

e.
$$\frac{\cot \theta}{\sin\left(\frac{\pi}{2} - \theta\right)} = \csc \theta$$

f.
$$\frac{\sin \theta}{\cos \theta} + \frac{\cos \theta}{\sin \theta} = \sec \theta \csc \theta$$

g.
$$\sin(x + y) + \sin(x - y) = 2 \sin x \cos y$$

h.
$$\cos(\pi + x) = -\cos x$$

30. If $\sin A = \frac{4}{5}$ and A is in Quadrant 2, find:

a. $\sin 2A$

b. $\cos 2A$

31. Solve the following equations on the interval $[0, 2\pi)$.

a. $2 \sin \theta = -\sqrt{2}$

b. $3 \cos \theta + 4 = 5 \cos \theta + 5$

32. Simplify the following expressions and evaluate.

a.
$$\sin \frac{5\pi}{8} \cos \frac{3\pi}{8} - \cos \frac{5\pi}{8} \sin \frac{3\pi}{8}$$

b.
$$\cos \frac{5\pi}{6} \cos \frac{\pi}{6} - \sin \frac{5\pi}{6} \sin \frac{\pi}{6}$$

PART 2 CALCULATOR SECTION

A calculator may be used on these problems.

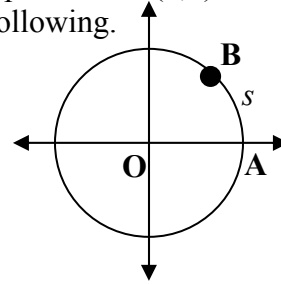
33. The function $f(x)$ below represents the weight of a 1-pound object as a function of its distance, x , from the center of the earth. The surface of the earth is represented as $x = 4000$.

$$f(x) = \begin{cases} \frac{1}{4000}x, & \text{if } 0 \leq x \leq 4000 \\ \frac{16000000}{x^2}, & \text{if } x \geq 4000 \end{cases}$$

- a. What is the weight of this object 1000 miles above the surface of the earth?
- b. What is the weight of this object 1000 miles below the surface of the earth?
34. A spring with a weight on it bounces up and down. Sam uses a stopwatch and notices that the weight is at its highest, 80 feet above the ground when $t = 3$ seconds. When $t = 7$ seconds the weight is at its lowest point, 20 feet above the ground.
- a. Write a sinusoidal equation for the distance the weight is above the ground as a function of time.
- b. What will the distance the weight is above the ground at $t = 11.5$ seconds?
- c. Give two times when the distance the weight is above the ground is 70 feet.
35. At Ocean Tide Dock the first high tide of the day occurs at midnight with depth of 6 meters, and the first low tide occurs at 6:30 A.M. with a depth of 2 meters.
- a. Sketch and label a graph showing the depth (d) of the water at the dock as a function of time (t). Let $t = 0$ represent midnight.
- b. Find a sinusoidal model that represents the graph.
- c. Suppose a tanker requiring at least 3 meters of water depth is planning to dock after 6 A.M. Determine the earliest possible time that the tanker can dock.

36. The length of arc AB in circle O is s . If the coordinates of point A are $(1,0)$ and the coordinates of point B are $(0.8,0.6)$ find the value of the following.

- $\tan(x)$
- $\cos(x + 2\pi)$
- $\sin(x - \pi)$



37. Given \widehat{AB} on a unit circle with $A(1,0)$ and $B\left(-\frac{5}{13}, \frac{12}{13}\right)$, find the value of the following.

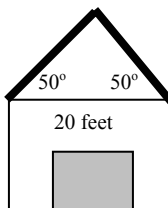
- $\cos \widehat{AB}$
- $\sin \widehat{AB}$

38. Complete the following chart

Radius	Angle	Arc Length
6 inches	$\frac{\pi}{4}$	
	$\frac{5\pi}{6}$	15π feet
10 meters		30 meters

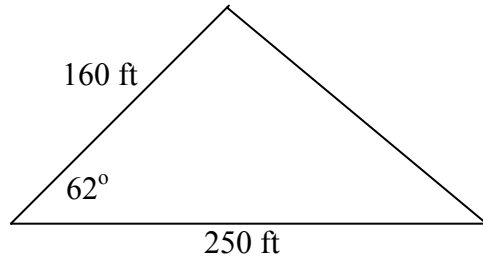
- In $\triangle ABC$, $a = 50$, $c = 80$, and $\angle A = 27^\circ$. How many triangles are possible?
- In $\triangle ABC$, $\angle B = 160^\circ$, $b = 6$, and $a = 10$. How many triangles are possible?
- Given triangle ABC , where $\angle A = 41^\circ$, $\angle B = 58^\circ$, and $c = 19.7$ cm, find the length of side b .
- In $\triangle ABC$, $a = 9$, $b = 12$, $c = 16$. What is the measure of $\angle B$?

43. Find the area of each triangle. Give answer to the nearest tenth if necessary.
- $\triangle ABC : a = 4, b = 10, m\angle C = 30^\circ$
 - $\triangle ABC : a = 17, b = 13, c = 18$
44. Find the remaining sides and angles of a triangle with $\angle A = 58^\circ$, side $a = 11.4$ and side $b = 12.8$.
45. From a point 200 feet from its base, the angle of elevation from the ground to the top of a lighthouse is 55 degrees. How tall is the lighthouse?
46. A truck is traveling down a mountain. A sign says that the degree of incline is 7 degrees. After the truck has traveled one mile (5280 feet), how many feet in elevation has the truck fallen?
47. A person is driving towards a mountain. At one point, the angle of elevation from the ground to the mountain is 37 degrees. 1000 feet later, the angle of elevation from the ground to the mountain is 40 degrees. How high is the mountain?
48. The owner of the garage shown below plans to install a trim along the roof. The lengths required are in bold. How many feet of trim should be purchased?

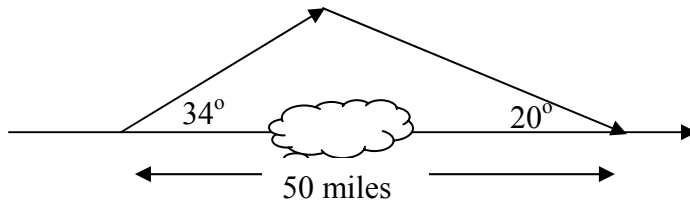


49. Solve for θ or x , where $0 \leq \theta < 360, 0 \leq x < 2\pi$.
- $3 \cos \theta + 9 = 7$
 - $2 \sin^2 \theta - 3 \sin \theta + 1 = 0$
 - $3 \sin x = 1 + \cos 2x$

50. A real estate appraiser wishes to find the value of the lot below.



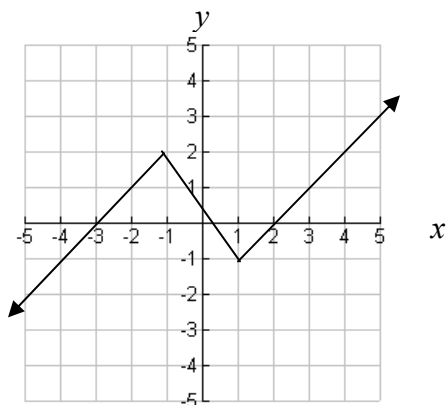
- a. Find the area of the lot.
- b. An acre is 43560 square feet. If land is valued at \$56,000 per acre, how much is the land worth?
51. An airplane needs to take a detour around a group of thunderstorms, as shown in the figure below. How much farther does the plane have to travel due to the detour?



The remaining problems on this review are for HONORS Precalculus Students.

Part 3 NO CALCULATOR SECTION

52. Look at the graph of $f(x)$ below.



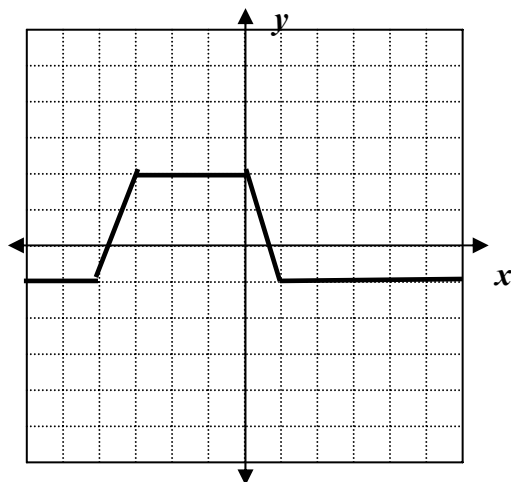
Sketch the graph of $f(|x|)$.

53. Which of the following correctly describes the end behavior of the function

$$f(x) = \frac{3}{x^2}?$$

- A $\lim_{x \rightarrow \infty} f(x) = -\infty$
- B $\lim_{x \rightarrow \infty} f(x) = 0$
- C $\lim_{x \rightarrow \infty} f(x) = 3$
- D $\lim_{x \rightarrow \infty} f(x) = \infty$
54. Write an algebraic expression without trig functions for $\sin(\tan^{-1}x)$.
55. Find the period of $f(x) = 2 \sin 5x - 3 \cos 2x$.
56. Describe the end behaviors of $f(x) = \tan^{-1}x$.
57. The points (1,3) and (4,6) lie on the graph of the power function $f(x) = ax^b$.
What is $f(9)$?

58. State the amplitude, period, the phase shift and vertical translation of the sinusoid $g(x) = 7 \sin(3x - \pi) - 2$ relative to the basic function $f(x) = \sin x$.
59. Prove the following identities.
- $\sin^2 \theta + \sin^2 \theta \tan^2 \theta = \tan^2 \theta$
 - $\tan x + \cot x = \frac{1}{\sin x \cos x}$
 - $\frac{1}{1 - \cos x} + \frac{1}{1 + \cos x} = 2 \csc^2 x$
60. For the function $h(x) = (x + 4)^2$, find functions f and g such that $f(g(x)) = h(x)$.
61. If $f(x) = \frac{x + 4}{x - 2}$, find a formula for $f^{-1}(x)$.
62. Let x and y be related by the equation $x + y^2 = 17$.
- Find the values of y if $x = 0, 1$, and 8 .
 - Is this relation a function? Justify your answer.
 - Find two functions defined implicitly by the relation.
63. Look at the graph of $f(x)$ below. The domain of $f(x)$ is $-6 \leq x \leq 6$.



- Find the domain and the range of $g(x) = f(x + 2) - 3$.
- Find the domain and the range of $h(x) = -f(x - 1)$.

Part 4 A calculator may be used on these problems.

64. A wheel of radius 12 cm turns at 7 revolutions per second. Find the linear velocity of a point on the edge of the wheel in meters per second.
65. An automobile tire has a radius of 16 inches. If the car is traveling at 88 ft/sec, how many revolutions per minute is the wheels making?
66. A point on the tip of a tuning fork vibrates in harmonic motion described by the equation $d = 14\sin \omega t$. Find ω for a tuning fork that has a frequency of 264 vibrations per second.
67. A regular pentagon is inscribed in a circle of radius 40 meters. What is the length of the apothem of the pentagon?