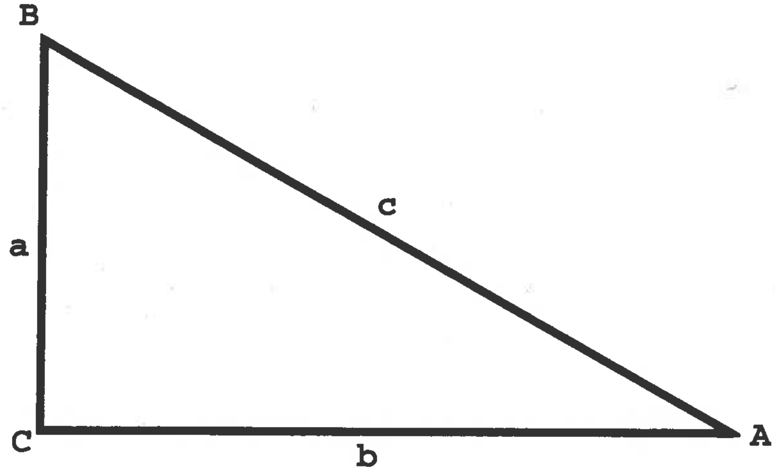
Right Triangles

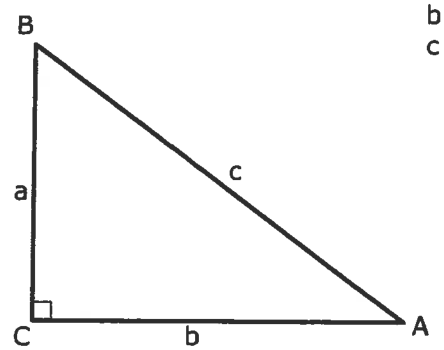


Pythagorean Theorem	$c^2 = a^2 + b^2$	$c = \sqrt{a^2 + b^2}$
Given: a,c	$b = \sqrt{c^2 - a^2}$ $\cos B = \frac{a}{c}$	$area = \frac{a}{2}\sqrt{c^2 - a^2}$ $\sin A = \frac{a}{c}$
Given: b,c	$a = \sqrt{c^2 - b^2}$ $\sin B = \frac{b}{c}$	$area = \frac{b}{2}\sqrt{c^2 - b^2}$ $\cos A = \frac{b}{c}$
Given: a,b	$c = \sqrt{a^2 + b^2}$ $\tan A = \frac{a}{b}$ $\tan B = \frac{b}{a}$	$area = \frac{ab}{2}$ $\cot A = \frac{b}{a}$ $\cot B = \frac{a}{b}$
Given: A,a	$b = a \cot A$ $c = \frac{a}{\sin A}$	$area = \frac{a^2 \cot A}{2}$
Given: A,b	$a = b \tan A$ $c = \frac{b}{\cos A}$	$area = \frac{b^2 \tan A}{2}$
Given: A,c	$a = c \sin A$ $b = c \cos A$	$area = \frac{c^2 (\sin A)(\cos A)}{2}$ $area = \frac{c^2 \sin 2A}{4}$

Maryland Society of Surveyors (2010)

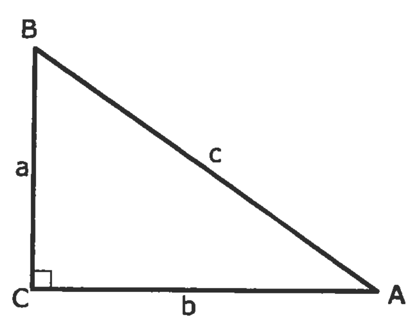
Right Triangles

RT-1. For the following right triangle, solve for B.



b = 400.00'
c = 500.00'

RT-2. For the following right triangle, solve for a.

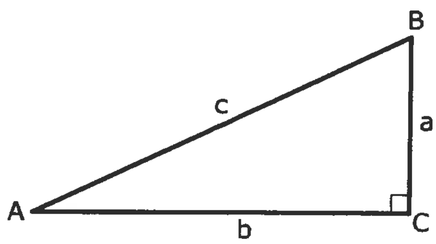


b = 372.52'
c = 455.00'

A = 35°02'32"

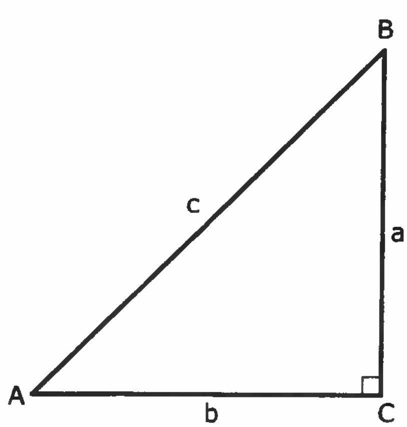
Rt triangle 1.dwg

RT-3. For the following right triangle, find the area.



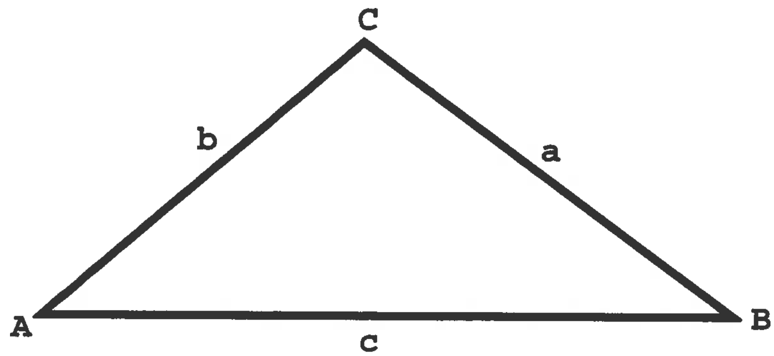
c = 449.27' A = 25°16'34"

RT-4. For the following right triangle, solve for c.



a = 375.75' B = 45°00'00"
b = 375.75'

Oblique Triangles



Law of Sines	$\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinC}$
Law of Cosines	$\boldsymbol{a}^2 = b^2 + c^2 - 2bc\ cosA$ $\boldsymbol{b}^2 = a^2 + c^2 - 2ac\ cosB$ $\boldsymbol{c}^2 = a^2 + b^2 - 2ab\ cosC$

$$for\ the\ formulas\ below:\ s = \frac{(a+b+c)}{2}$$

Given: a, b, c	$sin\boldsymbol{A} = 2\left(\frac{\sqrt{s(s-a)(s-b)(s-c)}}{bc}\right)$ $sin\boldsymbol{B} = 2\left(\frac{\sqrt{s(s-a)(s-b)(s-c)}}{ac}\right)$ $\boldsymbol{C} = 180 - (A+B)$	$cos\boldsymbol{A} = \frac{(b^2 + c^2 - a^2)}{2bc}$ $cos\boldsymbol{B} = \frac{(a^2 + c^2 - b^2)}{2ac}$ $cos\boldsymbol{C} = \frac{(a^2 + b^2 - c^2)}{2ab}$ $\boldsymbol{area} = \sqrt{s(s-a)(s-b)(s-c)}$
Given: a, A, B	$\boldsymbol{C} = 180 - (A+B)$ $\boldsymbol{b}\ or\ \boldsymbol{c} = law\ of\ sines$	$\boldsymbol{area} = \frac{a^2 sinB\ sin(A+B)}{2\ sinA}$

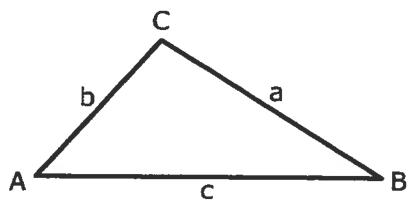
Maryland Society of Surveyors (2010)

Oblique Triangles

Given: a, b, A	$B = law\ of\ sines$ $C = 180 - (A + B)$ $c = \frac{a\ sin(A + B)}{sinA}$	
Given: a, b, C	$c = law\ of\ cosines$ $tanA = \frac{a\ sinC}{b - (a\cos C\ )}$ $B = 180 - (A + C)$	$area = \frac{ab}{2}\ sinC$
Given: A, B, C, a	$b\ or\ c = law\ of\ sines$	$area = \frac{a^2(sinB)(sinC)}{2\ sinA}$

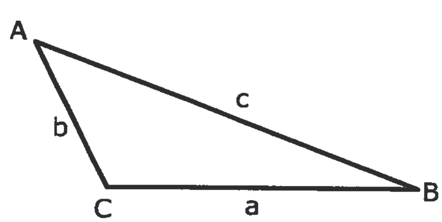
Oblique Triangles

OBT-1. For the following oblique triangle, solve for B.



a = 282.62'
b = 198.63'
c = 372.65'

OBT-2. For the following oblique triangle, find the area.

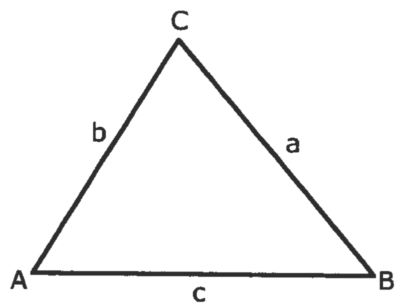


a = 334.68'

A = 42°43'54"
B = 21°00'07"

Oblique Triangle 1.dwg

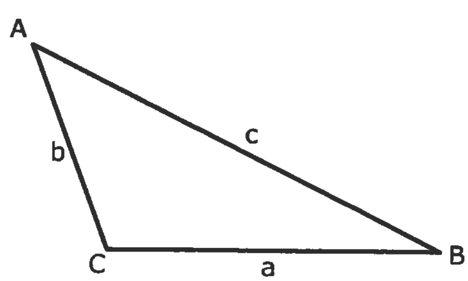
OBT-3. For the following oblique triangle, solve for c.



a = 333.38'
b = 296.09'

A = 59°11'34"
B = 49°42'50"

OBT-4. For the following oblique triangle, solve for A.



a = 356.82'
b = 238.70'

C = 110°36'55"

42 30 58

Oblique Triangle 2.dwg

Horizontal Curves

$$R = \frac{5729.58}{D}$$

$$D = \frac{5729.58}{R}$$

$$L = 100\frac{\Delta}{D}$$

$$LC = 2R\,sin\frac{\Delta}{2}$$

$$T = R\,tan\frac{\Delta}{2}$$

$$E = R\left[\frac{1}{cosA\frac{\Delta}{2}} - 1\right]$$

$$M = R\left(1 - \frac{cos\Delta}{2}\right)$$

$$circle\ area = \pi r^2$$

$$sector\ area = \frac{\Delta}{360}\pi R^2$$

$$sector\ area = R\frac{L}{2}$$

$$segment\ area = \left(\pi R^2\frac{\Delta}{360}\right) - \frac{C}{2}(R-M)$$

$$segment\ area = \frac{L * R - C(R-M)}{2}$$

$$fillet\ area = R^2\left(tan\frac{\Delta}{2} - \frac{\Delta\pi}{360}\right)$$

$$fillet\ area = R\left(T - \frac{L}{2}\right)$$

$$area\ below\ chord = \frac{R^2}{2}sin\Delta$$

$$area\ below\ chord = \frac{C}{2}(R-M)$$

$$area\ below\ chord = \left(R\ sin\frac{\Delta}{2}\right)\left(R\ cos\frac{\Delta}{2}\right)$$

$$\frac{\left(\frac{1718.8734}{R}\right)}{60} = deflection\ angle\ per\ foot\ of\ arc\ in\ decimal\ degrees$$

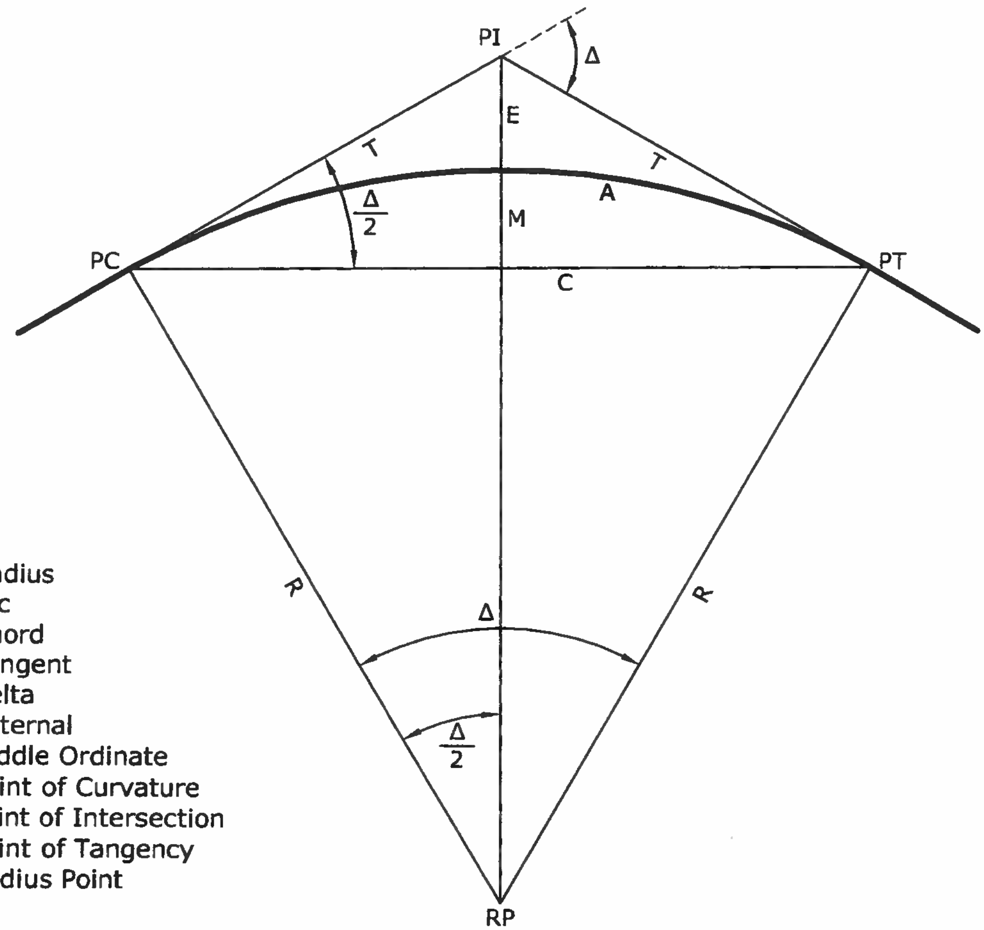
$$\frac{L}{R} = \Delta(in\ radians)$$

$$decimal\ degrees = radians\frac{180}{\pi}$$

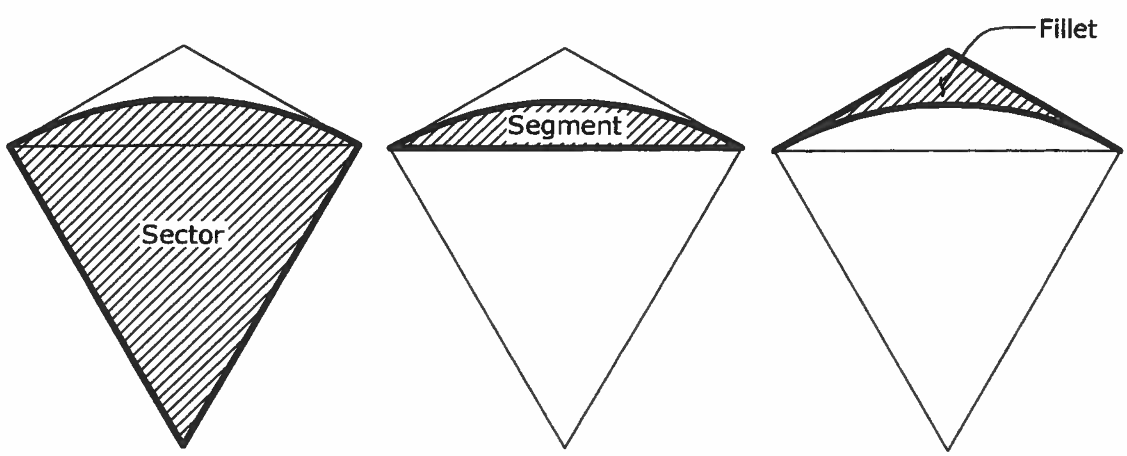
$$radians = decimal\ degrees\frac{\pi}{180}$$

$$1\ degree = 0.0174532925\ radians$$

Horizontal Curves



R = Radius
A (or L) = Arc
C = Chord
T = Tangent
Δ = Delta
E = External
M = Middle Ordinate
PC = Point of Curvature
PI = Point of Intersection
PT = Point of Tangency
RP = Radius Point

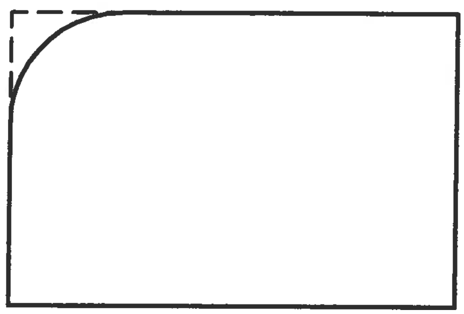


formula figures 1.dwg

Computations

1. To provide adequate vehicular turning radius an 80' wide by 120' deep rectangular lot must be truncated with a 30 foot radius fillet at it's northwest corner. What is the new area of the lot?

   (A) 9600.00 square feet
   (B) 8893.14 square feet
   (C) 9406.86 square feet
   (D) 8827.43 square feet



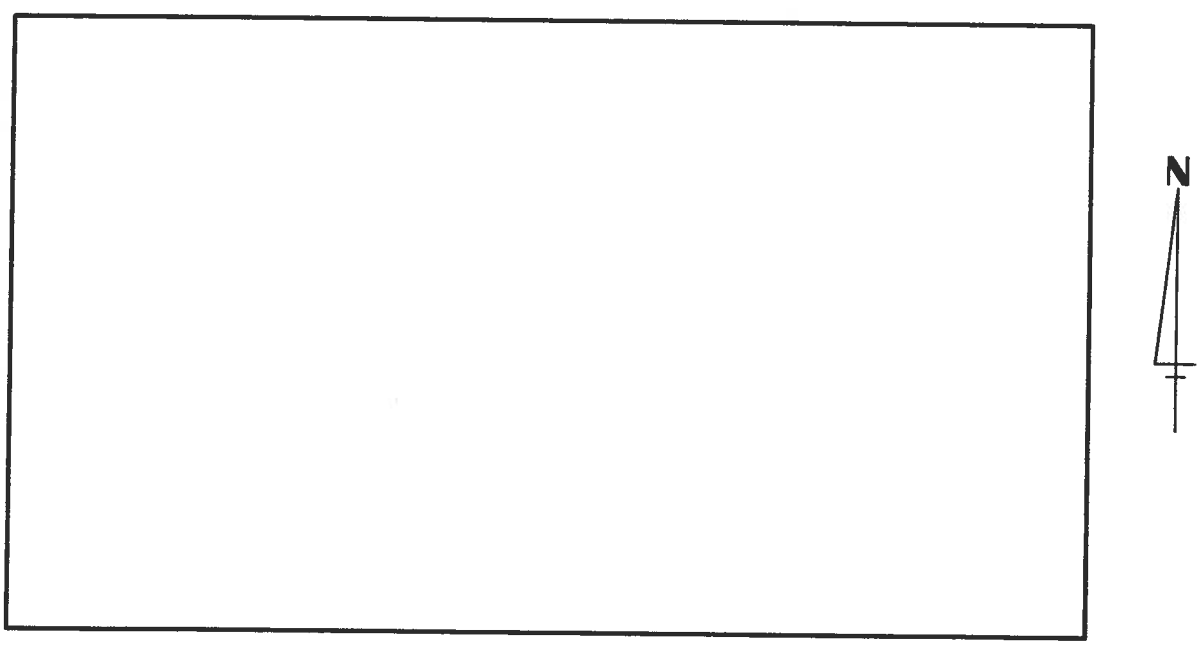
2. Two iron pipes are found along a tangent portion of a highway. Point "A" is found at elevation 421.25 feet, 42.36 feet to the right of baseline station 9+52.36. Point "B" is found at elevation 360.42, 39.25 feet to the left of baseline station 17+86.22.

   What is the slope distance between Point "A" and Point "B"?

Comps 1–2.dwg

3. In 1985 Brown sold the northerly 20 acres of his 40 acre tract to Smith without the benefit of a boundary survey. In 1990 Brown sold the southerly 20 acres of the 40 acre tract to Jones. Following the 1990 conveyance Jones had the property surveyed and discovered that the original 40 acre tract only contained 38 acres.
How much land does each of the parties own?

4. In 1985 Brown sold the northerly 20 acres of his 40 acre tract to Smith without the benefit of a boundary survey. In 1990 Brown sold the southerly 20 acres of the 40 acre tract to Jones. Following the 1990 conveyance Jones had the property surveyed and discovered that the 40 acre tract contained 41 acres.
How much land does each of the parties own?

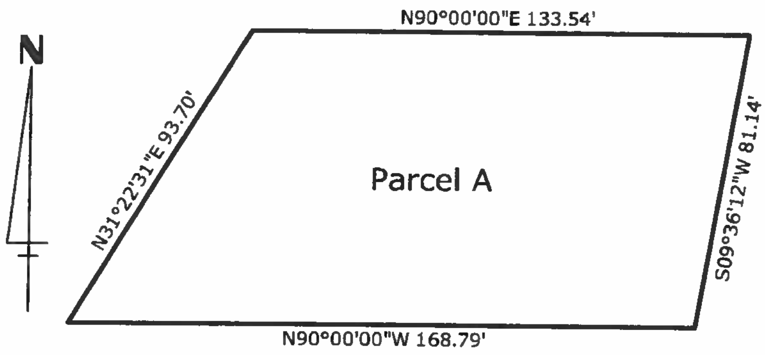


"Brown's 40 Acre Tract"

Comps 3–4.dwg

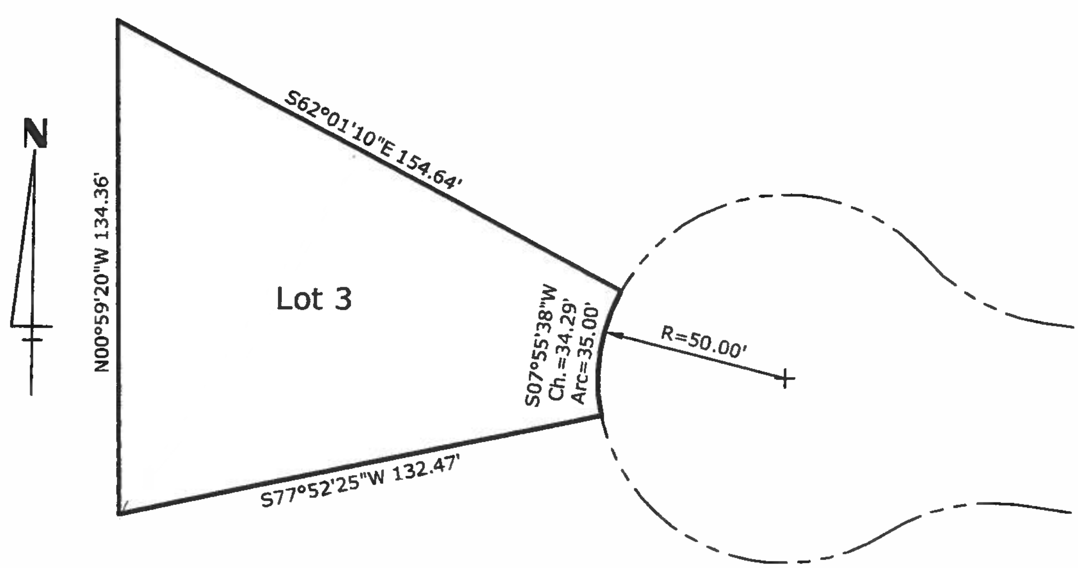
5. What is the land area of the Parcel A shown below?

(A) 11,966 square feet
(B) 12,041 square feet
(C) 12,093 square feet
(D) 12,119 square feet



6. Assuming the northerly and southerly lines of Lot 3 are radial to the cul-de-sac curve, what is the land area of the Lot 3 shown below?

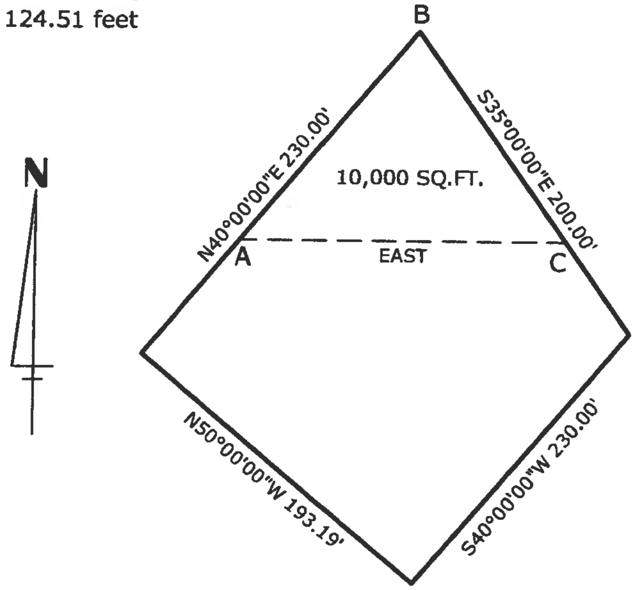
(A) 11,023 square feet
(B) 11,152 square feet
(C) 11,222 square feet
(D) 12,027 square feet



Comps S-6.dwg

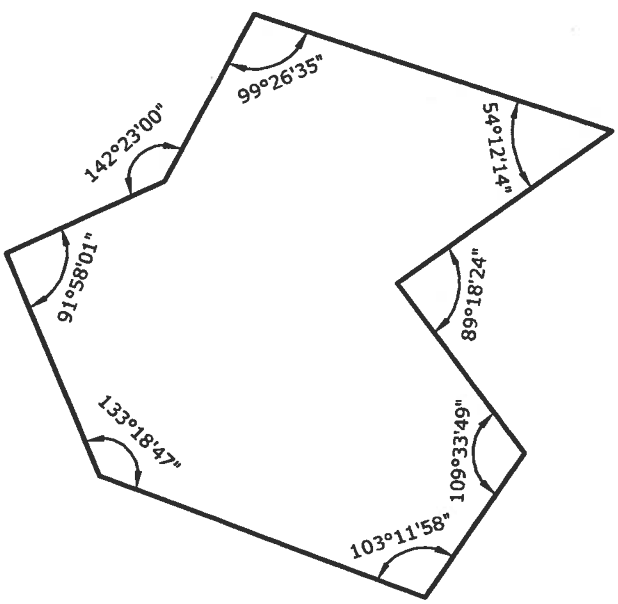
7. A 10,000 square foot parcel is to be established north of line AC. What is the length of side BC?

(A) 113.99 feet
(B) 148.80 feet
(C) 139.15 feet
(D) 124.51 feet



8. What is the sum of the exterior angles of the closed figure shown below?

9. What is the sum of the interior angles of the closed figure shown below?



Comps 7-8.dwg

10. The area in square feet of the segment of the curve shown below is most nearly?

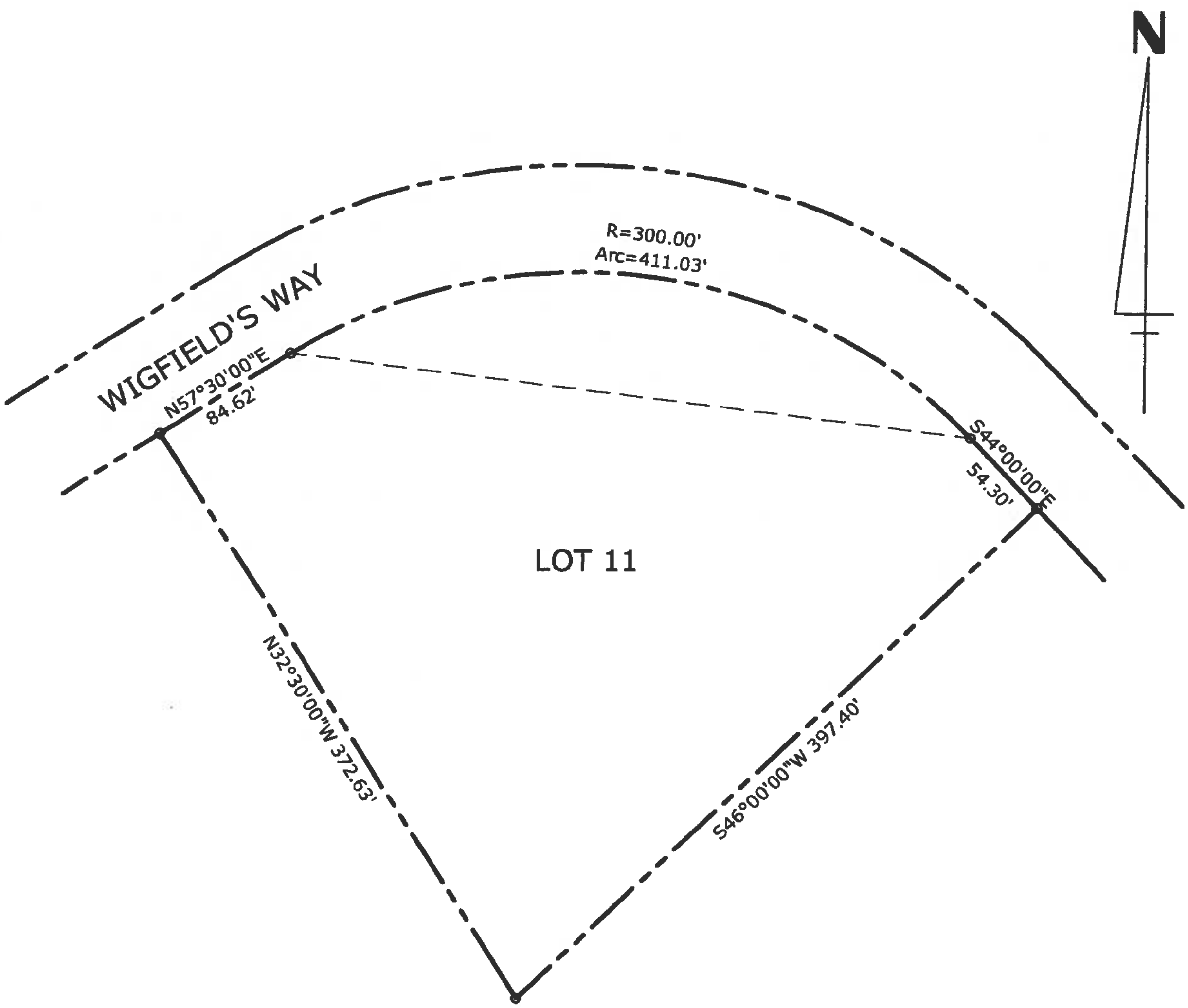
(A) 17,557
(B) 29,436
(C) 15,755
(D) 21,358

11. The area in square feet of the sector of the curve shown below is most nearly?

(A) 44,097
(B) 57,736
(C) 29,436
(D) 61,654

12. The area in square feet of the fillet of the curve shown below curve is most nearly?

(A) 29,436
(B) 11,879
(C) 27,583
(D) 11,747



Comps 10-12.dwg

1. **Calculate the standard deviation of the following measurements:**

125.25
125.21
125.22
125.21
125.24
125.22
125.23
125.22
125.24
125.21

2. **Calculate the standard deviation of the following measurements:**

58
56
57
60
59
58
62
57
56
58
61
58
58
59

3. **What is the total cost of a capital acquisition of $60,000.00 financed at 9% simple interest for 6 years with a payment schedule of $10,000.00 plus interest due, payable at the end of each year.**

AREA BY DMD WORKSHEET

Bearing	Dist	cos	sin	Latitude (cos x dist)		Departure (sin x dist)		DMD	Double Area DMD x Latitude	
----------------	--------	--------	--------	+	-	+	-	----------	+	-
							Double Area Totals			
							Algebraic Difference			
						Area = Algebraic Difference/2				

Always start at the most westerly corner
For the initial line the DMD = the departure of that line
For subsequent lines the DMD = the DMD for the previous line + the departure for the previous line + the departure for the current line.

Quadrant	cos	sin
NE	+	+
SE	-	+
SW	-	-
NW	+	-

AREA BY DMD WORKSHEET

Bearing	Dist	cos	sin	Latitude (cos x dist)		Departure (sin x dist)		DMD	Double Area DMD x Latitude	
----------------	--------	--------	--------	+	-	+	-	----------	+	-
						Double Area Totals				
						Algebraic Difference				
					Area = Algebraic Difference/2					

Always start at the most westerly corner
For the initial line the DMD = the departure of that line
For subsequent lines the DMD = the DMD for the previous line + the departure for the previous line + the departure for the current line.

Quadrant	cos	sin
NE	+	+
SE	-	+
SW	-	-
NW	+	-