The Science of Mathematics

The New Riverbank Park

Ann Street School

MATHEMATICS FAIR
EIGHTH GRADE PARTICIPANTS

Classroom 401		Carina Ferreira Rodrigo Fideles
Classroom 402		Jennifer Stradiotti Ricardo Velez
Classroom 403		Jean-Pierre Pinto Janete Rodas
Classroom 404		David Caetano Luis Costa Adriana Evaristo Nicole Moinhos Sonia Nobre Sandra Raposo Belen Tome Melanie Valente
Classroom 405		Daniela Nogueira Jhonatan Ramirez Diego Sanchez
Teachers	**Math**	Ms. Joel Soltys
	Science	Mr. Manuel Oliveira
	Science Lab	Ms. Michele Romano
	Staff Developer	Mr. Roger Colarusso

Riverbank Park

Ann Street School's remodelization of Riverbank Park involves the application of mathematics and science principles. With these principles, we brought into consideration the many advantages as well as the disadvantages. The creativity and architectural style was inspired by the ideas of our future generation, adolescents.

The project was completed in two phases. First, we used mathematical method on similar geometric shapes, along with ratios to transfer actual measurements to scale. The ratio for our model is every inch is approximately twenty feet. We also used the Pythagorean Theorem to figure out the dimensions of triangular shapes in the model.

The second phase was the use of science. We used the fundamentals of structure development in creating an appealing look for the park as well as a safe environment.

Safety is one of the main keys used in our project. As a team, we decided what materials are to be used in building the best and safest structures. We also took into consideration the safety surrounding the community. Since we built an underground parking lot, it would most definitely benefit the safety of the environment by diminishing traffic and double parking.

This park would have such remarkable use to those who live in our community. Not only would kids of all ages be able to enjoy themselves but also the adults. Recreational groups or local teams would be capable of utilizing our soccer, basketball, baseball or softball, and football fields. This would bring enjoyment for the community of all ages. The new park will also help keep kids off the streets and provide a place for kids to hangout with family and friends.

Overall, this project made us think, analyze, and apply everything we learned in Math and Science . Our final goal is to present our model to City Hall.

First step in the project was contacting County of Essex Department of Parks, Recreation and Cultural Affairs. We spoke to Mr. Joe Lanzara by phone concerning the dimensions of Riverbank Park. We explained our project goal and received information needed via fax in a matter of minutes.

After considering the dimensions needed for a soccer, football, baseball, basketball, roller hockey, track, kid park, picnic area, and security/information center, a park layout was created. The creativity and architectural style of this park was inspired by the eighth grade students. The actual model of the park is scaled to 1 inch is approximately 20 feet.

UNDERGROUND PARKING LOT

In creating our underground parking lot, we felt it would be a major improvement and necessity to the New Riverbank Park. We decided to make it a separate level to accommodate as many cars as possible. Since traffic and parking in Newark is a problem this was a major consideration in our design. The scale used for the underground parking lot is 5 feet is ~ 1 inch.

Please see the following sketch for the outlay of the underground parking lot.

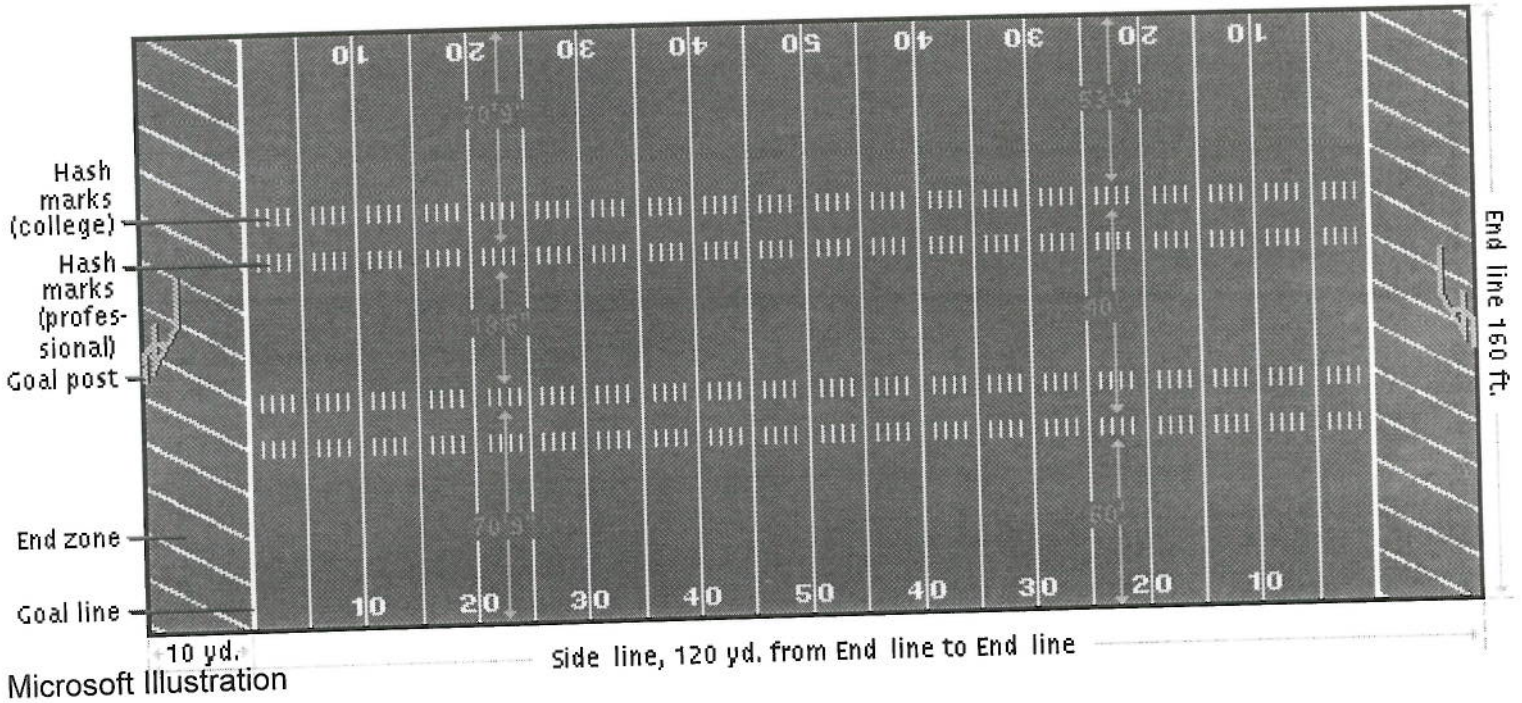
SOCCER/FOOTBALL FIELD

In creating our soccer/football field, we looked up the measurements of regulation size fields in Encarta Encyclopedia '97. We chose to create a dual purpose field for our New Riverbank Park. Looking at the dimensions of the football field we realized that the soccer field would be able to fit within its boundaries.

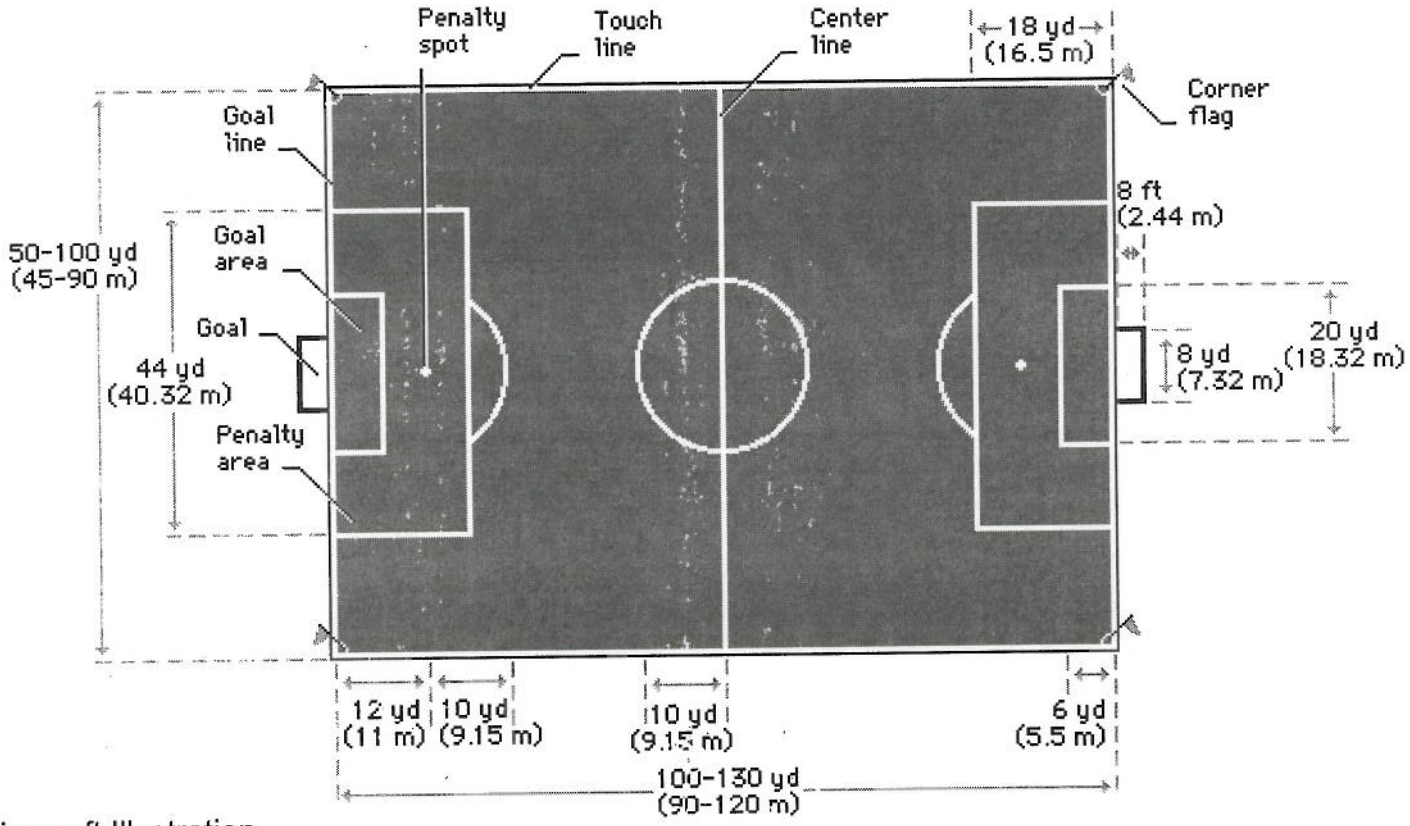
Our method of decreasing the field size was by a conversion system. In this system we transformed actual yards to feet, and finally feet to inches. Our model scale is, for every inch it is approximately twenty feet.

The length of the football field is 120 yards, multiplied by 3 equals 360 feet, divided by 20 feet gives us a scale model of ~18 inches. The length of the soccer field is only a 100 yards, using the same method as above, it gave us a scale model of ~15 inches. We then subtracted 18 from 15 which equals 3 and divided it by 2 to get 1.5 inches to scale. We then measured from the football field end lines to create the soccer field boundaries. The width of the football feet is ~53 yards which is ~160 feet which is ~8 inches to scale. The same width was used for the soccer field.

Although it is a dual purpose field we chose to use the soccer field in our model. The center line was found by dividing its length in half, 300 feet divided by 2 equals 150 feet, then dividing by 20 gave us ~7.5 inches for the model. Center circle radius is 10 yards which equals 30 feet which is ~1.5 inches in our model. In order to find the penalty area for a field the size of 53 yards we used a ratio/proportion method. Using penalty area as a reference we used 44 yards divided by 100 yards width of the field is equal to x yards divided by 53 yards width which gave us ~ 23 yards which is ~ 3.5 inches in our model. The goal area was found using the same ratio as above, 44 yards divided by 100 yards width of the field is equal to x yards divided by 20 yards width goal area, which gave us ~ 8.8 yards which is ~ 1.5 inches in our model. All work is shown on the following pages.



Microsoft Illustration



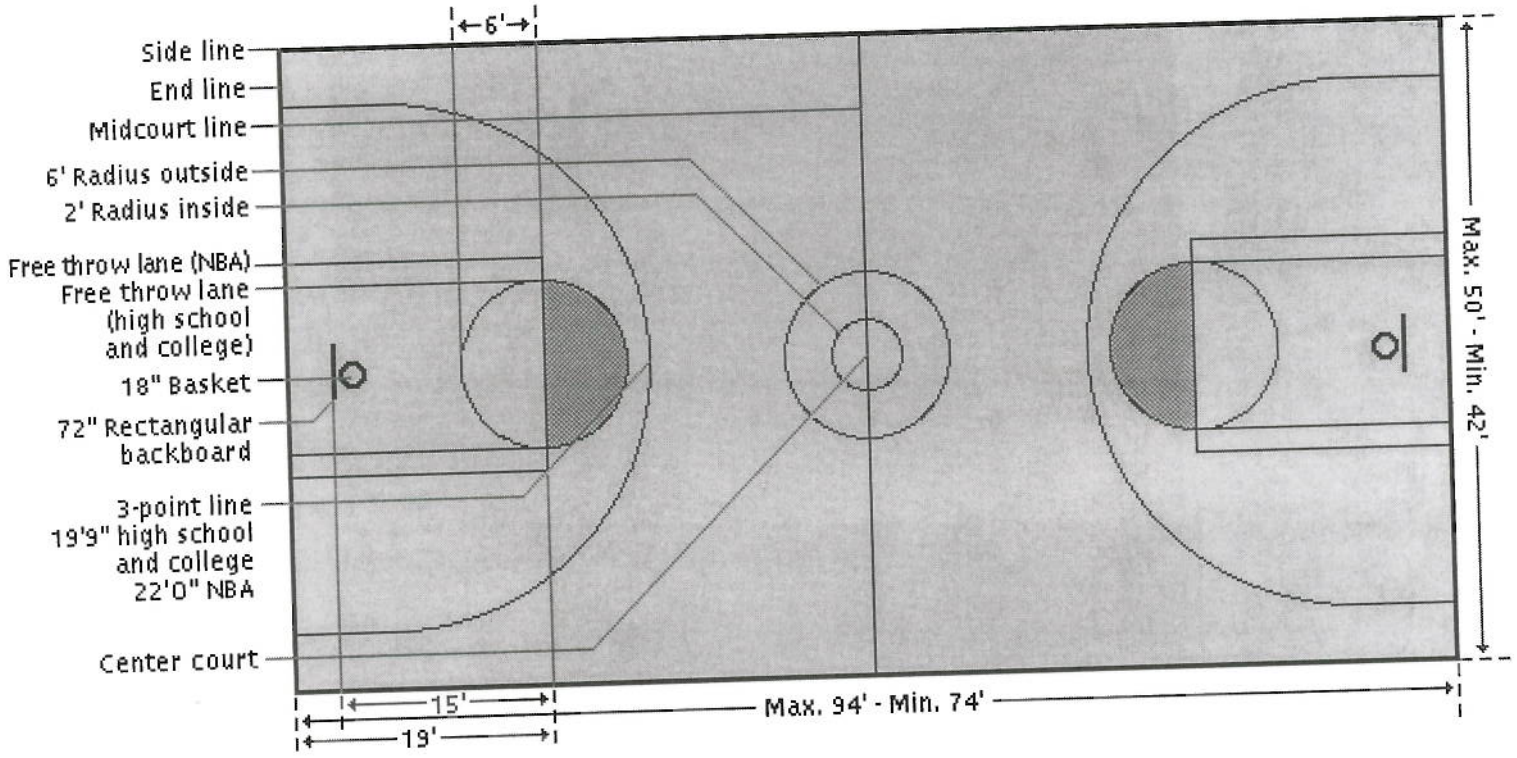
Microsoft Illustration

BASKETBALL COURTS

In order to construct our basketball court, we researched the information on the regulation size court in Encarta Encyclopedia '97. Our park layout has the basketball courts area measuring 80 feet by 120 feet. We created two separate basketball courts each 50 feet in width with a 20 foot area in between. In order to scale down to our model size, we converted feet to inches by dividing by 20 feet which is our model ratio.

The width is 50 feet divided by 20 feet which gives us ~ 2.5 inches for our model. To locate the basketball pole we divided 2.5 inches by 2 which gives us 1.25 inches. The length is 80 feet divided by 20 feet which gives us ~ 4 inches for our model. To determine the half court line, we divided 80 feet by 2 which equals 40 feet which is ~ 2 inches in our model. Center court radius is equal to 6 feet which is ~ .3 inches in our model. The free throw line is an area equal to 15 feet by 15 feet, divided by 20 feet which gives us ~ .75 inches. In order to position the free throw line in the center of the width we divided .75 inches by 2 which gives us ~ .375 inches.

Please refer to the scale graph for actual work.



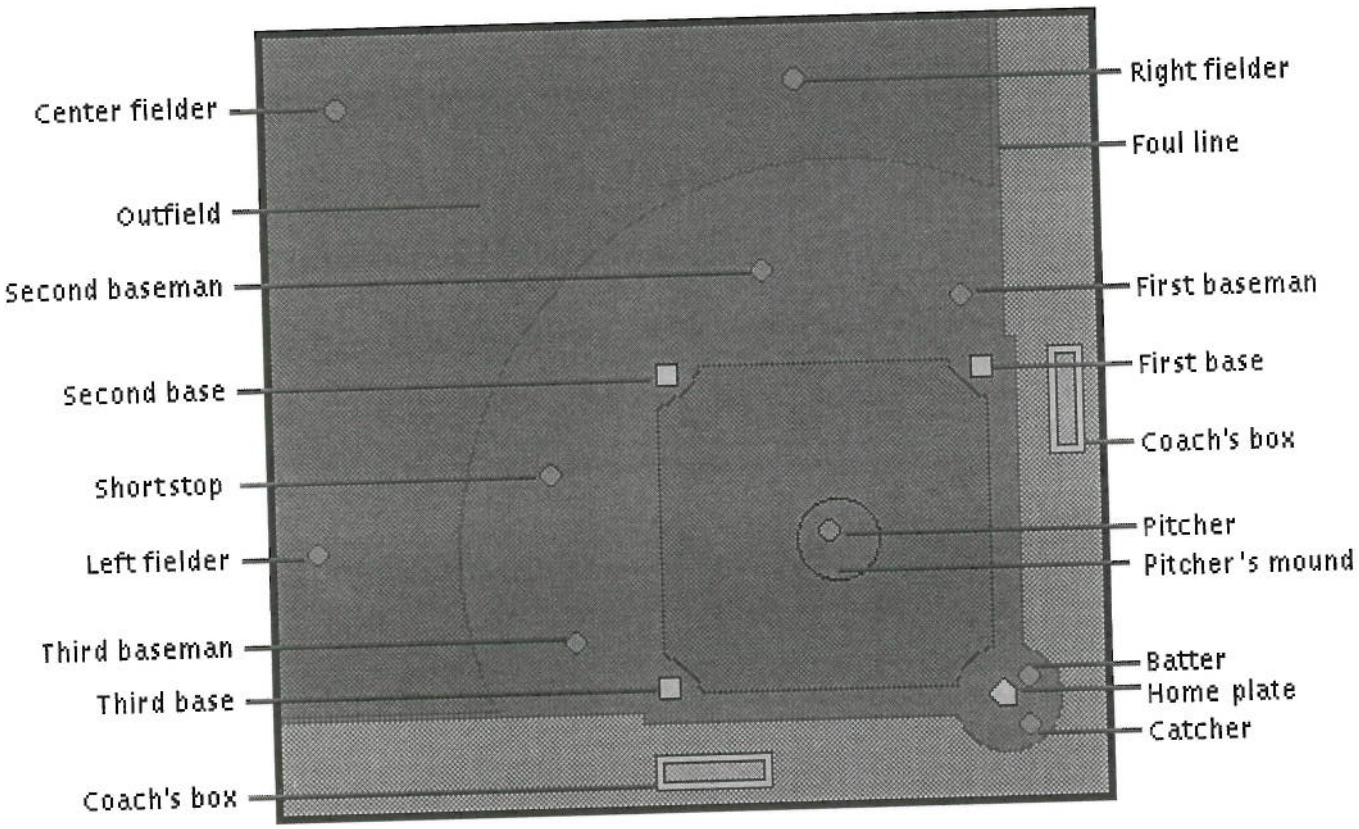
Microsoft Illustration

BASEBALL FIELD

In researching Encarta Encyclopedia '97 we were unable to acquire dimensions for the baseball field. We decided to create a field which would fit the dimensions of our park.

The left field foul line is equal to 200 feet which is ~ 10 inches in our model. The right field foul line had to be calculated by using the Pythagorean Theorem this came to ~ 209 feet which is ~ 10 inches in our model. Using the Pythagorean Theorem we calculated the distance to the center field wall from home plate, this gave us ~ 256 feet which is ~ 13 inches in our model. The bases are 90 feet apart forming a diamond shape, we divided 90 feet by 20 feet which gave us ~ 4.5 inches in our model. The pitchers mound is 35 feet from home plate which is ~ 1.75 inches in our model.

All work is shown on the following pages.



Microsoft Illustration

SECURITY/INFORMATION CENTER

The security/information center covers an area of 140 feet by 100 feet. The length is 140 feet which divided by 20 feet gives us ~ 7 inches in our model. The width is 100 feet which divided by 20 feet gives us ~ 5 inches in our model. The height of the building is 40 feet which divided by 20 feet gives us ~ 2 inches in our model.

See following page for work.

CONCERT BUILDING

The concert building is triangular in shape, two sides are 80 feet in length at a right angle. The length of 80 feet was divided by 20 feet which gave us ~ 4 inches in our model. In order to find the third side the Pythagorean Theorem was used, using the model size scale which gave us ~ 6 inches for the third side.

See following page for work.

COUNTY OF ESSEX
DEPARTMENT OF PARKS, RECREATION AND CULTURAL AFFAIRS
115 CLIFTON AVENUE
NEWARK, NEW JERSEY 07104
TELEPHONE 973-268-3500
FACSIMILE 973-268-3502

JAMES W. TREFFINGER
COUNTY EXECUTIVE

COLEEN D'ALESSANDRO
DIRECTOR

FAX TRANSMITTAL

TO FAX NUMBER 973-465-4185

NAME MR OLIVEIRA

LOCATION ANN ST SCHOOL

FROM NAME JOE LANZARA

SECTION

DATE 4.29.98

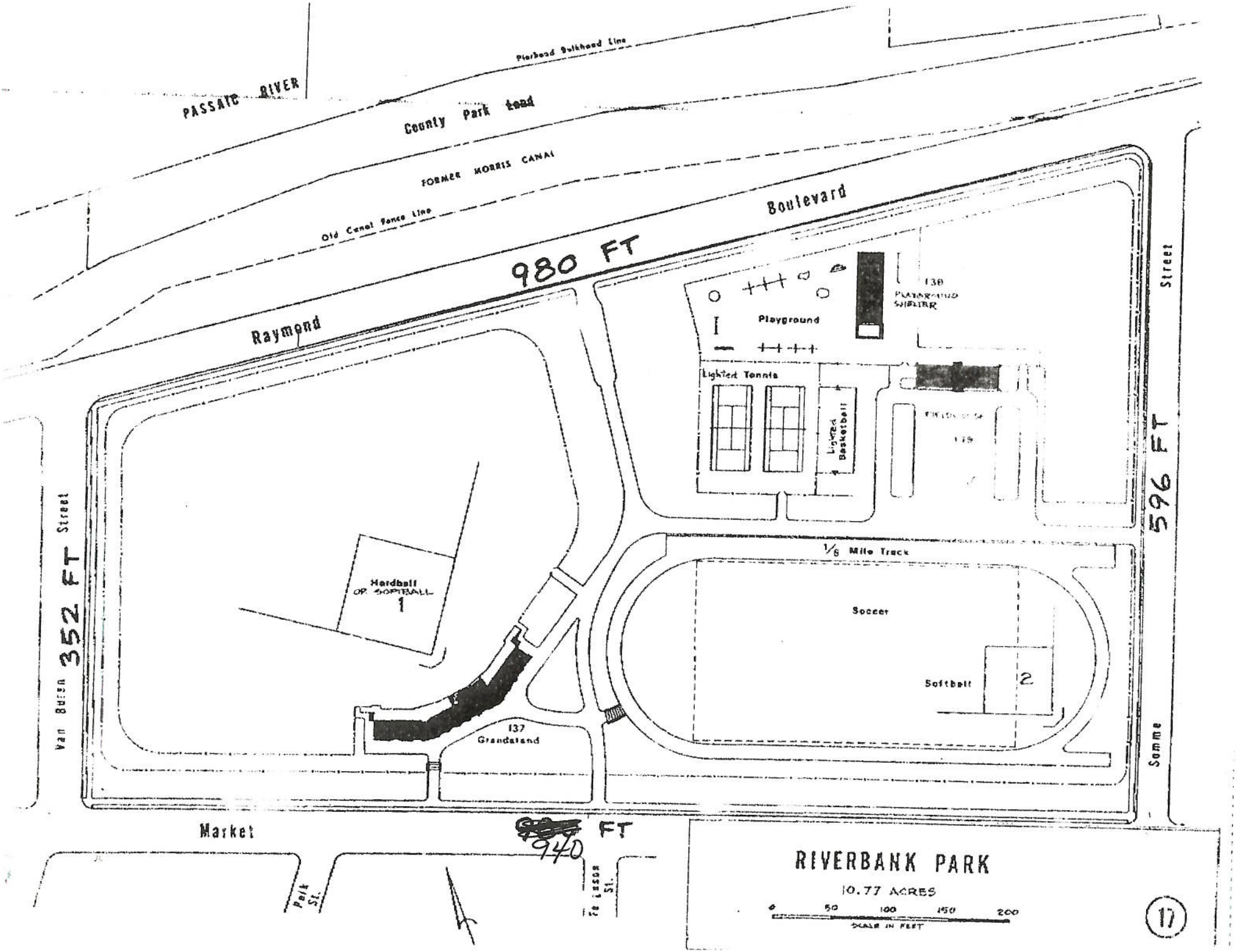
TOTAL NUMBER OF PAGES INCLUDING COVER LETTER 2

MESSAGE RIVERBANK PARK DIMENSIONS

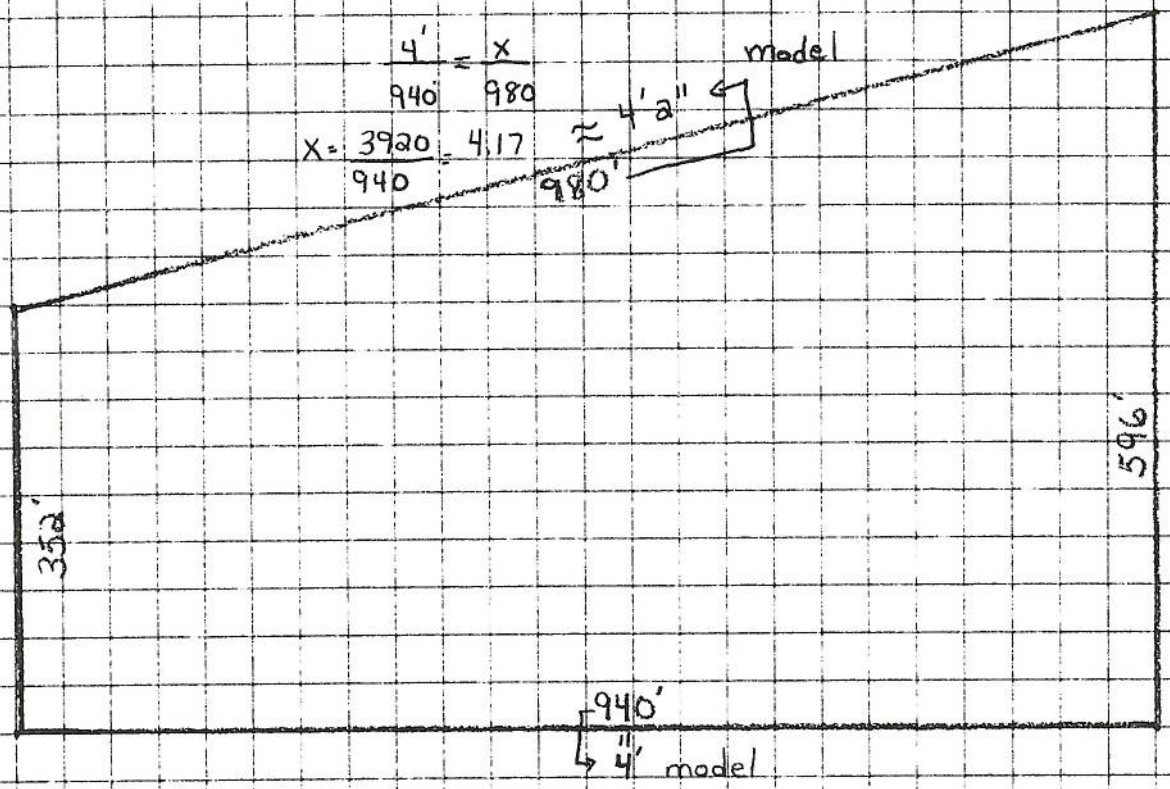
IF YOU DO NOT RECEIVE ALL THE PAGES, PLEASE CALL

NAME

TELEPHONE


PASSAIC RIVER
Pierhead Bulkhead Line
County Park Road
FORMER MORRIS CANAL
Old Canal Fence Line
Boulevard
980 FT
Raymond
Street
596 FT
352 FT
Van Buren Street
Playground
138
PLAYGROUND SHELTER
Lighted Tennis
Lighted Basketball
1/8 Mile Track
Soccer
Softball
2
Hardball OR SOFTBALL
1
137
Grandstand
Somme
Market
940 FT
Park St.
St. Lesser St.
RIVERBANK PARK
10.77 ACRES
0 50 100 150 200
SCALE IN FEET
17

Converting Actual to Model



$\frac{4'}{940'} = \frac{x}{980'}$

$x = \frac{3920}{940} = 4.17 \approx 4'2''$ ← model

$\frac{4'}{940} = \frac{x}{352}$

$x = \frac{1408}{940} = 1.497$

$x \approx 1'6''$ model

$\frac{4'}{940'} = \frac{x}{596'}$

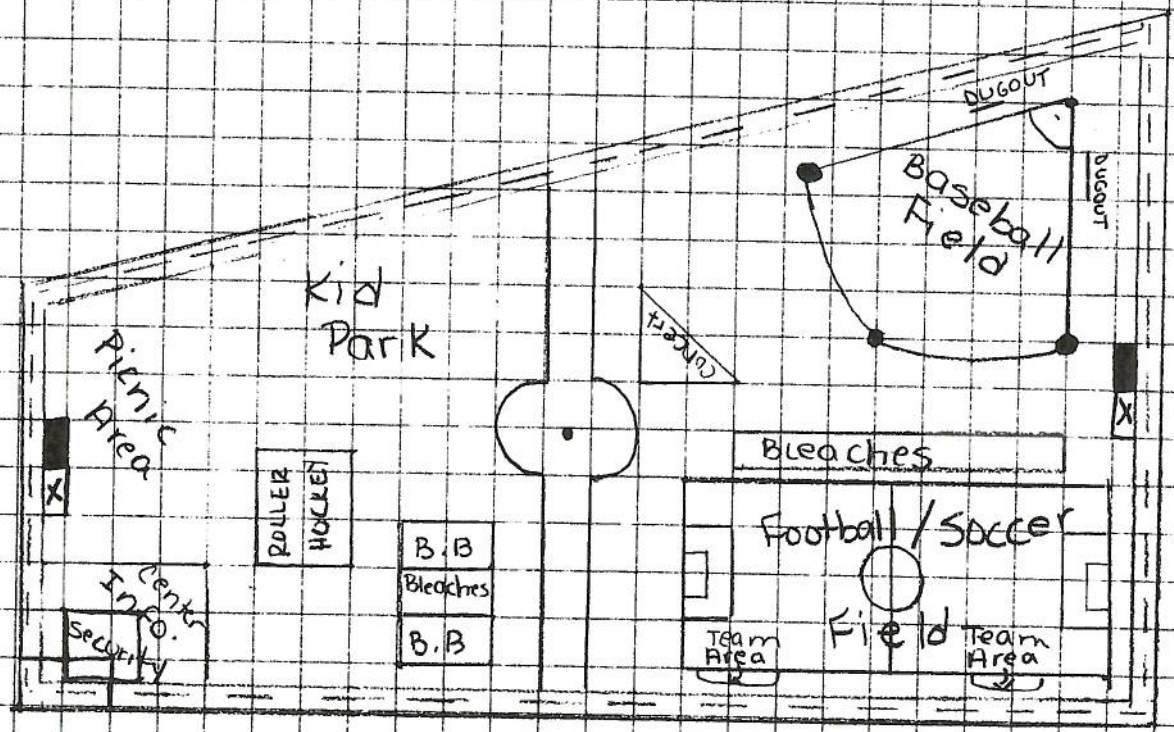
$x = \frac{2384}{940} = 2.536$

$x \approx 2'6''$ → model

940' → 4' model

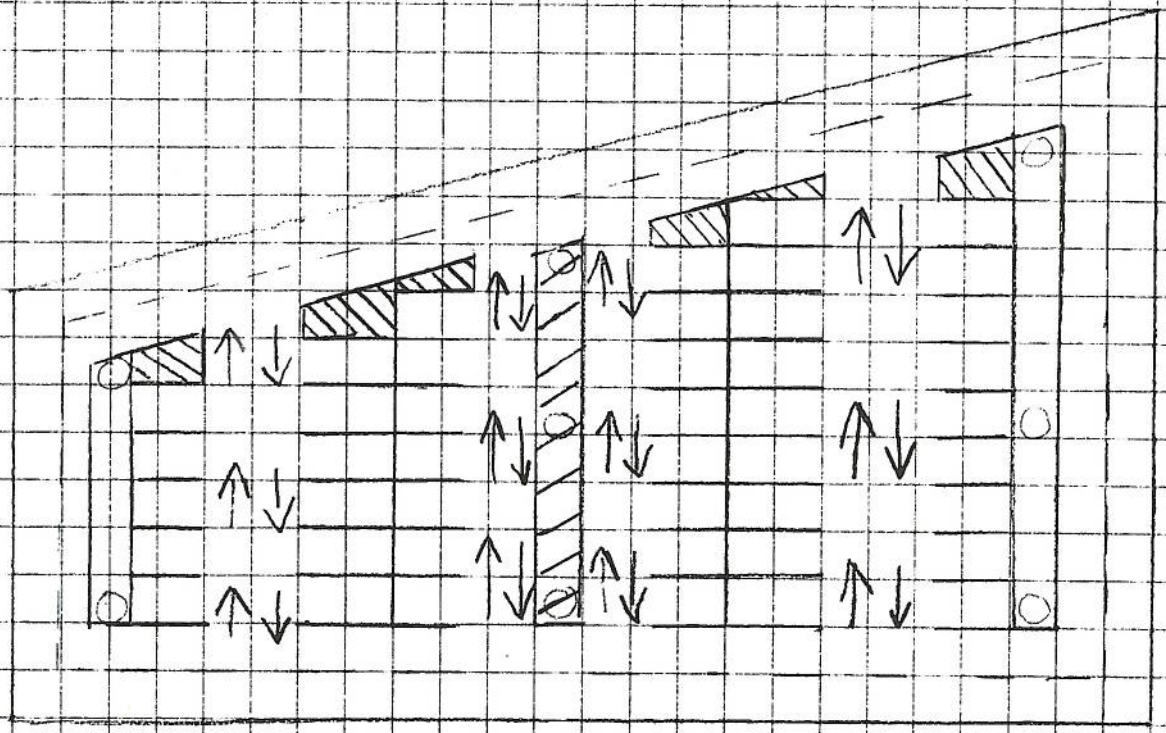
Scale $1/4'' \approx 40'$

PARK LAYOUT



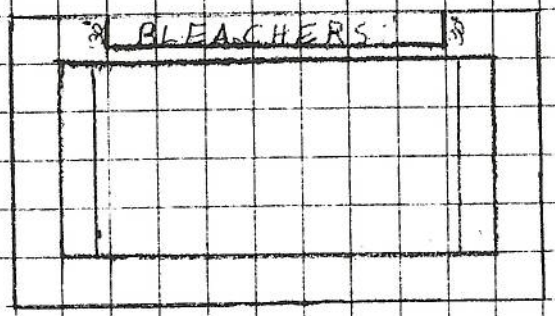
Scale 1/4" ≈ 40 ft

Parking Lot



Scale 1/4" ≈ 20 ft.

Football Field



BLEACHERS 30 FT. wide
280 FT. Long

Football Field 160 FT. wide
360 FT. Long

120 yd
× 3
360 feet Long

160 feet wide

360' ÷ 20' = 18" Long

160' ÷ 20 = 8" wide

280' ÷ 20' = 14" Long

30' ÷ 20' = 1.5" wide

Each □ ≈ 40 ft.

Model Scale 1" ≈ 20 ft
Soccer Field

Penalty Area = $\frac{44}{100} = \frac{x}{53}$

$x = \frac{2332}{100} \approx 23\text{yd} \times 3 \approx 69' \approx 3\frac{1}{2}$" model

P.A

Side to Side: $160' - 69' = 91' \approx 4\frac{1}{2}$" model $4\frac{1}{2} \div 2 \approx 2.3$"

18 yd = 54 ft ≈ 2.7" ≈ 3" model

Goal Area = $\frac{44}{100} = \frac{x}{20\text{yd}}$

$x = \frac{880}{100} = 8.8\text{yd} \approx 27\text{ ft} \approx 1\frac{1}{2}$" model

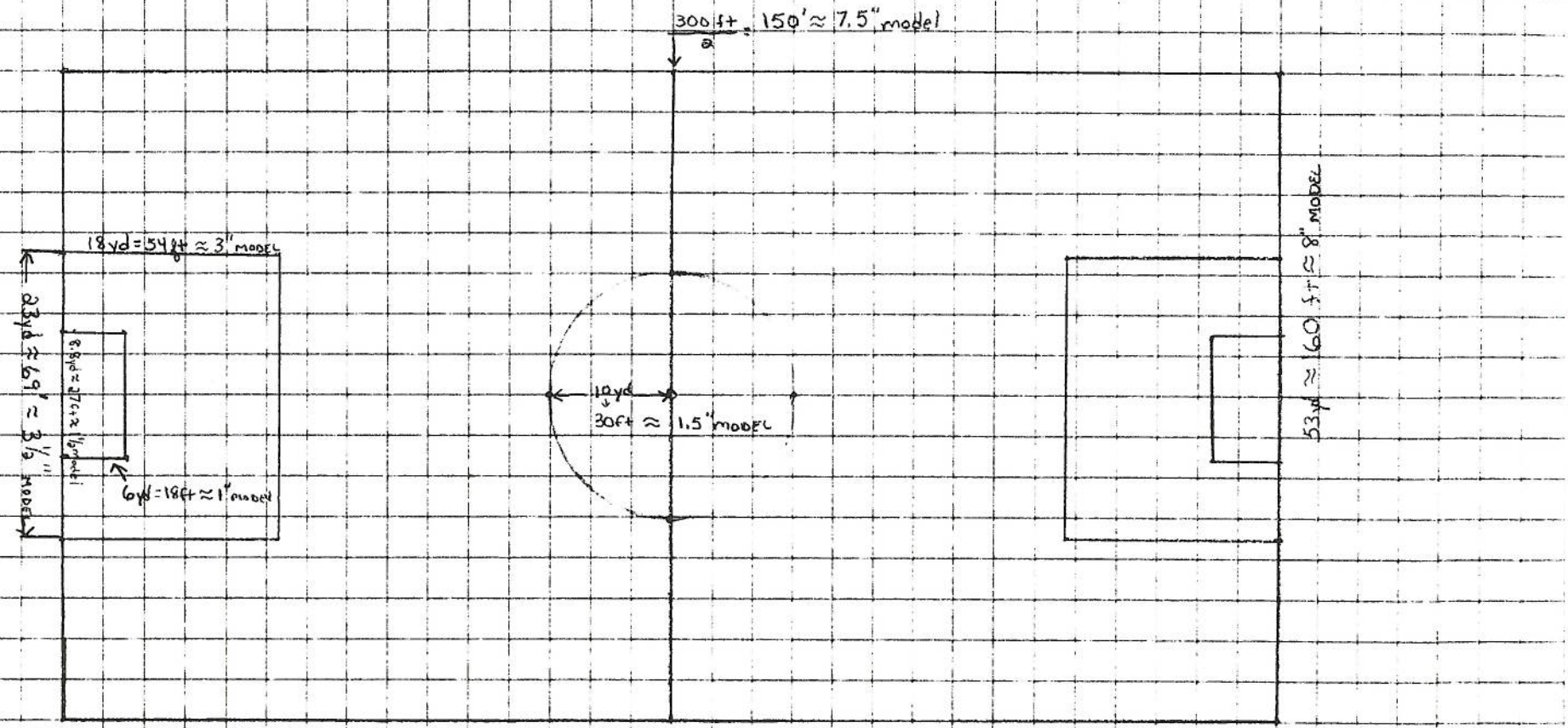
Penalty Area − Goal Area

$3\frac{1}{2}" - 1\frac{1}{2}" = 2" \div 2 = 1"$ from each side

Side to Side

6yd = 18 ft ≈ 1"

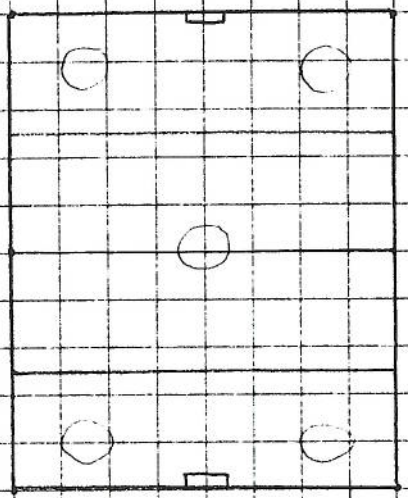
Center Radius: 10 yd = 30 ft ≈ 1.5 model



100 yd = 300 ft ≈ 15" model

scale ¼" ≈ 10'

Roller Hockey Rink

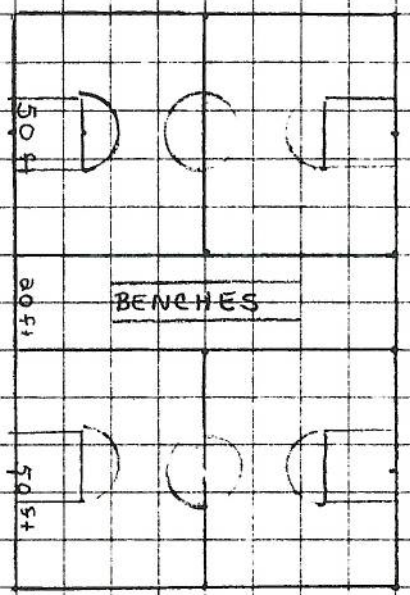


80 ft ÷ 20 ft ≈ 4 inch MODEL

Dimensions unavailable
for Roller Hockey Rink
Measurements were estimated

BASKET BALL

FREE THROW LINE 15 ft ≈ .75" model
.75" ÷ 2 = .375



Width
50 ft ÷ RO
2.5 inc
Mo

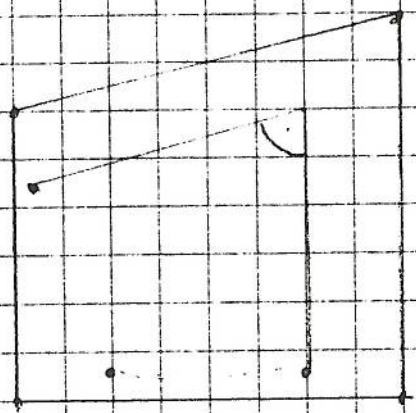
LENGTH 80'
¼ inc

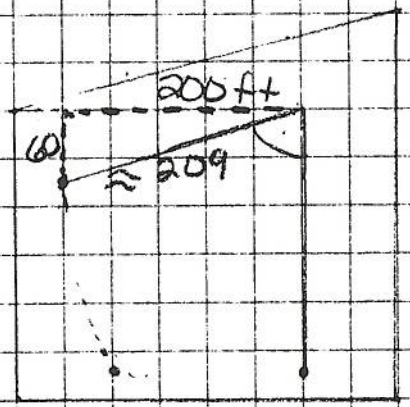
80 ft

CENTER COURT RADIUS = 6 ft ≈ .3" model

SCALE 1/4" = 10'

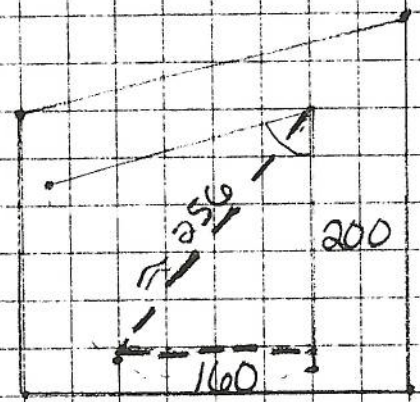
BASEBALL FIELD



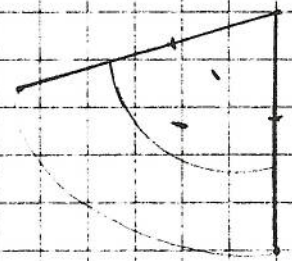


$40 \times 5 = 200$
$40 + 20 = 60$

$a^2 + b^2 = c^2$
$200^2 + 60^2 = 209^2$
$40,000 + 3,600 = 43,600$
208.80613
$\sqrt{43,600}$



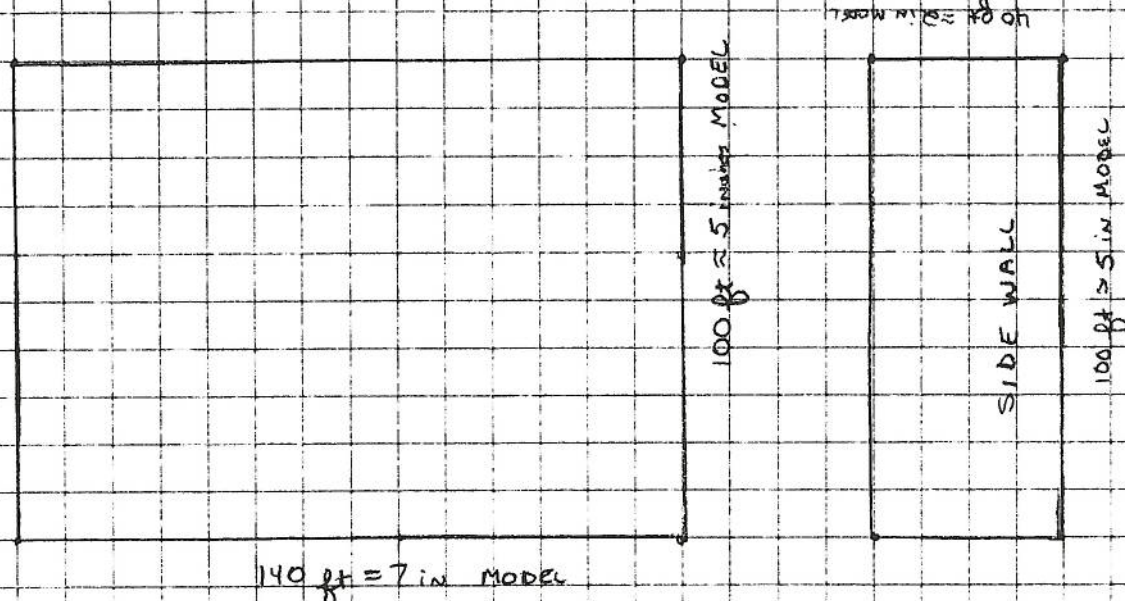
$a^2 + b^2 = c^2$
$200^2 + 160^2 = 256^2$
$40,000 + 26,000 = 65,600$
256.02497
$\sqrt{65,600}$

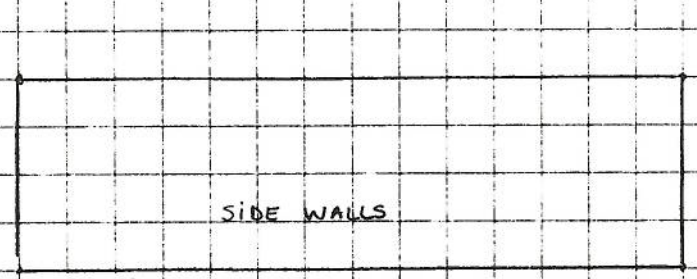


bases 90 ft ≈
Pitchers mou
35 ft ≈ 1.75

Scale 1/4" = [illegible]

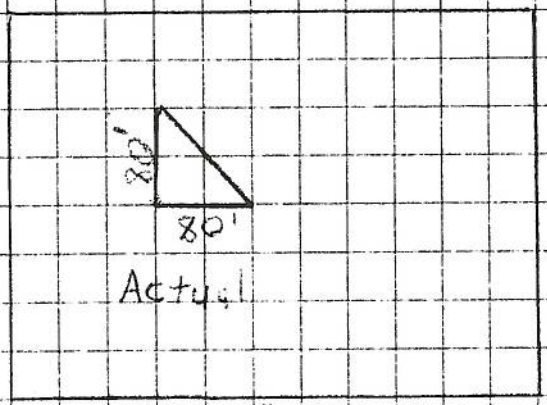
Security - Information Center



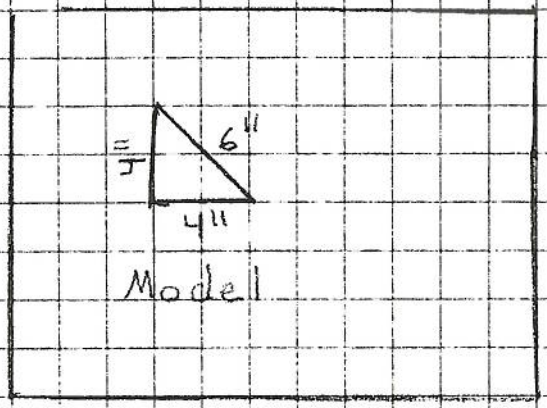


SCALE ½" = 10'

Concept



Actual



Model

SCALE 1/4" = 40'

80' ÷ 20' = 4"

80 ÷ 20 = 4"

$9^2 + 6^2 = c^2$

$4^2 + 4^2 = c^2$

$16 + 16 = 32$

$\sqrt{32} \approx 5.65$ ≈ 6" MODEL

Sides