

SAINTS GLOBAL ACTIVITY PLAN

SURVEYING

INTELLECTUAL CORE

Version 2026.1



Companion to the BRC: a series of one-hour activity sessions for use on weekly activity night or at home. Each session declares which requirements it contributes to.

THE CULMINATING EVENT

The five-sided lot survey

In Session 3, saints take the instrument, the tape, and the GPS to a five-sided lot next to the meeting place — a churchyard, a parking lot, a yard with five marked corners — and run a real radial survey. Each saint sets the instrument on the corner point, measures angle and distance to the four other corners, picks up five topographic features (a tree, a hydrant, a curb point, a shed, a flower bed), and reads each point a second time with handheld GPS for comparison. They also run a level off an assumed-elevation benchmark and record rod readings on each corner. The field notes, the GPS log, and the rod-reading sheet go home; the scaled map gets plotted from them in Session 4.

OUTDOOR — A FIVE-SIDED LOT ADJACENT TO THE MEETING PLACE, WITH FIVE MARKED OR PICKABLE CORNERS AND AT LEAST FIVE DISTINCT TOPOGRAPHIC FEATURES IN VIEW

4 SESSIONS IN THIS PLAN

SESSION 1 · INTELLECTUAL CORE

⌚ 60 min target

Safety, the deed, and the tools of the trade

Know the hazards, the legal frame, and what each instrument measures.

SESSION AIM

Open Step 1 and Step 3e in-session. Saints walk the first-aid responses for the injuries surveying produces, name the local poisonous plants and animals they would actually see, read a real property deed and identify its parts, and handle each instrument they will use next session — tape, level, transit or theodolite, and GPS. Saints leave with 1a and 3e marked and the tools-reference card.

🎯 WALK AWAY WITH

- Can demonstrate first aid for the injuries surveying produces and name local plants and animals to avoid
- Has read a real deed and can point to its legal description, boundaries, and recorded date
- Has handled the tape, the level, the transit, and the GPS and can name what each measures
- Has the tools-reference card to bring back to Session 2

📦 BRING / SET UP

- Full first-aid kit unpacked on the table: trauma shears, gauze, tape, irrigation bottle, ice pack, electrolyte powder, antihistamine, tick remover, snake-bite reference card
- One real recorded property deed (a copy is fine), printed full-page, for the group to read
- Each instrument the group owns or has borrowed: a steel or fiberglass tape (100 ft), a builder's level or auto-level with rod, a transit or theodolite (or a sighting compass plus protractor as the field substitute), and one handheld GPS unit
- A field-guide page or printout of the local poisonous plants and animals on or near the lot (poison ivy, oak, sumac, ticks, copperhead/rattlesnake range, stinging insects)
- Tools-reference handouts (one per saint)
- BRC printouts and pens

🔧 THE HOUR

BLOCK 1 · DISCUSSION Opener — Hand on a tape measure

⌚ 5 min

Pass a 100-foot tape around the room. Ask: "Where on a job, a yard, or a building have you actually used a tape — and what went wrong?" Take three or four answers — readings off, the tape not square, somebody held the end wrong. Surveying is an extension of the same problem: measure something carefully enough that another person, weeks later, can find it again from the numbers.

SESSION 1 · SAFETY, THE DEED, AND THE TOOLS OF THE TRADE (PAGE 2 OF 3)

THE HOUR — CONTINUED

BLOCK 2 · SKILL PRACTICE **First aid for what goes wrong on a lot**

⌚ 16 min

1. Walk the kit. Each item gets named and its use stated in one sentence. Saints handle the tools that look unfamiliar — the irrigation bottle, the tick remover, the trauma shears.
2. Run a fast scenario set, one line each: a saint takes a tape edge across the back of his hand and is bleeding; a saint has been on the lot in 95-degree sun for forty minutes and stops sweating; a saint pulls a tick off his calf; a saint brushes through poison ivy on the way to a corner; a saint twists his ankle stepping off a curb with the rod over his shoulder. For each, the group gives the first three actions and the point at which a leader gets called or 911 gets dialed.
3. Cover the local plants and animals on the field-guide page — what they look like, how to avoid them, and the first response if a saint contacts one. Surveying happens in the brush at lot corners; this is the part of the work nobody warns you about.
4. Each youth states one stop rule aloud — the condition under which the field work ends early no matter what is left to measure.
5. Leader confirms 1a: first aid steps correct, hazard identification specific to this area.

REQ 1A

BLOCK 3 · DISCUSSION **Read a real deed**

⌚ 16 min

1. Hand each youth a copy of the same recorded deed. Read the opening paragraph aloud together — the grantor, the grantee, the consideration, and the date the deed was recorded.
2. Find the legal description. Read it together, slowly. Identify the point of beginning (the POB), the bearings and distances around the boundary, and the way the description closes back on itself. Bearings read like "N 32° 15' E" and distances in feet — every line on the page is a measurement a surveyor produced.
3. Identify the recording stamp: book and page, county, recorder's signature. That stamp is what makes the document evidence in court.
4. Discuss why this matters. A deed is only as honest as the survey behind it; the survey is only useful if the field notes can be re-walked decades later. A sloppy survey moves a property line and ends in lawsuits.
5. Each youth picks one bearing-and-distance line off the deed and explains aloud what it would look like to walk on the ground.
6. Leader confirms 3e: deed parts named, importance explained.

REQ 3E

SESSION 1 · SAFETY, THE DEED, AND THE TOOLS OF THE TRADE (PAGE 3 OF 3)

THE HOUR — CONTINUED

BLOCK 4 · SKILL PRACTICE **Meet the four instruments**

⌚ 18 min

1. Lay the four instruments on the table: the tape, the level (with rod), the transit or theodolite, and the GPS. Each youth picks one up and handles it without the group watching for thirty seconds — feel the weight, find the obvious controls, read whatever scale is on it.
2. Walk the tape. The tape measures distance — feet and tenths. It needs two people: a head saint at the point you are measuring to, a tail saint at the instrument. Both must call out the reading at the same mark. Pull tight; a slack tape adds inches across a hundred feet.
3. Walk the level. The level establishes elevation differences. A saint at the instrument sights the cross-hair on a graduated rod held by another saint at the point; the reading is how far below the instrument's line of sight the ground is. Assign an arbitrary elevation to a benchmark — say 100.00 feet — and every other reading gives a real elevation.
4. Walk the transit or theodolite. The transit measures horizontal angles and, on most models, vertical angles. It sits over a point on a tripod, gets leveled with a bubble, and is sighted to a target — a rod, a flag, a fellow saint with a clear mark. The angle reads off a scale or digital display.
5. Walk the GPS. The GPS gives a position on the globe — latitude and longitude, or a projected coordinate. It is accurate to maybe ten feet on a consumer unit, better with averaging, worse under tree cover or near buildings. It is fast but not always right.
6. Each youth states which instrument he is least sure of and asks one question about it before leaving the table. The tools-reference card goes home for review.
7. Leader notes who will need an extra hand at Session 2 setup.

BLOCK 5 · REFLECTION **Close — Step 1 marked, tools in hand**

⌚ 5 min

1. Confirm on each saint's BRC: 1a and 3e marked after this session.
2. Each youth names the one instrument he will look up before Session 2 — the tools-reference card and a five-minute search are enough.
3. Next week the group sets up the instrument on a corner and plans the radial survey for Session 3. Bring the card and the BRC.

AT THE CLOSE · DEBRIEF

1. Which first-aid response would you not have known to give if a saint went down on the lot today?
2. Which line on the deed surprised you most when you tried to walk it in your head?
3. Which of the four instruments do you most want your hands on at Session 2?

☒ Mark 1a and 3e on each saint's BRC after this session. The field-survey requirements (3a, 3b, 3d) are earned at the Session 3 field event; do not mark them yet.

SESSION 2 · INTELLECTUAL CORE

⌚ 60 min target

Set up the instrument and plan the radial survey

Practice the setup, the math, and the field-notes before the field day.

SESSION AIM

Saints set up the transit on a temporary corner in the meeting hall or parking lot, level it, and read sample angles. They drill the trigonometry and the scale conversions they will need for plotting, practice running a level off a benchmark, and write the radial-survey plan for the five-sided lot. Saints leave with the field-notes worksheet started and 2a marked.

🎯 WALK AWAY WITH

- Has set up and leveled the instrument on a tripod and sighted a target accurately
- Can solve the basic trig and scale-conversion problems the radial survey will require
- Has run a level off an assumed benchmark and calculated one new elevation
- Has the field-notes worksheet started with the radial-survey plan in pen

📦 BRING / SET UP

- The transit or theodolite from Session 1 set up on its tripod, plus one spare if available
- The builder's level and rod from Session 1
- Three sighting targets — a range pole, a marked stake, or a saint holding a rod — placed at known distances around the room or parking lot
- A 100-ft tape and a marked corner point (a chalk X or a survey nail)
- Field-notes worksheet handouts (one per saint) for the radial-survey plan
- Calculators or pencil-and-paper for the trig and scale drills
- BRC printouts and pens

🕒 THE HOUR**BLOCK 1 · DISCUSSION Opener — Cards in hand**

⌚ 5 min

Round the room, one line each: "Which instrument did you read up on, and what is one thing the tools-reference card did not tell you?" Keep it brief. The check-in surfaces gaps before the group has tools in its hands. Saints who did not look anything up name that now so the group can pair them with someone who did.

SESSION 2 · SET UP THE INSTRUMENT AND PLAN THE RADIAL SURVEY (PAGE 2 OF 3)

THE HOUR — CONTINUED

BLOCK 2 · SKILL PRACTICE **Set the instrument, read three angles**

⌚ 22 min

1. Each youth takes the transit through a full setup, one at a time while the others watch and call out the next step. Spread the tripod legs, plant them firmly so the head sits roughly level. Mount the instrument on the tripod. Center it over the corner point using the plumb bob or the optical plummet — the instrument must be directly above the X on the ground, within a quarter inch.
2. Level the instrument. Rotate the telescope until two leveling screws line up parallel to the bubble; adjust those two screws against each other until the bubble centers. Rotate ninety degrees; level on the third screw. Re-check the original position. The bubble must hold across a full rotation, or the readings are wrong.
3. Set the horizontal circle to zero on a chosen reference target — the first marked sighting point. With the scope locked horizontally, rotate to the second and third targets and read the angle off the scale. Read each angle aloud to a partner who writes it in the field-notes worksheet.
4. Practice the redundancy check: at every point, take two readings, separated by a re-sighting. If the two readings disagree by more than a minute of arc, set up again — that is what a real surveyor does, and it is what catches the bad data before it becomes a wrong line on a map.
5. Each youth states the order of setup steps aloud, no notes, before he moves on. The order has to be habit; on the field day the group does not have time to think it through.

REQ 2A

BLOCK 3 · SKILL PRACTICE **The math, in the room**

⌚ 14 min

1. On a whiteboard or large pad, walk three light-trigonometry problems the radial survey will demand: (a) given an angle of 47° and a distance of 82.4 feet, compute the north and east offsets from the corner — that is sine and cosine; (b) given two corner offsets, compute the straight-line distance between them — Pythagoras; (c) given a bearing read on the transit and a distance taped on the ground, compute where a topographic feature plots on the map.
2. Work each problem together first, then each youth runs one on his own with a fresh number set. Calculators are fine; saints should be able to explain what they typed in, not just read the result.
3. Walk the scale conversion. The Session 4 map will be plotted on letter paper at a scale of $1" = 20$ ft, or $1" = 10$ ft if the lot is small. Each youth computes the inch-equivalent of three sample real-world distances (45 ft, 110 ft, 6.5 ft) at the target scale.
4. Each youth writes the three formulas — sine, cosine, Pythagoras — and the chosen scale on the back of his field-notes worksheet so they are with him in the field.

REQ 2A

SESSION 2 · SET UP THE INSTRUMENT AND PLAN THE RADIAL SURVEY (PAGE 3 OF 3)

THE HOUR — CONTINUED

BLOCK 4 · CREATIVE **Run a level, plan the survey**

⌚ 14 min

1. Set up the level on its tripod and level it the same way as the transit. Pick one point in the room or parking lot and assign it an assumed benchmark elevation of 100.00 feet. Hold the rod on the benchmark; sight through the level; record the rod reading. That number is the height of the instrument above the benchmark, added to 100.00 — call it the height of instrument, or H.I.
2. Move the rod to a second point. Sight and read. The elevation of that point is H.I. minus the new rod reading. Each youth runs the level on one new point and computes its elevation aloud, with another saint checking the arithmetic.
3. Hand out the field-notes worksheet and walk the radial-survey plan together. The instrument will sit on the corner of a five-sided lot. From that corner, every other corner and every topographic feature gets read by angle and distance. Each youth fills in the worksheet: the corner he expects to be at, the four other corners labeled A through D, and five topographic features the group will pick up (a tree, a hydrant, a curb point, a shed, a flower bed — to be confirmed on site).
4. Walk the field-day flow: the group rotates so each saint runs the instrument for at least one corner reading. The leader logs who measured what. Field notes must be legible — if a number cannot be read three weeks later, the measurement did not happen.
5. Leader confirms the in-session half of 2a — instrument setup correct, plan written. The plan gets executed at the field event in Session 3.

REQ 2A

REQ 3D

BLOCK 5 · REFLECTION **Close — The field day, locked**

⌚ 5 min

1. Confirm on each saint's BRC: 2a marked after this session.
2. Each youth confirms which corner he will set up on, which corner he will run the rod at, and which instrument he is responsible for at the field event. Write it on the worksheet.
3. The field event is the next session and runs outdoors. Bring layers, water, the worksheet, and a pencil — pen smears in rain and field-notes have to last.

AT THE CLOSE · DEBRIEF

1. Which step of the instrument setup gave you the most trouble — was it the centering or the leveling?
2. Which of the three math moves — sine, cosine, scale — do you want one more example of before the field day?
3. Which corner of the lot are you running, and which instrument is on your sheet?

☒ Mark 2a on each saint's BRC after this session. Note any saint whose setup was slow and pair him with a confident saint at the field event.

SESSION 3 · INTELLECTUAL CORE

⌚ 60 min target

The five-sided lot survey

Run the radial survey on a real lot and record every measurement carefully.

SESSION AIM

The whole hour is the field event. The group walks to the five-sided lot, sets the instrument on the corner, and runs the radial survey end to end — angles and distances to the four other corners, five topographic features, GPS readings on every point, and a level loop off a benchmark. Saints leave with the field-notes sheet complete and 3a, 3b, and 3d marked.

WALK AWAY WITH

- Has measured angle and distance to every corner of a five-sided lot and to five topographic features
- Has read the same points by GPS and recorded the differences from the taped distances
- Has run a level off a benchmark and calculated elevations for every corner
- Has a complete field-notes sheet — legible, signed, and ready to plot in Session 4

BRING / SET UP

- The transit or theodolite, its tripod, plus one spare instrument if available
- The builder's level and rod, plus a marked benchmark on the lot (a survey nail, a manhole bolt, a corner of a curb — anything that will not move)
- Two 100-ft tapes, range poles or marked stakes for sighting, and chalk or flagging tape for the four other corners and five topographic features
- One handheld GPS unit (more if available), with fresh batteries
- Each saint's field-notes worksheet started in Session 2
- Clipboards, pencils with erasers, a covered binder for the notes in case of rain
- BRC printouts and pens for the leader

THE HOUR**BLOCK 1 · DISCUSSION Opener — Walk the lot, name the corners**

⌚ 5 min

Walk the lot together once before any instrument comes out. Each saint, pointing: that is corner A, that is B, that is C, that is D — the instrument will sit on the fifth, the home corner. The five topographic features get pointed out too — the tree, the hydrant, the curb point, the shed, the flower bed. The plan from Session 2 is now standing on the ground in front of the group.

SESSION 3 · THE FIVE-SIDED LOT SURVEY (PAGE 2 OF 3)

THE HOUR — CONTINUED

BLOCK 2 · PHYSICAL **Set, sight, and measure every corner**

⌚ 22 min

1. The home-corner saint sets up the instrument on the home corner using the steps drilled in Session 2 — tripod planted, instrument centered over the X, leveled across two axes. Other saints stand at corners A through D with range poles or rods held vertical and steady.
2. Set the horizontal circle to zero on corner A as the reference. With the scope locked horizontally, rotate to corner B and read the angle. The note-taker writes it on the field-notes worksheet — angle, then a redundant second reading after re-sighting. Tape the distance from the home corner to corner B with the two-saint tape technique — both saints calling the reading at the same mark, tape pulled tight.
3. Repeat for corners C and D. Saints rotate so a different saint runs the instrument on at least one corner. Every angle and every distance gets read twice; disagreements get re-measured, not averaged.
4. Pick up the five topographic features the same way — angle off the reference, distance taped or paced. A paced distance gets noted as paced so the plotter knows the looser tolerance later.
5. Field notes are signed and timestamped at the bottom of each page as they finish. Leader walks the rows and confirms 3a — the angles, distances, and features are recorded, the notes are legible, the redundancy checks were done.

REQ 3A

BLOCK 3 · PHYSICAL **GPS the same points, run the level**

⌚ 16 min

1. Each youth, with the GPS in hand, walks to corners A through D and the five topographic features in turn. At each point, hold the GPS steady, wait for the position to settle (the accuracy reading drops as the unit averages), and record the GPS-measured straight-line distance from the home corner to that point. Note the GPS accuracy figure too — five feet, twelve feet, whatever the unit displays.
2. Compute the difference between the GPS distance and the taped distance for each point on the field-notes worksheet. Some will agree within feet; some will be off by ten or twenty under tree cover or near a building. Each youth writes one sentence on his sheet explaining why a given point disagreed — signal blockage, multipath off a wall, the saint not holding the unit still.
3. Move to the level. Set it up next to the home corner, level it across two axes. Read the rod on the assumed benchmark first — that gives the height of instrument. Then read the rod on each of the four other corners. The note-taker records every reading; each youth computes the elevation of one corner aloud and another saint checks the arithmetic.
4. Leader confirms 3b and 3d — the GPS comparison is recorded with reasons for differences, the elevations are correctly computed from the rod readings.

REQ 3B

REQ 3D

SESSION 3 · THE FIVE-SIDED LOT SURVEY (PAGE 3 OF 3)

THE HOUR — CONTINUED

BLOCK 4 · SKILL PRACTICE **Pack out, sign off, stage the map**

⌚ 12 min

1. Break down the instruments. Tripod legs collapsed, instrument back in its case with the lens caps on, level put away, tape rolled back into its housing — leave no equipment on the lot. Walk the lot once after pack-out and pick up flagging tape, chalk marks if temporary, and any pencil shavings or scrap paper.
2. Each saint reads his completed field-notes worksheet back to the leader, line by line. The leader catches anything illegible, missing, or unsigned and the saint corrects it before leaving the lot. Field notes that cannot be read are not data.
3. Walk together what each saint will need for Session 4 plotting: the worksheet, a sharpened pencil with eraser, a protractor, an engineering scale or a clean ruler with tenths, and a sheet of plain paper at least 8.5 by 11. The plot is built from these notes — if the notes are clean, the map is.
4. Each saint, one sentence: which measurement on his sheet he is least confident in, so he knows what to double-check during plotting.

BLOCK 5 · REFLECTION **Close — Notes home, map next week**

⌚ 5 min

1. Confirm on each saint's BRC: 3a, 3b, and 3d marked after this session — every requirement was earned in the field today.
2. Field-notes worksheets go home in the binder. Saints who left a sheet outside or smudged it past readability stay after to redraw it from the leader's master copy before the binder gets sealed.
3. Next week the group plots the map from these notes and finishes the badge. Bring the worksheet, a protractor, and a scale.

AT THE CLOSE · DEBRIEF

1. Which corner gave the biggest disagreement between your taped distance and the GPS reading — and what do you think caused it?
 2. Whose redundancy reading caught a number that would otherwise have been wrong on your sheet?
 3. Which line on your field notes are you most worried about being able to read three weeks from now?
- ☒ Mark 3a, 3b, and 3d on each saint's BRC after the field event today. The map (3c) and the reflection requirements (4a, 4b) are earned in Session 4.

SESSION 4 · INTELLECTUAL CORE

⌚ 60 min target

Plot the map and sign off

Turn the field notes into a scaled map, then talk about where surveying is going.

SESSION AIM

Saints plot the scaled map of the five-sided lot from the Session 3 field notes — radial layout with protractor and engineering scale, north arrow, scale bar, title block, every corner and topographic feature in place, elevations labeled. They walk emerging technologies and surveying careers, then sign off the BRC. Saints leave with a finished map, the badge complete, and one named next step.

🎯 WALK AWAY WITH

- Has produced a scaled map of the surveyed lot with north arrow, scale bar, title, and every measured point in place
- Can explain how GPS, drones, and laser scanning are changing surveying — and what each does poorly
- Has named a real career or further-training pathway in surveying that interests him
- Has a signed BRC

📦 BRING / SET UP

- Each saint brings: his Session 3 field-notes worksheet, a sharpened pencil with eraser, a protractor (six-inch or larger), an engineering scale or a ruler with tenths, and a sheet of plain paper at least 8.5 by 11
- One printed map-symbology and scale-bar reference per saint
- A photograph or short printout of a drone-survey output and a laser-scan point cloud, for the emerging-tech block
- A printed page on licensed-surveyor pathways: the regional licensing board, the local community-college survey program, two or three career titles that use surveying (civil engineer, GIS analyst, construction layout)
- BRC printouts (final review) and pens

🕒 THE HOUR**BLOCK 1 · DISCUSSION Opener — Notes on the table**

⌚ 5 min

Each saint puts his field-notes worksheet flat on the table where the leader can see it. Quick scan, one line each: "What is one number on your sheet you trust most, and one you are least sure of?" The opener is a last gut check before plotting begins. Trusted numbers go down first; uncertain ones get a re-read or a flag on the map.

SESSION 4 · PLOT THE MAP AND SIGN OFF (PAGE 2 OF 4)

THE HOUR — CONTINUED

BLOCK 2 · CREATIVE **Plot the map**

⌚ 26 min

1. Each youth picks his scale based on the lot size. 1 inch = 10 feet for a small churchyard, 1 inch = 20 feet for a larger lot. Write the scale in the title block in the bottom-right corner of the sheet, along with the saint's name, the date of the survey, and the lot identifier.
2. Mark the home corner near the middle of the sheet. Orient the page with north toward the top — draw the north arrow first, so every angle from the field notes is read off it.
3. Plot each of the four other corners in turn. Set the protractor center on the home corner, mark the angle from the north reference for that corner, draw a faint line in that direction, then measure the distance along the line using the engineering scale and mark the corner point with a small triangle. Label each corner A, B, C, D.
4. Plot the five topographic features the same way — protractor on the angle, scale on the distance, small symbol for the feature (a circle for the tree, a square for the hydrant, an X for the curb point, a rectangle for the shed, a leafy mark for the flower bed). Use the symbology reference card — every map reader should recognize the symbol.
5. Label every corner with its elevation from the rod readings. Add a scale bar in the bottom-left corner — a drawn line marked with feet so a reader can measure off the map without knowing the inch-scale, and a one-sentence note explaining the elevation datum ("Benchmark assumed at 100.00 ft").
6. Leader walks the room and confirms 3c — each map is accurate, complete, drawn neatly, with title block, north arrow, scale bar, every point, and every elevation.

REQ 3C

SESSION 4 · PLOT THE MAP AND SIGN OFF (PAGE 3 OF 4)

THE HOUR — CONTINUED

BLOCK 3 · SKILL PRACTICE **Where surveying is going**

⌚ 14 min

1. Lay out the printouts: a drone-survey output and a laser-scan point cloud. Explain what each is in one sentence — a drone flies a programmed grid and stitches photographs into a measured surface; a laser scanner stands on a tripod like a transit and shoots millions of distance readings to build a point cloud of the scene.
2. Walk the trade-offs. Drone survey covers a lot of ground fast but is limited by weather, regulations, and tree cover. Laser scanning is accurate to the millimeter but expensive, slow to process, and overkill for a five-sided lot. GPS is fast, free of line-of-sight, but inaccurate under canopy or near buildings — the group already saw that in Session 3.
3. The transit and the tape do not disappear when these tools arrive. Drones still need ground control points set by a transit; laser scans still need a known origin set by a tape; GPS still gets verified against a measured baseline. Human judgment about which tool to reach for and which reading to trust is what the licensed surveyor brings.
4. Each youth names one technology and one limit aloud — what it does well and where it fails. Leader confirms 4a.

REQ 4A

BLOCK 4 · DISCUSSION **Licenses, careers, and the next step**

⌚ 10 min

1. Walk the pathways printout. A licensed surveyor in this state earns a degree (often a two-year survey technology program or a four-year geomatics degree), passes the Fundamentals of Surveying exam, works under a licensed surveyor for a set number of years, then passes the Principles and Practice exam. Licensing exists because a surveyor's signature sets property lines that hold up in court — the public has to be able to trust the signature.
2. Name three kinds of surveying briefly: boundary (what the group did today, scaled down), construction layout (staking out a building foundation or a road), and geodetic (measuring across continents for mapping and navigation systems). Each uses the same instruments at different scales.
3. Name three nearby careers that use survey skills without being a licensed surveyor: civil engineer, construction-project manager, GIS analyst. Each reads maps and field notes daily; each pays well; each is open to a saint who finishes high school with strong math.
4. Each youth names one realistic next step — a community college course, a summer day with a working surveyor (most will say yes to one), a free online course in GIS, a survey-tech program he wants to look into. Leader confirms 4b.

REQ 4B

SESSION 4 · PLOT THE MAP AND SIGN OFF (PAGE 4 OF 4)

THE HOUR — CONTINUED

BLOCK 5 · REFLECTION **Close — BRC sign-off**

⌚ 5 min

1. Walk the BRC with each saint, requirement by requirement. Mark what is done. Note anything outstanding with a concrete deadline before the Board of Review.
2. Each saint signs his name in the title block of his finished map. The map goes home; the field-notes worksheet stays in the leader's binder as the source of record.
3. Leader gives one short, specific note to each saint by name: one measurement, one math move, or one map element he did well this month that earned the badge.

AT THE CLOSE · DEBRIEF

1. Which point on the map gave you the most trouble plotting — and was the trouble in the field notes or in the protractor work?
 2. Which surveying technology would you most want to try next, and why?
 3. What is one realistic next step you would actually take in the next six months toward this field?
- ☒ *Mark 3c after the map is checked in Block 2, 4a after Block 3, and 4b after Block 4. With Step 1 done in Session 1, 2a in Session 2, and 3a, 3b, 3d done in Session 3, the BRC should fully sign off tonight.*

HANDOUT 1 OF 2

FROM SESSION 1 — MEET THE FOUR INSTRUMENTS

Surveying Tools — Reference Card

Bring this to Session 2. The four instruments do four different jobs; the radial survey uses all of them.

SURVEYING · FIELD CARD

Know what each instrument measures.

The radial survey uses all four. Know what each one reads and where it fails before the field day.

1 TAPE

100-foot steel or fiberglass, on a reel

MEASURES

Horizontal distance between two points.
Reads in feet and tenths of a foot.

SETUP

Two saints — one at each end, tape pulled tight, both calling the reading.

WATCH FOR

A slack tape adds inches across 100 feet.
Sag on long pulls; brush or grade interfering.

**2 LEVEL (with rod)**

Builder's level or auto-level on a tripod

MEASURES

Elevation differences between points.
Reads rod heights in feet and hundredths.

SETUP

Level the instrument on tripod, rod-saint holds the rod plumb on the point.

WATCH FOR

A leaning rod gives a high reading.
Bubble drifting between sightings; long sights past 200 feet.

**3 TRANSIT or THEODOLITE**

On a tripod, sighted to a target

MEASURES

Horizontal and vertical angles between sights.
Reads degrees, minutes, seconds on a scale or display.

SETUP

Center over the point with a plumb bob, level on two axes, sight a target.

WATCH FOR

A bubble that drifts means a wrong angle.
Off-center setup; sighting the wrong part of a target.

**4 HANDHELD GPS**

Consumer unit, not a survey-grade receiver

MEASURES

Position on the globe — latitude and longitude.
Reads coordinates; distances are computed between points.

SETUP

Hold steady at the point, wait for the accuracy reading to settle.

WATCH FOR

Trees and walls cut accuracy to 20 feet or worse.
Multipath off buildings; consumer units are not survey grade.



Take readings twice and check the difference before you write the number down.

Print this handout for in-person reference during session 1 — meet the four instruments.

HANDOUT 2 OF 2

FROM SESSION 2 — RUN A LEVEL, PLAN THE SURVEY

Radial Survey — Field Notes

Fill the header in pen before the field event. Every angle, distance, and rod reading goes in this sheet — it is the source of the map in Session 4.

SURVEYING · WORKSHEET

Record every measurement here.

Fill the header in pen before the field event. The map in Session 4 is plotted from this sheet.

SAINT _____ DATE _____
 CORNER ID (home) _____ INSTRUMENT _____
 WEATHER _____ REFERENCE TARGET (0°) _____

1 ANGLE, DISTANCE, AND GPS

read each twice; flag any disagreement

POINT	ANGLE (° ' ")	TAPED (ft)	GPS (ft)	DIFF (ft)	REASON / NOTE
A (corner)					e.g. paced; brush; clean
B (corner)					
C (corner)					
D (corner)					
F1 (feature)					
F2 (feature)					
F3 (feature)					
F4 (feature)					
F5 (feature)					

2 LEVELING

assumed benchmark elevation = 100.00 ft unless noted

POINT	ROD READING (ft)	H.I. (ft)	ELEVATION (ft)	CHECK BY
Benchmark	first reading sets H.I.		= 100.00 ft (assumed)	
Corner A				
Corner B				
Corner C				

3 FIELD SIGN-OFF

READ BACK TO THE LEADER BEFORE LEAVING

- ☐ Every angle and every distance was read twice. Disagreements were re-measured.
☐ All entries are legible enough to read three weeks from now. Signed: _____

Bring this sheet back to Session 4 — the map is plotted from these numbers.

Print this handout for in-person reference during session 2 — run a level, plan the survey.