

Sample - Educational Material

WRITER'S NOTE: Written as part of a study guide regarding Circle Theorem.

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Interpol needs to infiltrate the Syndicate's secret hideout, built in a remote part of the Chihuahuan Desert. Their intelligence reports confirm that this hideout is full of illegal ammunition. The Syndicate has spent the past five years building a highly secure, perfectly circular den, with bunkers bordering its edge. Interpol has one chance to infiltrate the hideout, find the location of the den, and drop a gas bomb in the middle to sedate the Syndicate's members; their agents will then have enough time to get in, recover the illegal weapons, and arrest the Syndicate.

But first — they have to find the right den.

The most accurate method of detection, without giving away their position, is via drone which will survey the desert to detect human activity. The most human activity will be on the perimeter of the hideout, where the bunkers are located. The drone needs to find the points, or walls, of these bunkers in order to map out the circular den. Once the den is mapped out, Interpol will be able to move in with surgical precision. The snatch and jerk operation must run as smoothly as a Swiss watch — This is the only opportunity Interpol has to successfully catch The Syndicate.

Sharon Bates is on a team comprised of the agency's brightest minds. They are on a remote base waiting for data from the drone, but after figuring out the location of only three bunkers, the drone malfunctions and is unable to continue transmitting data. It seems one of the organisation's "best and brightest" forgot to charge the drone. Without it, the entire operation is in jeopardy and the Senior Officer decides they must abort the mission.

But Sharon knew a way to trace out the map of the circular hideout, based on the three bunker locations. Her boss is skeptical of her claim. Sharon says that since the locations are non-linear, there will only ever be one unique circle passing through them. Ignoring the protests from the other officers, she takes over a whiteboard to show her proof: Sharon draws out the given non-linear points, A, B, and C.

First, Sharon needs to prove that the given points are concyclic. We know that in a circle, the perpendicular originating from the center bisects the chord. On constructing the perpendicular bisectors of AB and BC, we observe that they intersect at a point, O. O would serve as the center of our circle if we can prove that the points A, B, and C are equidistant from it. Constructing the lines OA and OB gives birth to the triangles OAM and OBM. With side AM equal to side BM, angles OMA and OMB both equal 90 degrees, and the common edge OM; therefore triangles OAM and OBM can be proven congruent. This means the line segments OA and OB are equal to each other, since they form the corresponding parts of congruent triangles.

In the same way, Sharon demonstrates that OB and OC can be shown to be equal to each other.

This means that OA , OB , and OC are equal to each other and form the radii of the circle passing through them — the perimeter of the Syndicate's den.

For this to work perfectly, Sharon must prove that this circle is unique.

"Let's imagine that there's another circle," she explains, "this time with the center O that also passes through A , B , and C . Once again, constructing a perpendicular from the center O should bisect the chord AB at M . This means that OM is the perpendicular bisector of AB ."

She turns around and sees that her Senior Officer is rapt, as are her colleagues. A bright red clock slowly counts down in the corner — there isn't much time left.

"Since a line segment can only have one perpendicular bisector, we can conclude that OM and OM are the same. The center of circle O coincides with the center of O , proving that there is only one unique circle."

Sharon puts down the marker and turns from the whiteboard to face her colleagues.

Everyone is convinced that her proof is right, and they use the data collected from the drone to determine the exact center of the Syndicate's den. The mission goes ahead as planned, and is a roaring success thanks to Sharon's use of a Circle Theorem. The illegal arms are recovered and the leader of the Syndicate is captured and arrested by Interpol, thanks to Sharon's math proof.

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