Shake, Rattle, and Roll Anchor Papers

A seismometer is an instrument that responds to ground motions, such as caused by earthquakes, volcanic eruptions, and explosions. Seismometers are usually combined with a timing device and a recording device to form a seismograph. After an earthquake, you are given seismograph readings from three locations in Virginia. Your job as a scientist is to determine where the epicenter of the earthquake is located.

- Near Tappahannock at A (2,1), the epicenter is 5 units away.
- Near Farmville at B (-2, -2), the epicenter is 6 units away.
- In Near Harrisonburg at C (-6, 4), the epicenter is 4 units away.

Could a person living in Norfolk, VA feel the effects of the earthquake? Mathematically, justify your answer and provide a labeled diagram which models the problem and shows all variables to which you will refer.

Desmos calculator link

1. What are the coordinates of the epicenter?

2. People could feel the earthquake up to 9 miles from its epicenter. What equation could represent the circle that encompasses this region?

3. Could a person in Norfolk, Virginia (5, -4) feel the effects of the earthquake? Use the equation of a circle created above to justify your answer.

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STUDENT A

1. What are the coordinates of the epicenter?

$(-2, 4)$ All three circles intersect at $(-2, 4)$

2. People could feel the earthquake up to 9 miles from its epicenter. What equation could represent the circle that encompasses this region?
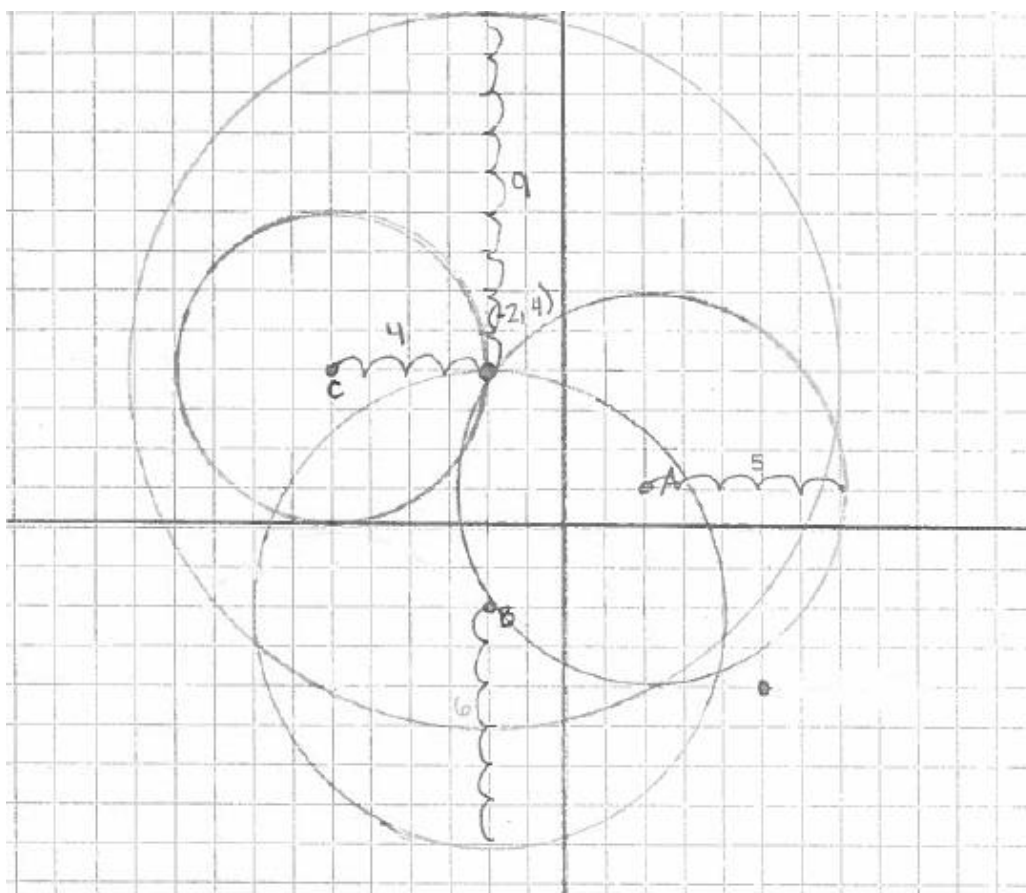
$(x+2)^2 + (y-4)^2 = 9^2$

center $(-2, 4)$ radius $= 9$

3. Could a person in Norfolk, Virginia (5, -4) feel the effects of the earthquake? Use the equation of a circle created above to justify your answer.

No

$(5+2)^2 + (-4-4)^2 = 9^2$
$7^2 + (-8)^2 = 81$
$49 + 64 = 81$

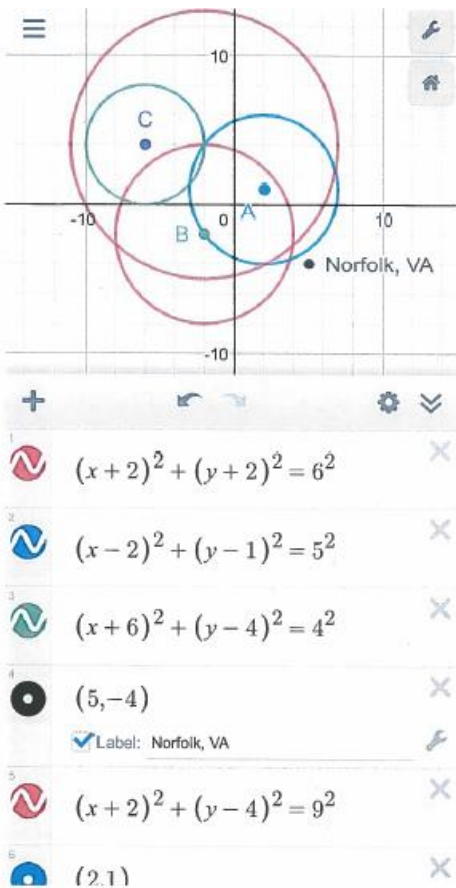## STUDENT B

1. What are the coordinates of the epicenter?

   $(-2, 4)$

2. People could feel the earthquake up to 9 miles from its epicenter. What equation could represent the circle that encompasses this region?

   $(x+2)^2 + (y-4)^2 = 9^2$

3. Could a person in Norfolk, Virginia (5, -4) feel the effects of the earthquake? Use the equation of a circle created above to justify your answer.

   No $(7)^2 + (-8)^2 = 81$

   $49 + 64$ $113 \overset{?}{=} 81$

                          81

$(x+2)^2 + (y+2)^2 = 6^2$

$(x-2)^2 + (y-1)^2 = 5^2$

$(x+6)^2 + (y-4)^2 = 4^2$

$(5, -4)$
✔ Label: Norfolk, VA

$(x+2)^2 + (y-4)^2 = 9^2$

$(2, 1)$

STUDENT C

https://www.desmos.com/calculator/mfupddd8w4

1. What are the coordinates of the epicenter?

$(1,1)$

2. People could feel the earthquake up to 9 miles from its epicenter. What equation could represent the circle that encompasses this region?

$$(x-1)^2 + (y-1)^2 = 9^2$$

3. Could a person in Norfolk, Virginia (5, -4) feel the effects of the earthquake? Use the equation of a circle created above to justify your answer.

No

$$(5-4)^2 + (-4-1)^2 = 9^2$$
$$1^2 + (-5)^2 = 9^2$$

$$1 + 25 = 9^2$$
$$26 = 81$$
No

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STUDENT D

1. What are the coordinates of the epicenter?

$(-2, -2)$

$(2, 1) + (-2, -2)$

$\dfrac{2 + -2}{2}, \dfrac{1 + 2}{2} \quad \dfrac{0}{2}, \dfrac{1}{2} + \left(\dfrac{-6}{2}, \dfrac{4}{2}\right)$

2. People could feel the earthquake up to 9 miles from its epicenter. What equation could represent the circle that encompasses this region?

$\sqrt{(-2-2)^2 + (2-1)^2} = \boxed{1}$

$\sqrt{0+1} = \sqrt{1}$

3. Could a person in Norfolk, Virginia (5, -4) feel the effects of the earthquake? Use the equation of a circle created above to justify your answer.

$(1, 1) \quad (5, -4)$

$\sqrt{(1-5)^2 + (1--4)^2}$

$\sqrt{(-4)^2 + (5)^2}$

$\sqrt{16 + 25}$

$= \sqrt{41}$

yes

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STUDENT E

$(x-h)^2 + (y-k)^2 = r^2$
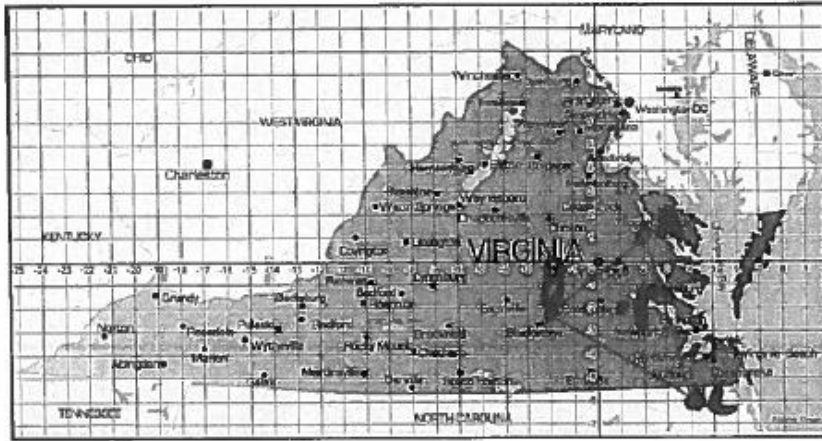
$(h,k) = center$

$r = radius$

Rich Mathematical Task – Geometry– *Shake, Rattle, and Roll!*

Shake, Rattle, and Roll!

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- In Near Harrisonburg at C (-6, 4), the epicenter is 4 units away. $(x-6)^2 + (y-4)^2 = 4^2$

Could a person living in Norfolk, VA feel the effects of the earthquake? Mathematically, justify your answer and provide a labeled diagram which models the problem and shows all variables to which you will refer.

1. What are the coordinates of the epicenter?

   $(1, -2)$

2. People could feel the earthquake up to 9 miles from its epicenter. What equation could represent the circle that encompasses this region?

   $1(9 miles)^2$

3. Could a person in Norfolk, Virginia (5, -4) feel the effects of the earthquake? Use the equation of a circle created above to justify your answer.

   Maybe?