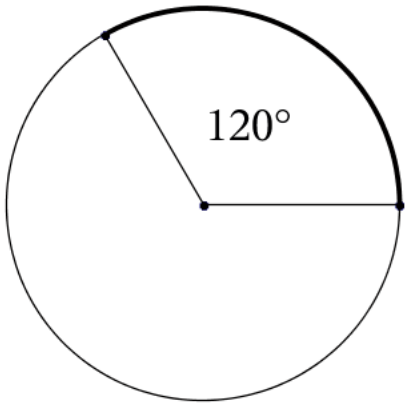
d=3 *inches*



You have a paint roller that has a diameter of 3 inches. You push the roller against the wall and it travels 120°

1) Number of revolutions

$\frac{120}{360} \blacktriangleright \frac{1}{3}$ number of revolutions $= \frac{1}{3}$

2) Measure of the angle in radians

$120 \cdot \frac{\pi}{180} \blacktriangleright \frac{2 \cdot \pi}{3}$ so $\theta = \frac{2 \cdot \pi}{3}$ radians

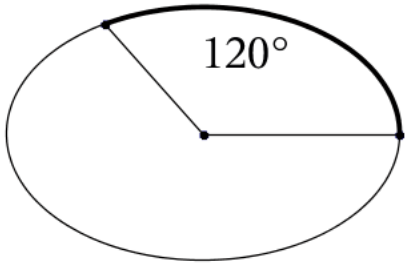
3) Length of of the arc

$s = \theta r$ so $s = \left(\frac{2 \cdot \pi}{3}\right)\left(\frac{3}{2}\right) = \pi$ inches

4) Amount of paint coverage linearly

π inches ≈ 3.142 inches

$d=3$ *inches*



$\theta=\frac{2\cdot\pi}{3}$ radians $r=\frac{3}{2}$ inches

$s=\pi$ inches

5) if it took 10 seconds to roll the roller, then

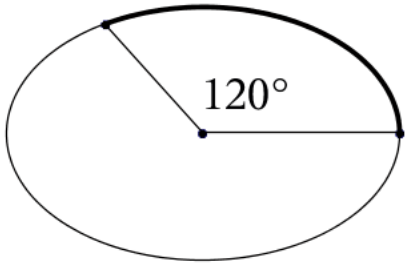
5a) Find linear speed in inches/second

$$\text{linear speed}=\frac{s}{t}=\frac{\theta r}{t}$$

$$=\frac{\left(\frac{2\cdot\pi}{3}\right)\cdot\frac{3}{2}\,inches}{10\ seconds}$$

$$=\frac{\pi}{10}\ \frac{in.}{\text{sec.}}$$

$d=3$ *inches*



$\theta=\frac{2\cdot\pi}{3}$ radians $r=\frac{3}{2}$ inches

s = π inches

5) if it took 10 seconds to roll the roller, then

5b) Find linear speed in feet/second

$$\text{linear speed} = \frac{s}{t} = \frac{\theta r}{t}$$

$$= \frac{\left(\frac{2\cdot\pi}{3}\right)\cdot\frac{3}{2}\,inches}{10\ seconds}$$

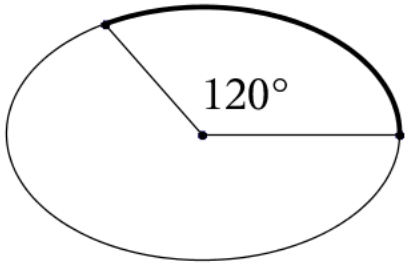
$$= \frac{\pi}{10}\ \frac{in.}{\text{sec.}}$$

Now convert to $\frac{ft.}{\text{sec}}$

$$= \left(\frac{\pi}{10}\ \frac{in.}{\text{sec.}}\right)\left(\frac{1\ ft.}{12\ in.}\right)$$

$$= \frac{\pi}{120}\ \frac{ft.}{\text{sec.}}$$

$d=3$ *inches*



$\theta=\frac{2\cdot\pi}{3}$ radians $r=\frac{3}{2}$ inches

$s=\pi$ inches

5) if it took 10 seconds to roll the roller, then

5c) Find linear speed in feet/minute

$$\text{linear speed} = \frac{s}{t} = \frac{\theta r}{t}$$

$$= \frac{\pi}{120}\frac{ft.}{\text{sec.}}$$

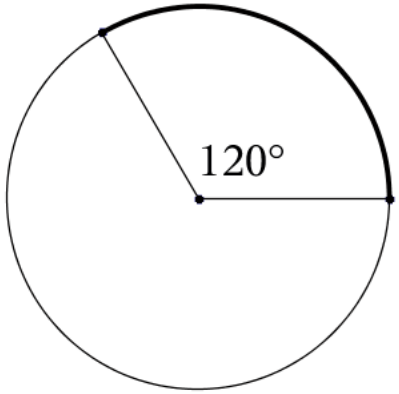
Now convert to $\frac{ft.}{\text{min.}}$

$$= \left(\frac{\pi}{120}\frac{ft.}{\text{sec.}}\right)\left(\frac{60\ \text{sec.}}{1\ \text{min.}}\right)$$

$$= \frac{60\pi}{120}\frac{ft.}{\text{min.}}$$

$$= \frac{\pi}{2}\frac{ft.}{\text{min.}}$$

$d=3$ *inches*



$\theta=\frac{2\cdot\pi}{3}$ radians $r=\frac{3}{2}$ inches $s=\pi$ inches

Linear speed $=\frac{\pi}{10}\frac{in.}{\text{sec.}}$

$=\frac{\pi}{120}\frac{ft.}{\text{sec.}}$

$=\frac{\pi}{2}\frac{ft.}{\text{min.}}$

6) if it took 10 seconds to roll the roller, then

6a) Find angular speed in radians per second

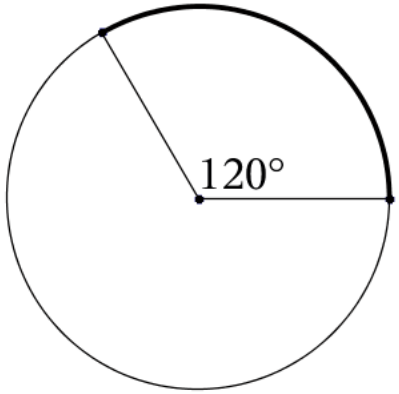
angular speed $=\frac{\theta}{t}$

$=\frac{\frac{2\cdot\pi}{3}}{10}\frac{radians}{\text{sec.}}$

$=\frac{2\cdot\pi}{3}\cdot\frac{1}{10}\frac{radians}{\text{sec.}}$

$=\frac{\pi}{15}\frac{radians}{\text{sec.}}$

$d=3$ *inches*



$\theta=\frac{2\cdot\pi}{3}$ radians $r=\frac{3}{2}$ inches $s=\pi$ inches

Linear speed $=\frac{\pi}{10}\frac{in.}{\text{sec.}}$

$=\frac{\pi}{120}\frac{ft.}{\text{sec.}}=\frac{\pi}{2}\frac{ft.}{\text{min.}}$

Angular speed $=\frac{\pi}{15}\frac{radians}{\text{sec.}}$

6) if it took 10 seconds to roll the roller, then

6a) Find angular speed in radians per minute

angular speed $=\frac{\theta}{t}$

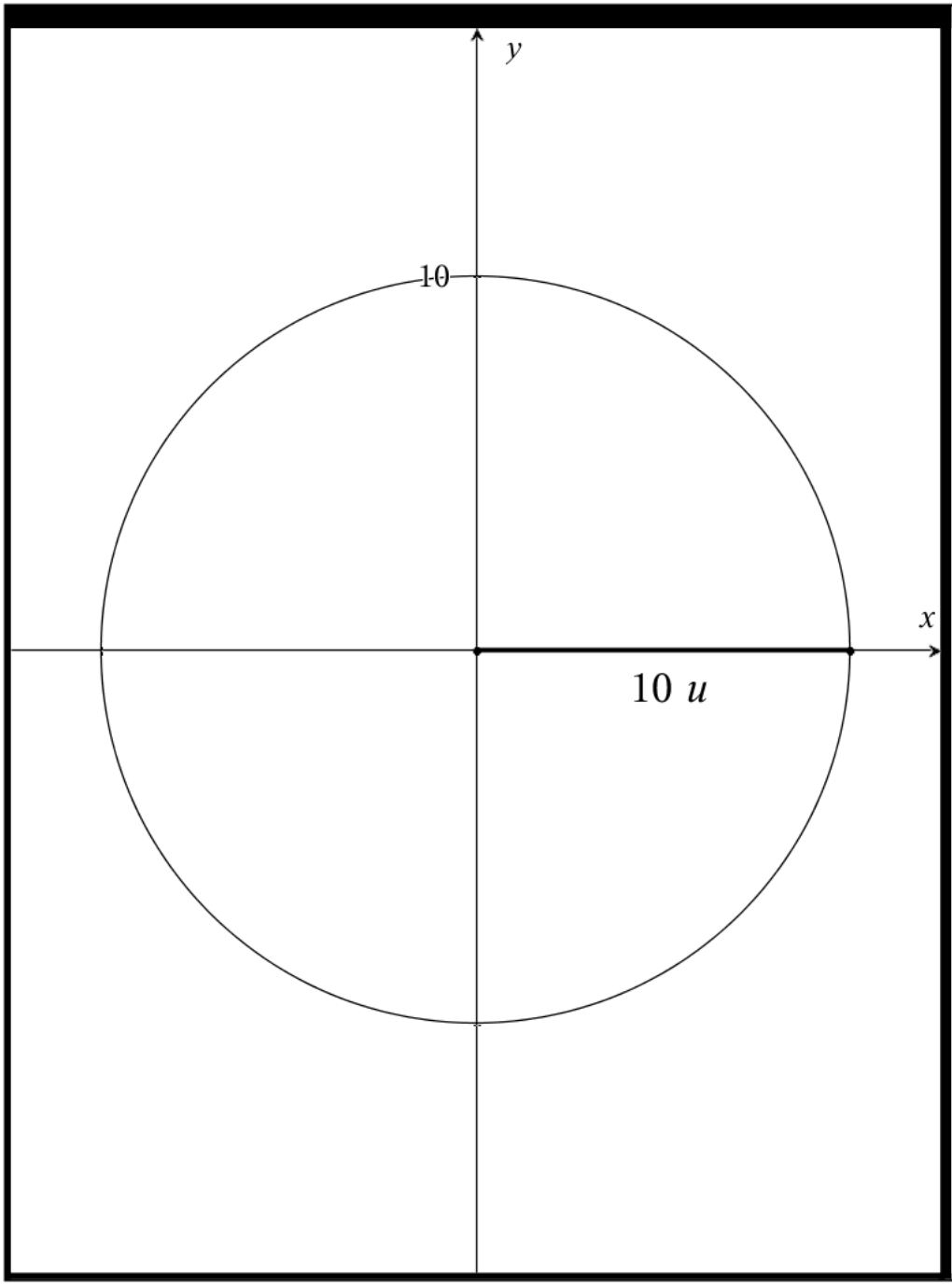
$=\frac{\pi}{15}\frac{radians}{\text{sec.}}$

Now convert to $\frac{radians}{minute}$

$=\left(\frac{\pi}{15}\frac{radians}{\text{sec.}}\right)\left(\frac{60\text{ sec.}}{1\text{ min.}}\right)$

$=\frac{60\pi}{15}\frac{radians}{\text{min}}$

$=4\cdot\pi\frac{radians}{\text{min}}$



7. You are pulling a cart and the cart's wheel is 20 inches in diameter and you notice that the wheel is making 1.8 revolutions per second

1.8 revolutions per second

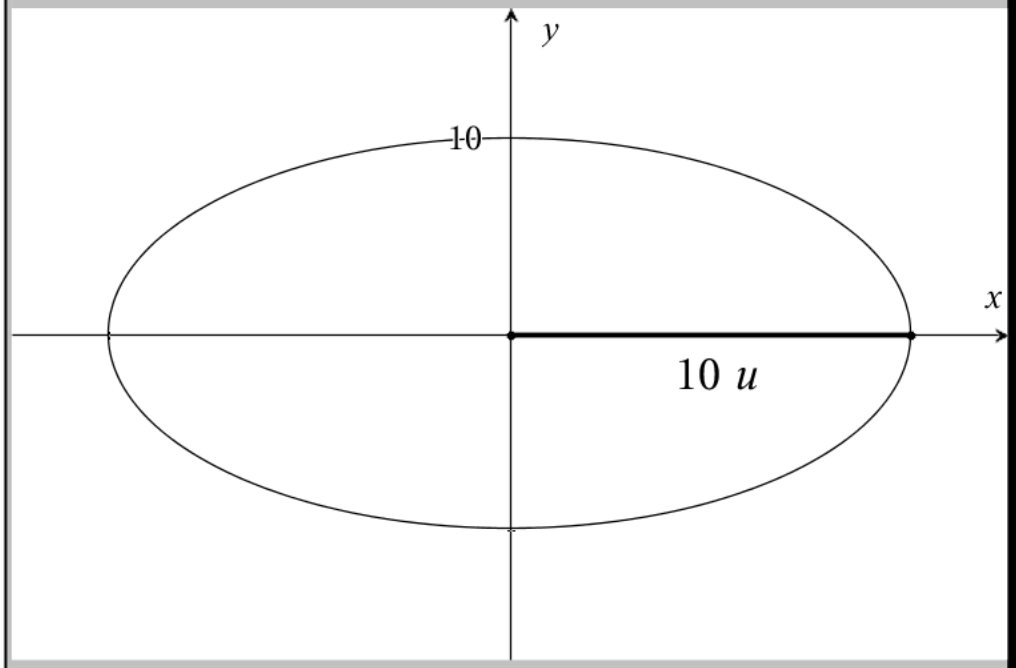
Angular speed $= \frac{1.8\ rev.}{\text{sec.}} \cdot \frac{360°}{rev}$

$= \frac{648°}{\text{sec}}$

7a) Angular speed $= \frac{1.8\ rev.}{\text{sec.}} \cdot \frac{2\pi}{rev}$

$= \frac{3.6\pi\ radians}{\text{sec}}$

Note Linear Speed =(Angular speed)(radius)



Angular speed $= \frac{1.8\ rev.}{\text{sec.}} \cdot \frac{2\pi}{rev}$

$= \frac{3.6\pi\ radians}{\text{sec}}$

$\theta = 3.6 \cdot \pi\ radians$ $\quad r = \frac{20}{2} = 10$ inches

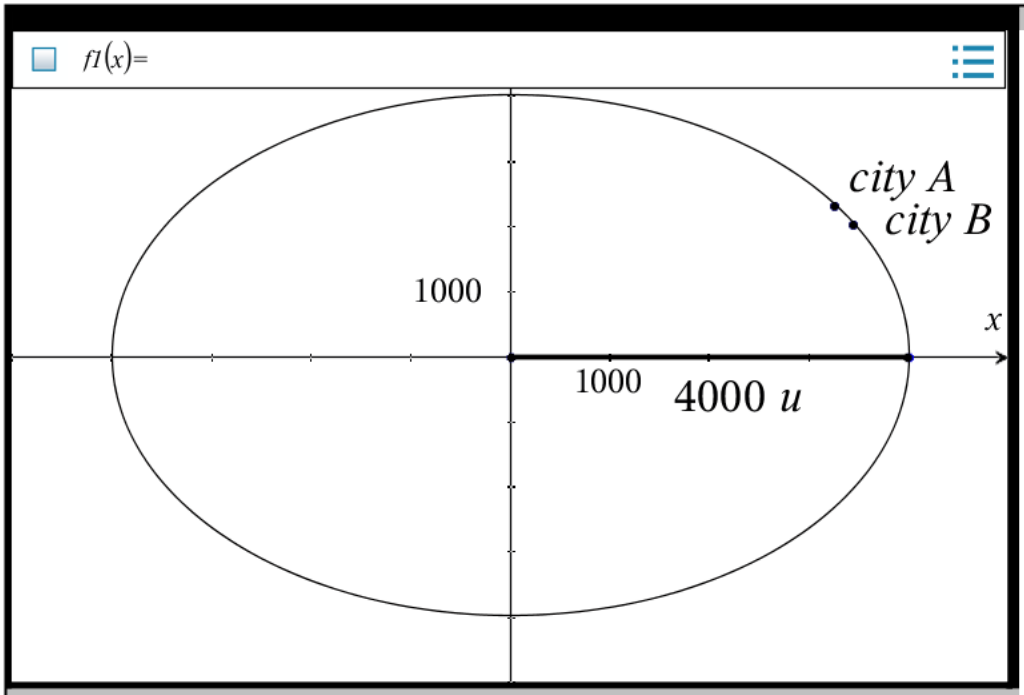
7. You are pulling a cart and the cart's wheel is 20 inches in diameter and you notice that the wheel is making 1.8 revolutions per second

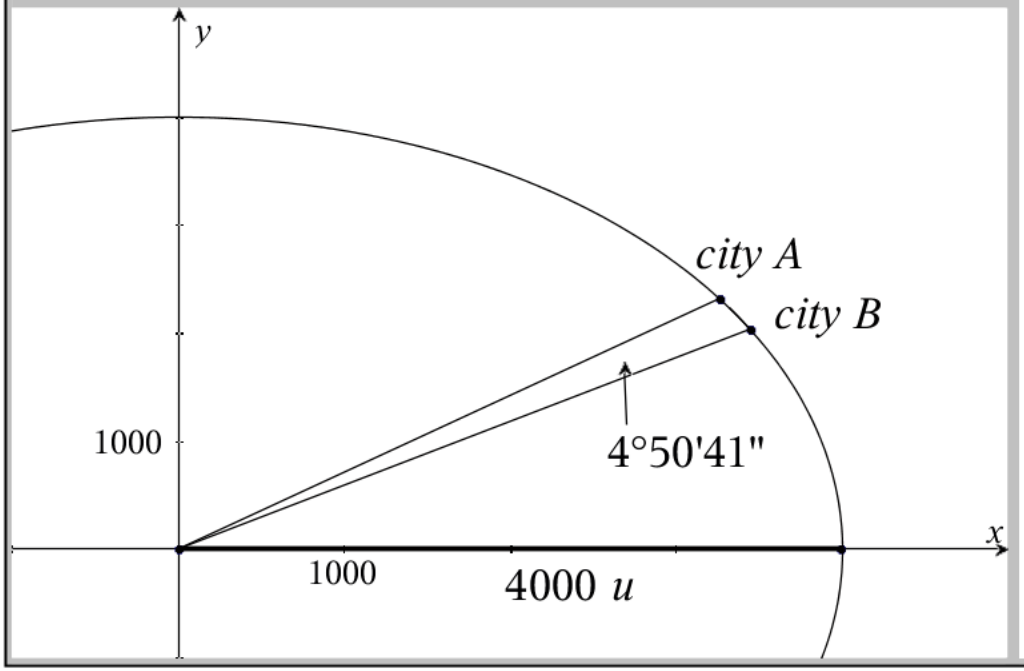
Linear Speed $= \frac{\theta r}{t} = \frac{3.6 \cdot \pi \cdot 10\ in.}{1\ \text{sec.}}$

$= \frac{36 \cdot \pi\ in.}{1\ \text{sec}}$

$\approx 113.097\ \frac{in.}{\text{sec.}}$

Note Linear Speed =(Angular speed)(radius)





City A has a latitude of 35° 19’ 46” N

City B has a latitude of 30° 29’ 5” N

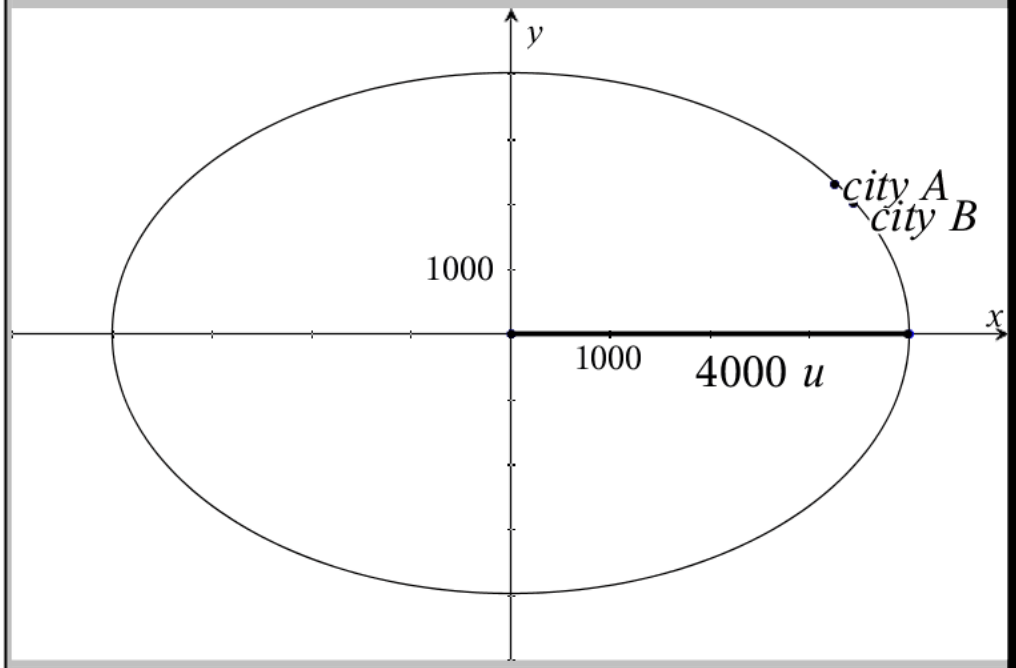
City A is due north of City B

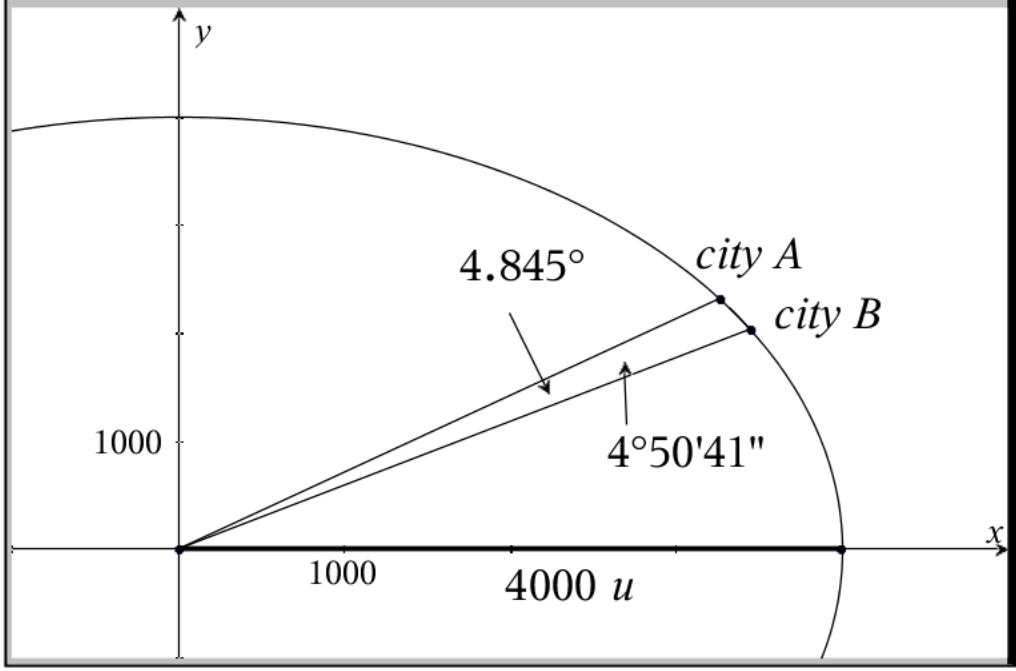
8a) What is the difference in latitude measures in DMS?

35° 19’ 46” N −30° 29’ 5” N =

34° 79’ 46” N −30° 29’ 5” N =

=4° 50’ 41”





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difference in latitude measures in DMS

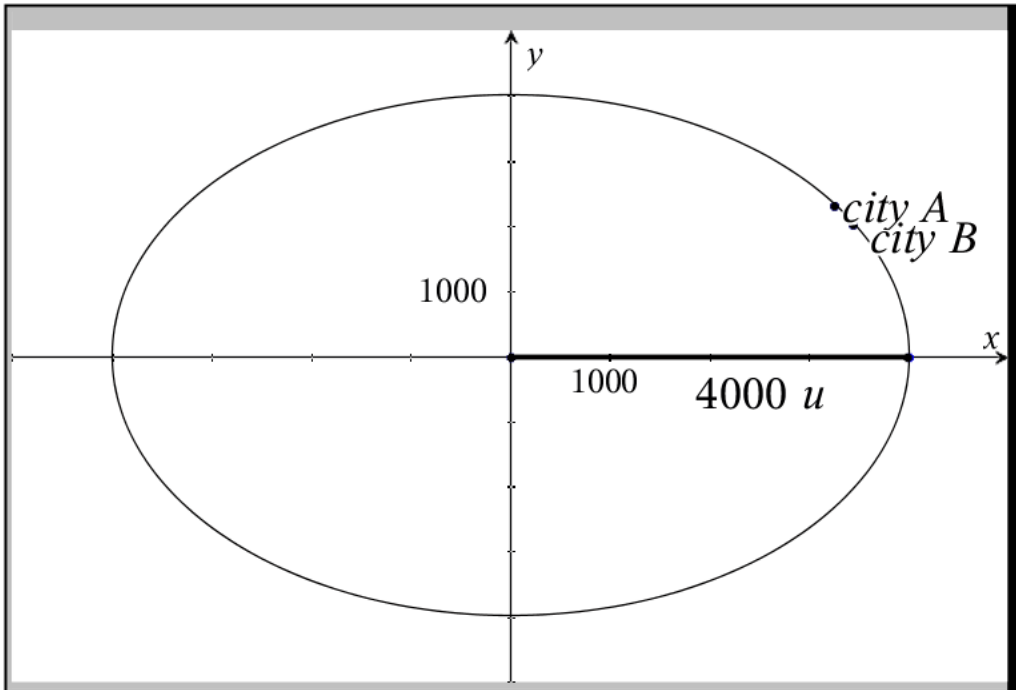
=4° 50’ 41”

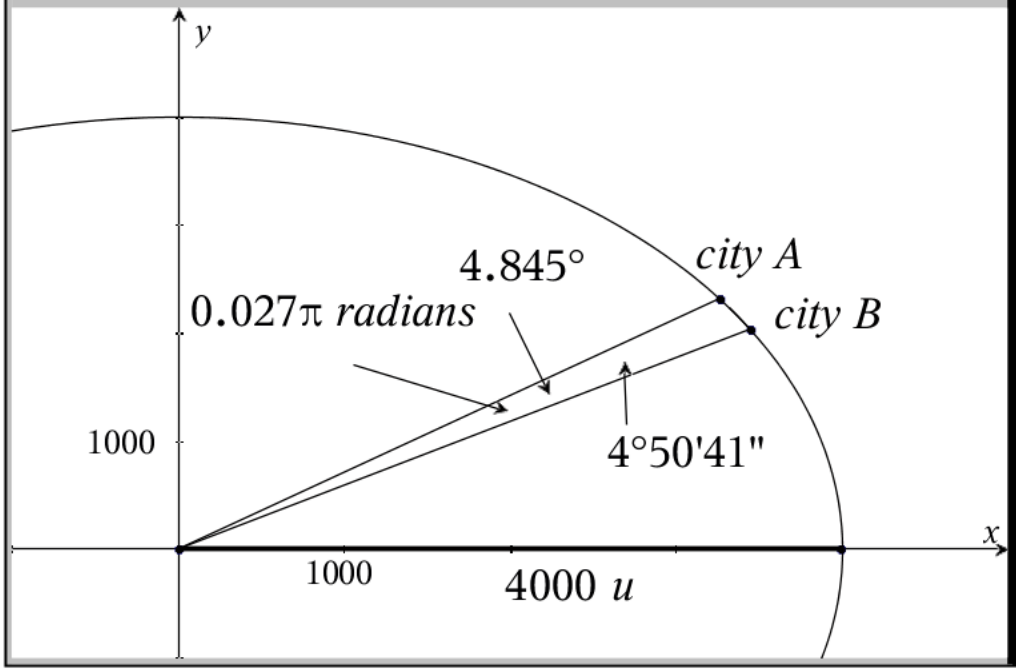
b. What is the difference in latitude measures in DD?

$$4° + \frac{50}{60}° + \frac{41}{3600}°$$

$$= 4 + \frac{50}{60} + \frac{41}{3600} = \frac{17441}{3600}°$$

$$= 4.84472222222°$$





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difference in latitude measures in DMS
=4° 50' 41"
difference in latitude measures in DD
$=4.84472222222\ °$

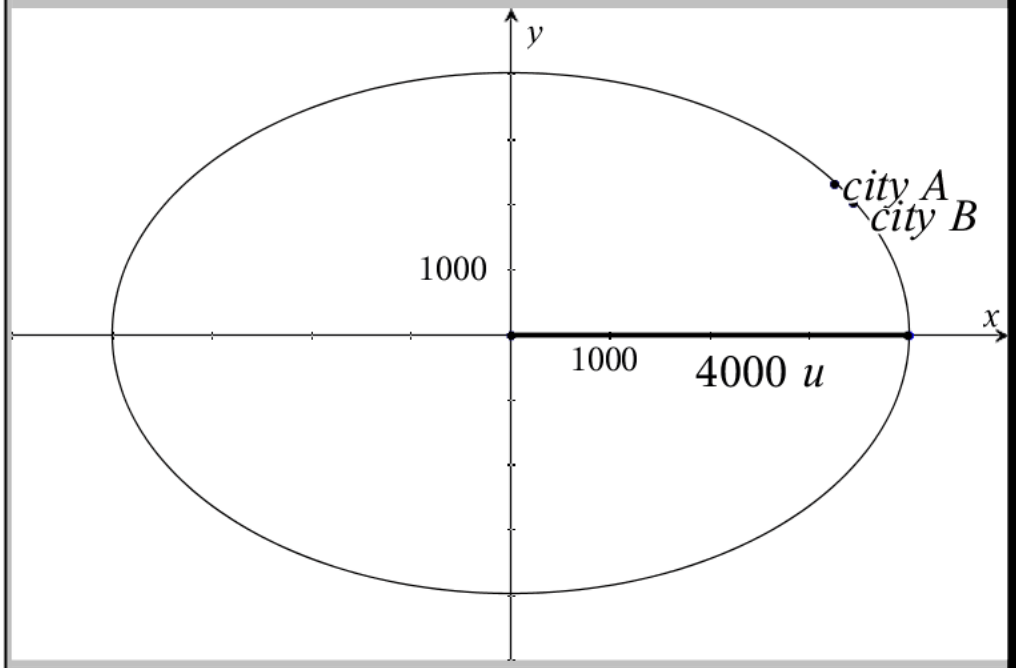
8c. What is radian measure of the latitude difference?

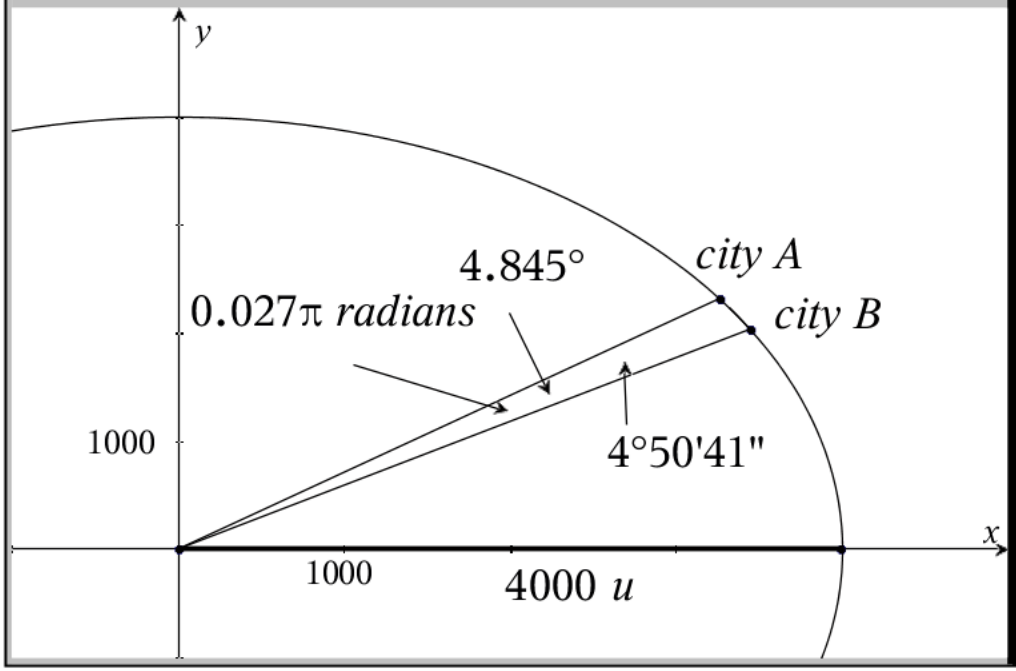
$4.84472222222\ ° \cdot \frac{\pi}{180°}$ radians

$\frac{17441 \cdot \pi}{648000}$ radians

but for our purposes $\approx 0.027\,\pi$ radians will do

So $\theta \approx 0.027\,\pi$ radians





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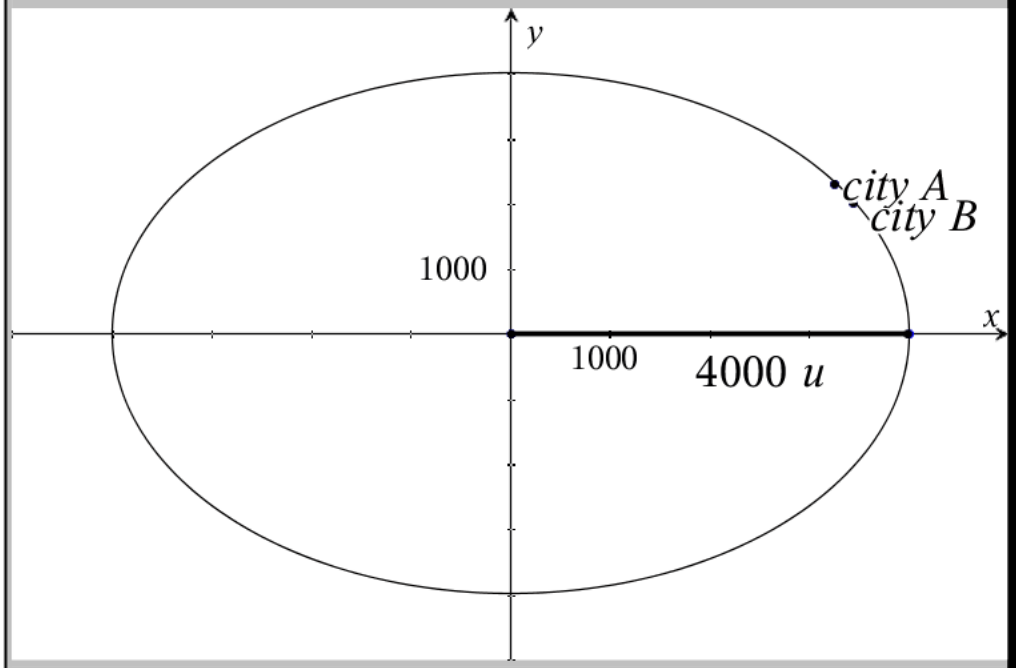
radius of earth approximately 4000 miles

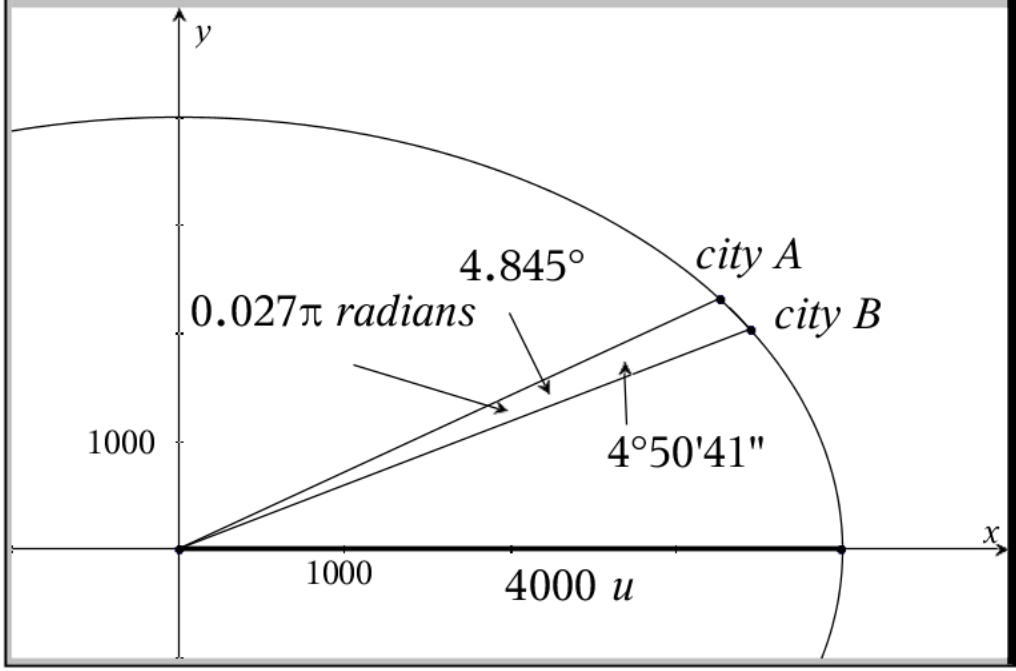
$\theta = \frac{17441 \cdot \pi}{648000}$ radians $\quad \theta \approx 0.027\,\pi$ radians

8d. What is the EXACT distance between cities?

$s = \theta r = \frac{17441 \cdot \pi}{648000} \cdot 4000 = \frac{17441 \cdot \pi}{162}$ miles

$s = \theta r \approx (0.027\,\pi)(4000) \approx 108.\,\pi$ miles





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radius of earth approximately 4000 miles

$\theta = \frac{17441 \cdot \pi}{648000}$ radians $\quad \theta \approx 0.027\,\pi$ radians

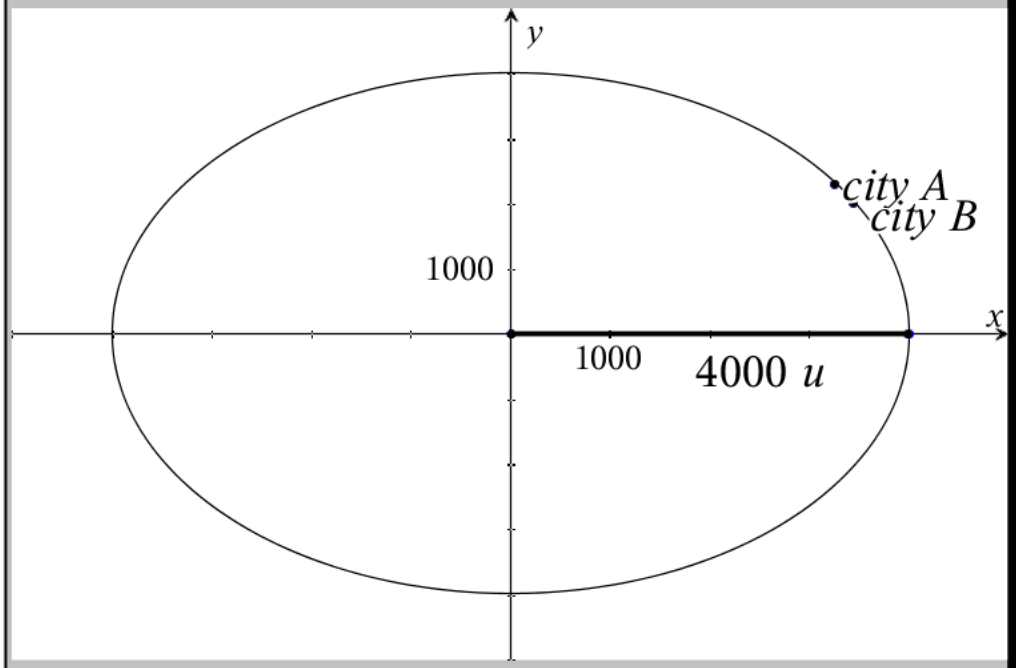
8e. What is the APPROXIMATE distance between cities?

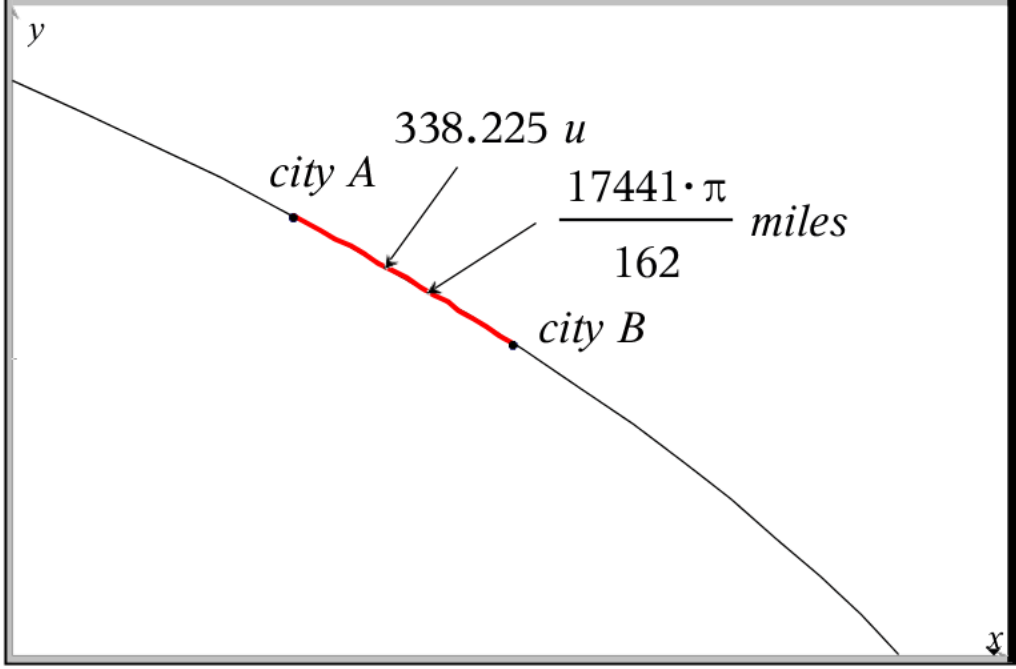
$s = \theta r = \frac{17441 \cdot \pi}{648000} \cdot 4000 = \frac{17441 \cdot \pi}{162}$ miles

$\approx \frac{17441 \cdot \pi}{162.}$ ▸ 338.225 miles

$s = \theta r \approx (0.027\,\pi)(4000) \approx 108.\,\pi$ miles

≈ 339.292 miles





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radius of earth approximately 4000 miles

8e. What is the APPROXIMATE distance between cities?

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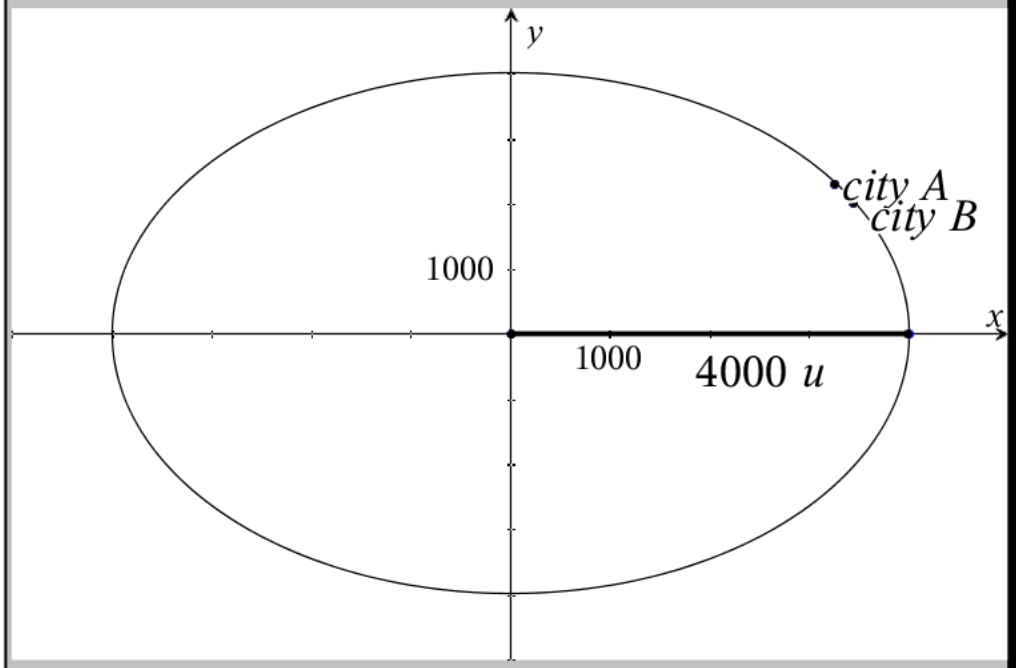
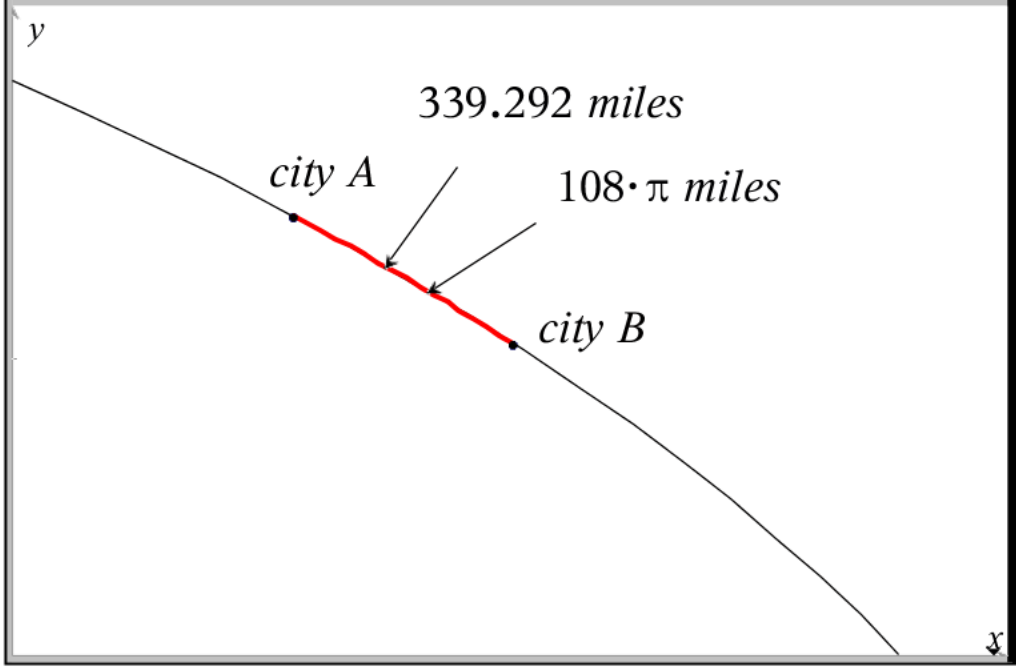
$$\approx \frac{17441 \cdot \pi}{162.} = 338.225 \text{ miles}$$

$$s = \theta r \approx (0.027\,\pi)(4000) \approx 108.\,\pi \text{ mile}$$

$$\approx 339.292 \text{ miles}$$





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$$\approx 339.292 \text{ miles}$$