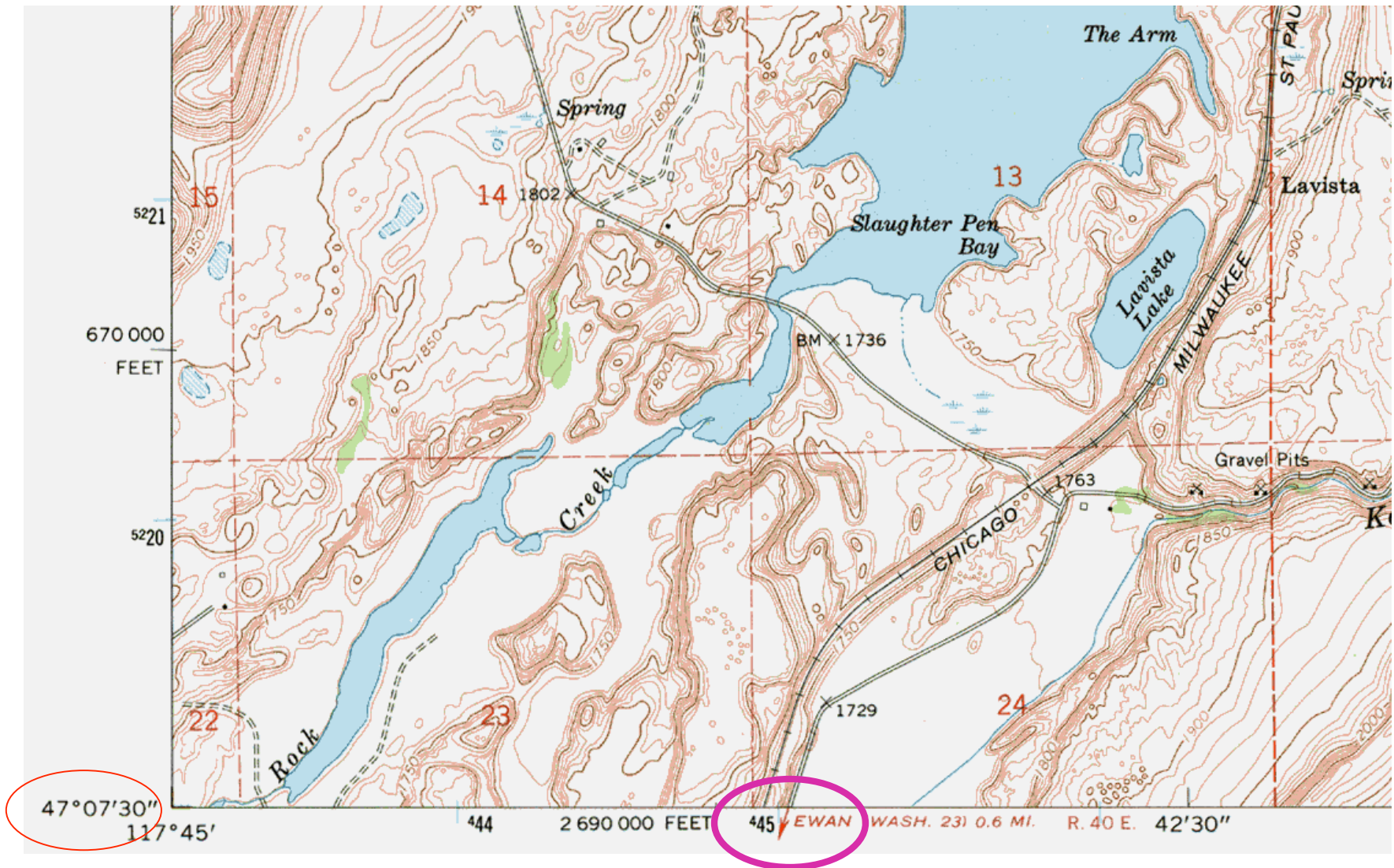


Whitman – What is the latitude and longitude where the railroad leaves the map towards Ewan?



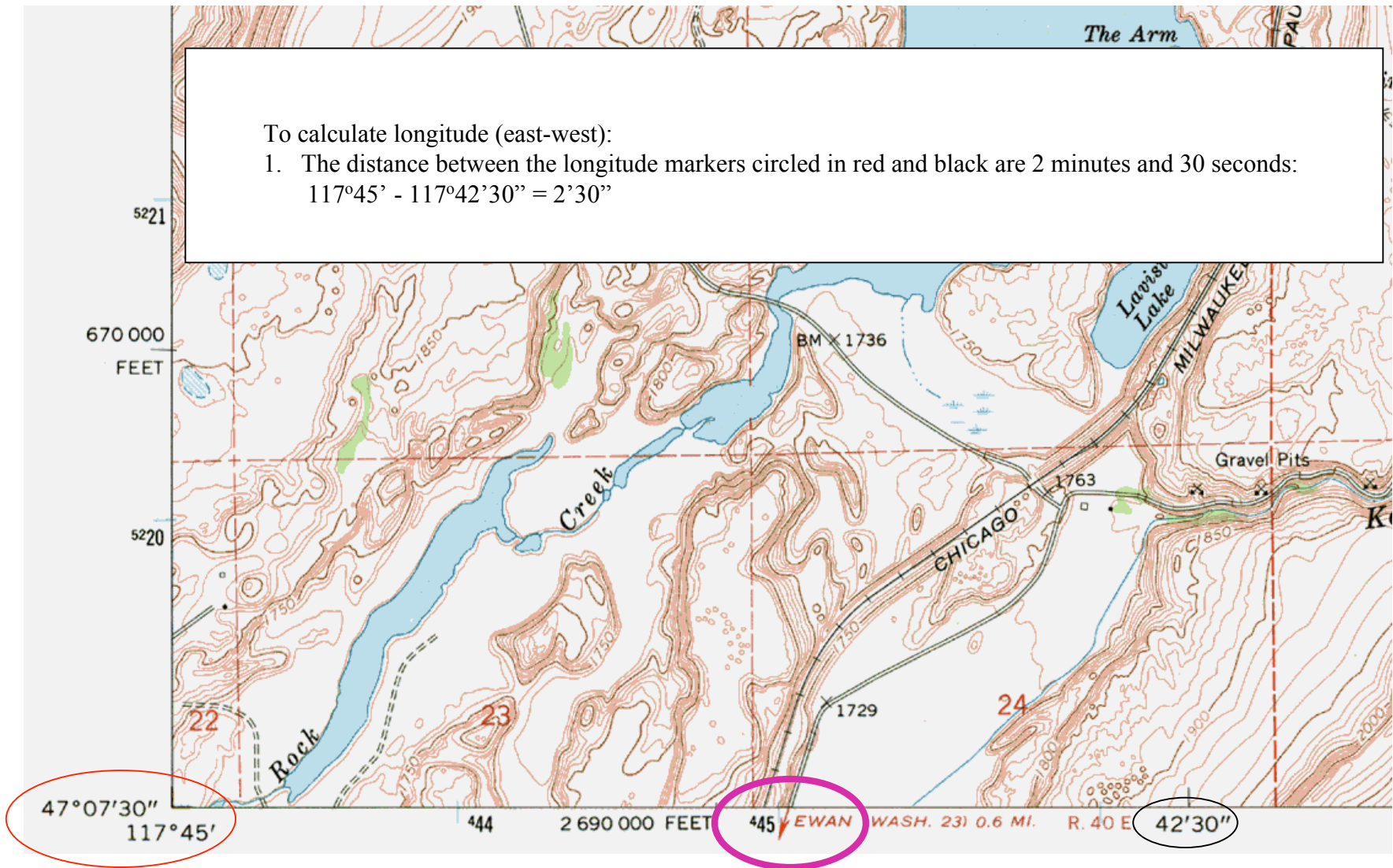
To calculate latitude (south-north):

1. The lower edge of the map is latitude $47^{\circ}07'30''$

Answer: $47^{\circ}07'30''$ latitude (47 degrees, 7 minutes and 30 seconds)

To calculate longitude (east-west):

1. The distance between the longitude markers circled in red and black are 2 minutes and 30 seconds:
 $117^{\circ}45' - 117^{\circ}42'30'' = 2'30''$



To calculate longitude (east-west):

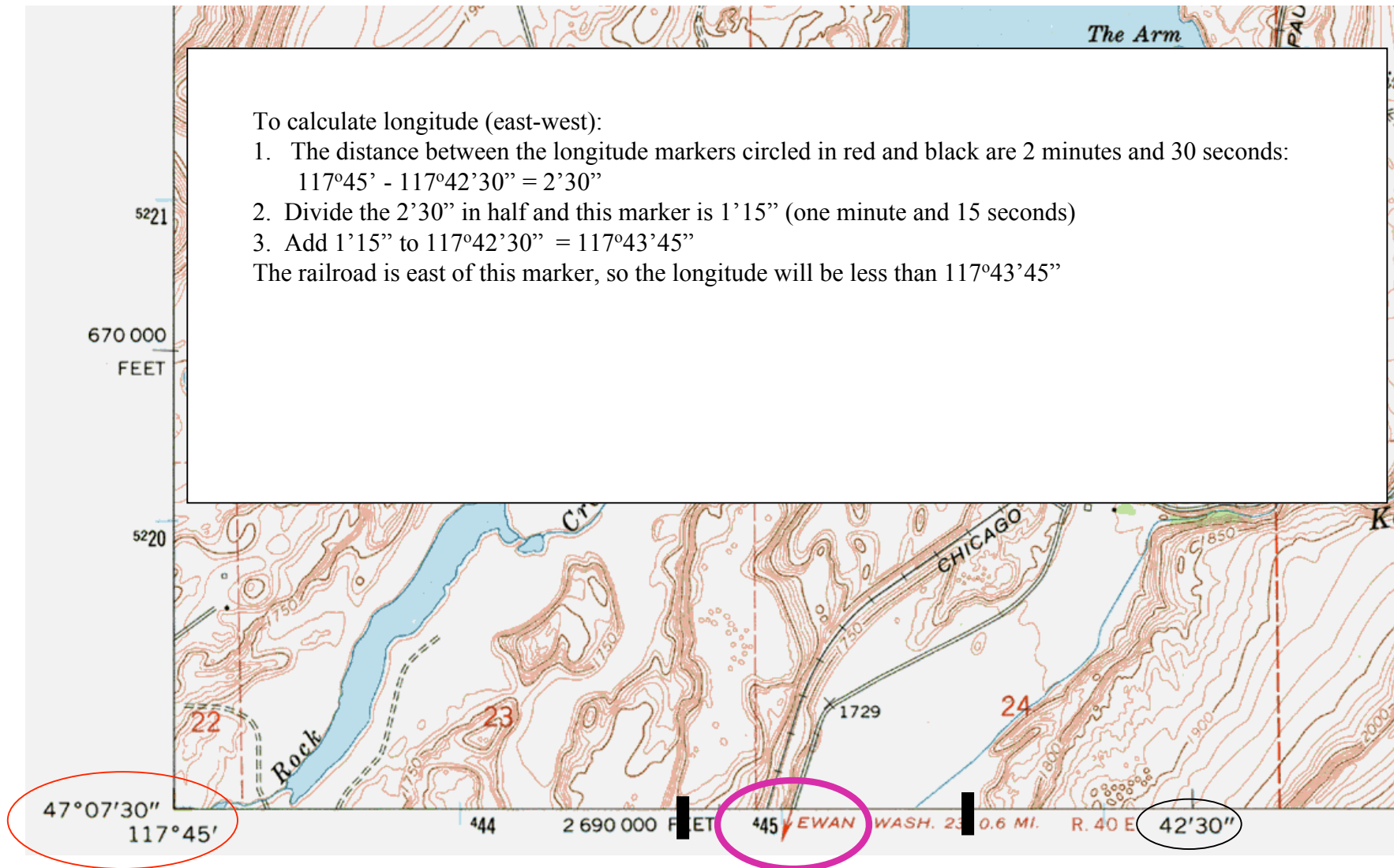
1. The distance between the longitude markers circled in red and black are 2 minutes and 30 seconds:

$$117^{\circ}45' - 117^{\circ}42'30'' = 2'30''$$

2. Divide the 2'30'' in half and this marker is 1'15'' (one minute and 15 seconds)

3. Add 1'15'' to 117°42'30'' = 117°43'45''

The railroad is east of this marker, so the longitude will be less than 117°43'45''



117°43'45''

To calculate longitude (east-west):

1. The distance between the longitude markers circled in red and black are 2 minutes and 30 seconds:

$$117^{\circ}45' - 117^{\circ}42'30'' = 2'30''$$

2. Divide $2'30''$ in half and this marker is $1'15''$ (one minute and 15 seconds)

3. Add $1'15''$ to $117^{\circ}42'30'' = 117^{\circ}43'45''$

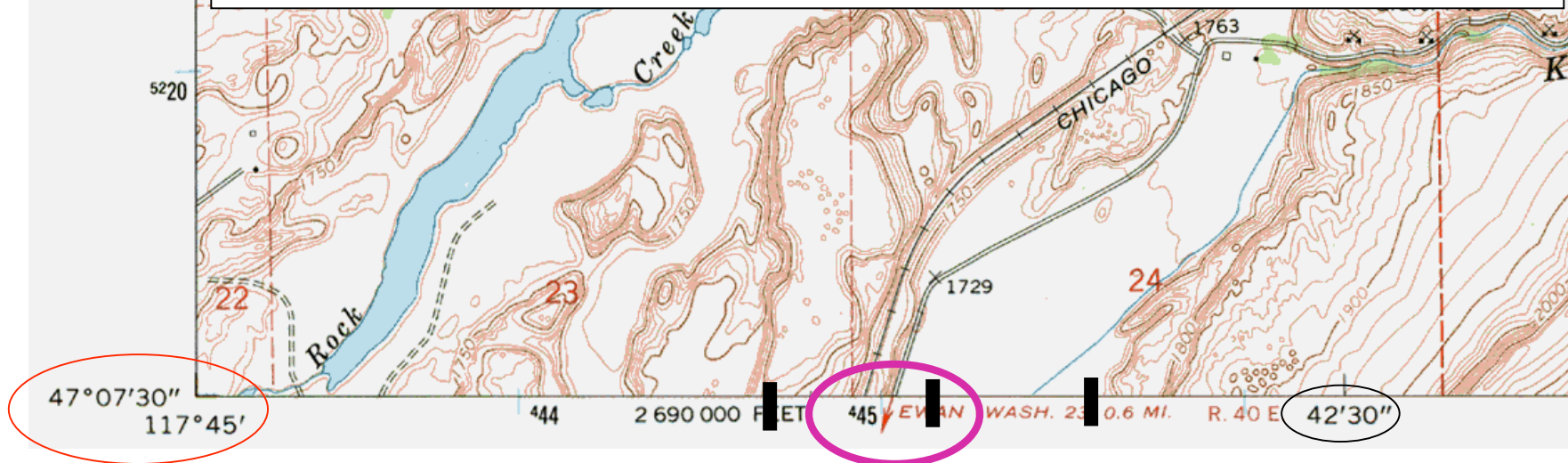
The railroad is east of this marker, so the longitude will be less than $117^{\circ}43'45''$

4. Divide $1'15''$ in half and this marker is $37.5''$ (convert to seconds and divide in half: $75''$ divided by $2 = 37.5''$)

5. Add $37.5''$ to $117^{\circ}42'30'' = 117^{\circ}42'67.5''$ or $117^{\circ}43'07.5''$ ($67.5''$ is $1'07.5''$ – one minute and 7.5 seconds)

Round up for this exercise: $117^{\circ}43'08''$

The railroad is west of this marker, so the longitude will be greater than $117^{\circ}43'08''$ and less than $117^{\circ}43'45''$



$117^{\circ}43'45''$

$117^{\circ}43'08''$

To calculate longitude (east-west):

1. The distance between the longitude markers circled in red and black are 2 minutes and 30 seconds:

$$117^{\circ}45' - 117^{\circ}42'30'' = 2'30''$$

2. Divide $2'30''$ in half and this marker is $1'15''$ (one minute and 15 seconds)

3. Add $1'15''$ to $117^{\circ}42'30'' = 117^{\circ}43'45''$

The railroad is east of this marker, so the longitude will be less than $117^{\circ}43'45''$

4. Divide $1'15''$ in half and this marker is $37.5''$ (convert to seconds and divide in half: $75''$ divided by $2 = 37.5''$)

5. Add $37.5''$ to $117^{\circ}42'30'' = 117^{\circ}42'67.5''$ or $117^{\circ}43'07.5''$ ($67.5''$ is $1'07.5''$ – one minute and 7.5 seconds)

Round up for this exercise: $117^{\circ}43'08''$

The railroad is west of this marker, so the longitude will be greater than $117^{\circ}43'08''$ and less than $117^{\circ}43'45''$

6. Divide $37.5''$ in half and this marker is $18.75''$ (round up to $19''$)

7. Add $19''$ to $117^{\circ}43'08'' = 117^{\circ}43'27''$

8. The railroad is approximately half-way between $117^{\circ}43'45''$ and $117^{\circ}43'27''$

9. $45'$ minus $27' = 18''$

10. $\frac{1}{2}$ of $18'' = 9''$

11. Add $9''$ to $117^{\circ}43'27'' = 117^{\circ}43'36''$

Answer: Approximately $117^{\circ}43'36''$ (117 degrees 43 minutes 36 seconds)



$43'45''$ $43'36''$ $43'27''$ $43'08''$