

MATHEMATICS

Level Two

Degrees ° minutes' seconds''

Task A (NB When adding two angle measures, every 60'' = 1' and every 60' = 1°).

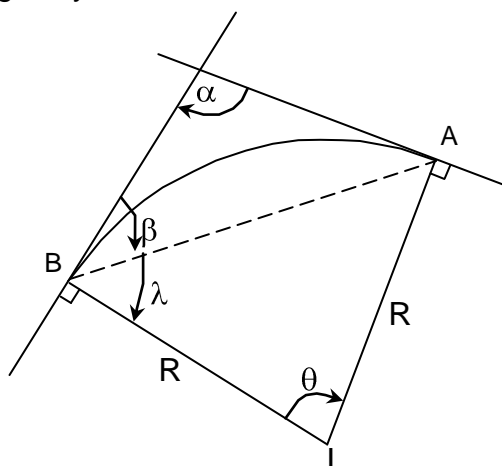
1)

- a. Add $16^{\circ} 14' 28''$ and $35^{\circ} 41' 36''$
- b. Add $8^{\circ} 19' 26''$, and $12^{\circ} 53' 41''$
- c. Add $185^{\circ} 35' 54''$ and $33^{\circ} 45' 16''$
- d. Subtract $36^{\circ} 14' 48''$ from $72^{\circ} 12' 15''$
- e. Subtract $27^{\circ} 15' 16''$ from $136^{\circ} 35' 43''$
- f. Find the angular difference between $83^{\circ} 21' 03''$ and $61^{\circ} 54' 48''$.

- 2) Convert the answers to the above, into decimal degrees.
- 3) Assuming that a sphere can approximate the earth, derive an algebraic expression for the distance around the surface of the sphere between two cities that are separated in latitude by the angle theta (θ). For the purpose of this example, assume one city is directly north of the other.
- 4) Taking the radius of the earth as approximately 6374km, find the difference in latitude of two places, one of which is 4000 km North of the other.

Task B

Below is a diagram of a proposed roading alignment from an old highway to a new highway.



1) If α is equal to 74° compute

- a. θ
- b. β
- c. λ

2) If α is equal to 58° compute

- a. θ
- b. β
- c. λ

- 3) What properties of triangles are you using to compute these angles?
- 4) What is the relationship between θ and β ?
- 5) Calculate the length of arc (AB) connecting the two roads if:
 - a. $\alpha = 74^{\circ}$ and the radius = 60m
- 6) Assume that a peg is placed at A and another peg is placed at B. You are required to place as few additional pegs as you can, at equal intervals around the curve, but the spaces between the pegs must not be more than 10m. How many pegs do you need? How far apart will the pegs be?