

## Exercise 5

Describe the geometric meaning of the following mappings in spherical coordinates:

(a)  $(\rho, \theta, \phi) \mapsto (\rho, \theta + \pi, \phi)$

(b)  $(\rho, \theta, \phi) \mapsto (\rho, \theta, \pi - \phi)$

(c)  $(\rho, \theta, \phi) \mapsto (2\rho, \theta + \pi/2, \phi)$

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### Solution

#### Part (a)

This mapping rotates the point  $180^\circ$  around the  $z$ -axis (as indicated by the right-hand corkscrew rule).

#### Part (b)

This mapping reflects the point across the  $xy$ -plane.

#### Part (c)

This mapping rotates the point  $90^\circ$  around the  $z$ -axis (as indicated by the right-hand corkscrew rule) and doubles its distance from the origin.