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Question: 6.2 PQ The surface of the earth is not a true inertial refer- enc...

6.2 PQ ◀ The surface of the earth is not a true inertial reference frame because there is a centripetal acceleration due to the earth's rotation. The earth rotates once every 24 hours and has a diameter of 8000 miles. What is the centripetal acceleration on the surface of the earth, and how does it compare to the gravitational acceleration?

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Solution

Time of rotation - 24 hours.

$$d = 8000 \text{ miles} = 12874.75 \text{ km}$$

$$\text{radius} = d/2 = 6437.375 \text{ km}$$

$$\text{Angular velocity of rotation } (\omega) = \frac{2\pi}{24 \times 60 \times 60}$$

$$\omega = 7.277 \times 10^{-5} \text{ sec}^{-1}$$

→ Centripetal acceleration (a_c) = $\omega^2 R$.

$$= (7.277 \times 10^{-5})^2 \times (6437 \times 10^3)$$

$$a_c = 0.03408 \text{ ms}^{-2}$$

→ Mass of earth = $5.98 \times 10^{24} \text{ kg}$

$$G = \text{Gravitational constant} = 6.673 \times 10^{-11} \frac{\text{Nm}^2}{\text{kg}^2}$$

acceleration due to gravity (g)

$$= \frac{GM}{R^2} = \frac{5.98 \times 10^{24} \times 6.673 \times 10^{-11}}{(6437.3)^2}$$

$$g = 9.8066 \text{ ms}^{-2}$$

Centripetal acceleration
→ It's dependent on radius and angular velocity.

→ It can change based upon the object.

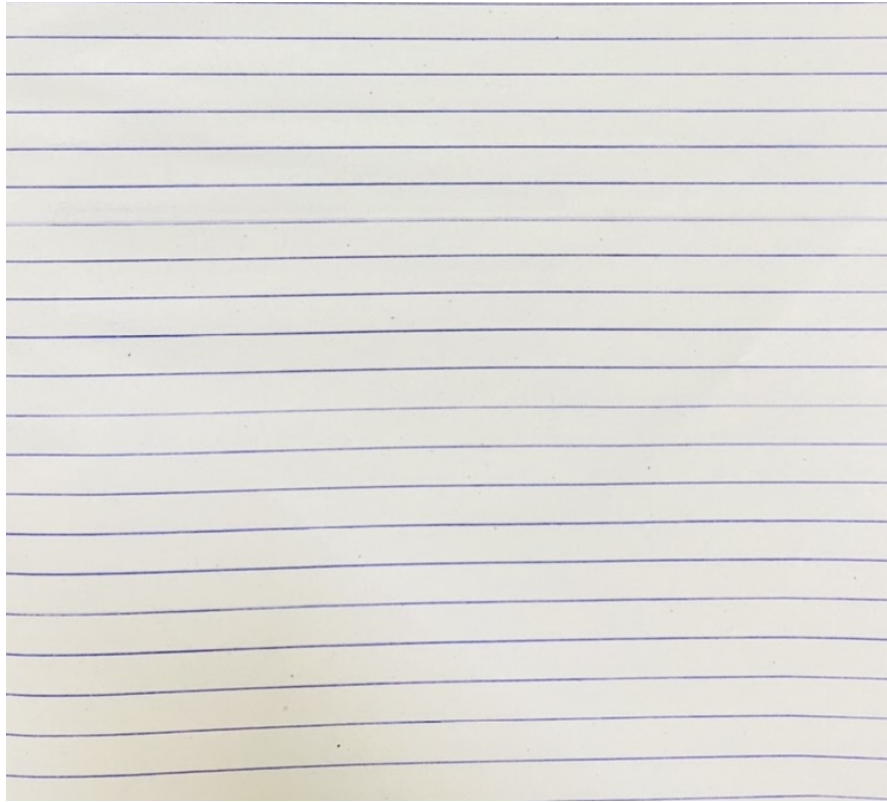
→ It is due to circular motion of object around planet.

Gravitational acceleration

→ It's dependent on mass and radius.

→ It is constant for a particular planet.

→ It's due to rotation of earth on its own axis.



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Problem 2. Using the Routh-Hurwitz criterion, tell how many closed-loop

Problem 2. Using the Routh-Hurwitz criterion, tell how many closed-loop poles of the transfer function shown in the below figure lie in the left half-plane, in the right half-plane, and on the imaginary axis.

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