(1) An artificial satellite orbits around the Earth in an elliptical orbit of the kind illustrated fig. The only appreciable force acting on the satellite is then the attractive gravitational force exerted on it by the Earth, a force which decreases with increasing distance betw the satellite & Earth.

a) Is the magnitude of the satellites accln at the point C larger than, smaller than or the same as the magnitude of its accln at point A?

Ans → distance CE < EA

Force of C > Force of A

Accln of C > Accln of A

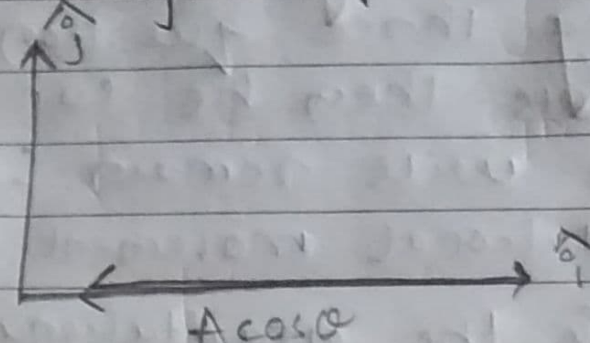
b) Is the satellites speed at the point C larger than, smaller than or the same as its speed at point A?

Ans → **$V_C > V_A$** [Speeds increases while approaching the nearest point to Earth called Perigee and slows down when we move farther called apogee.]

c) Consider the components a_i and a_j of the satellite's accln along the indicated $\hat{i}$ and $\hat{j}$

directions. Is the Acel^n component a_j at the point A positive negative or zero? Is the Acel^n component a_j at point A negative, positive or zero?

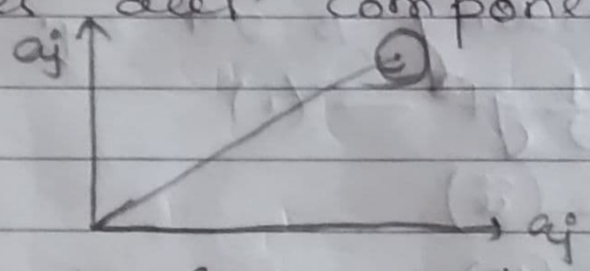
Ans →



when any vector concides with x-axis, its vertical components is zero and the horizontal component will equals to vector itself. Here, as the acel^n is opposite from point A. So,

a_i = −ve
a_j = 0

d) Answer the same question about the sateleites acel^n components at point B



a_i = −ve
a_j = −ve

e) Answer the same question about the satellite Acel^n componnts at 'c'?

Ans → If the vector concider with y-axis, then its horizontal component is zero and the vertical component becomes vector itself.

also,

a_i = +ve	a_j = 0
a_j = 0	a_i = +ve

Q) suppose that the satellite were moving around its orbit in the opposite sense (i.e., clockwise rather than in the counter-clockwise sense indicated in fig) would the answer the proceeding three question about the acm components then be same or different?

Ans → The ans. will remain same. As it doesn't depend on rotational movement of orbit.

Q) How much is the gravitational force that keeps an artificial satellite of mass 3500 kg in orbit around the Earth an altitude of 4500 km –

Ans → 10000 N.

3) The value of g is maximum →

Ans → at poles of Earth.

1) A stone is thrown vertically upwards & caught at the point of projection after 10 seconds. The time taken by the stone to reach the highest point is— Time taken to go upwards is equal to time taken to travel downwards from same height. According to 2nd eq. of motion–

$$S_1 = ut - \frac{1}{2}gt^2 \quad \text{— (i)}$$

$$S_2 = \frac{gt^2}{2} \quad \text{— (ii)}$$

Equation (i) and (ii)

$$ut = gt^2$$

$$u = gt$$

Time of ascent = Time of decent.

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So, $2t = 10 sec.$

$\boxed{t = 5 sec}$

(a) 5 sec.

(5) The period of a satellite in a circular orbit of Radius R is 'T', the period of another satellite in a orbit of Radius 4R is →

→ $T^2 \propto R^3$ [Kepler's 3rd law]

$$= \frac{T_1^2}{T_2^2} = \frac{R_1^3}{R_2^3}$$

(3) 8T