

Variations of "g" Due to Various Factors (in Hindi)

LESSON 5 OF 5



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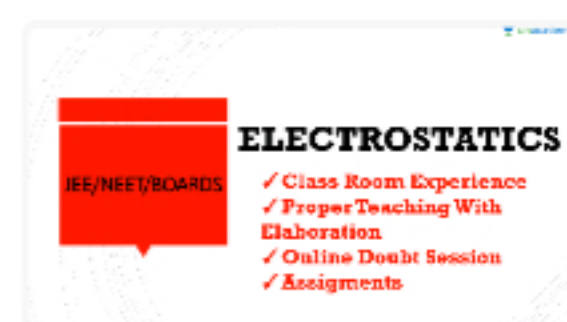
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Exam Shifts: First Shift (9:00 AM to 12:30 PM) and Second Shift (3:00 PM to 6:30 PM).
Type of Question: Questions will be Objective Type (Multiple Choice and Reason-Assertion type).
No. of Question: Total 200 questions will be asked in the examination.
Language: Question paper will be provided either in English or in Hindi language.

(Hindi) NEET 2018 Solutions and
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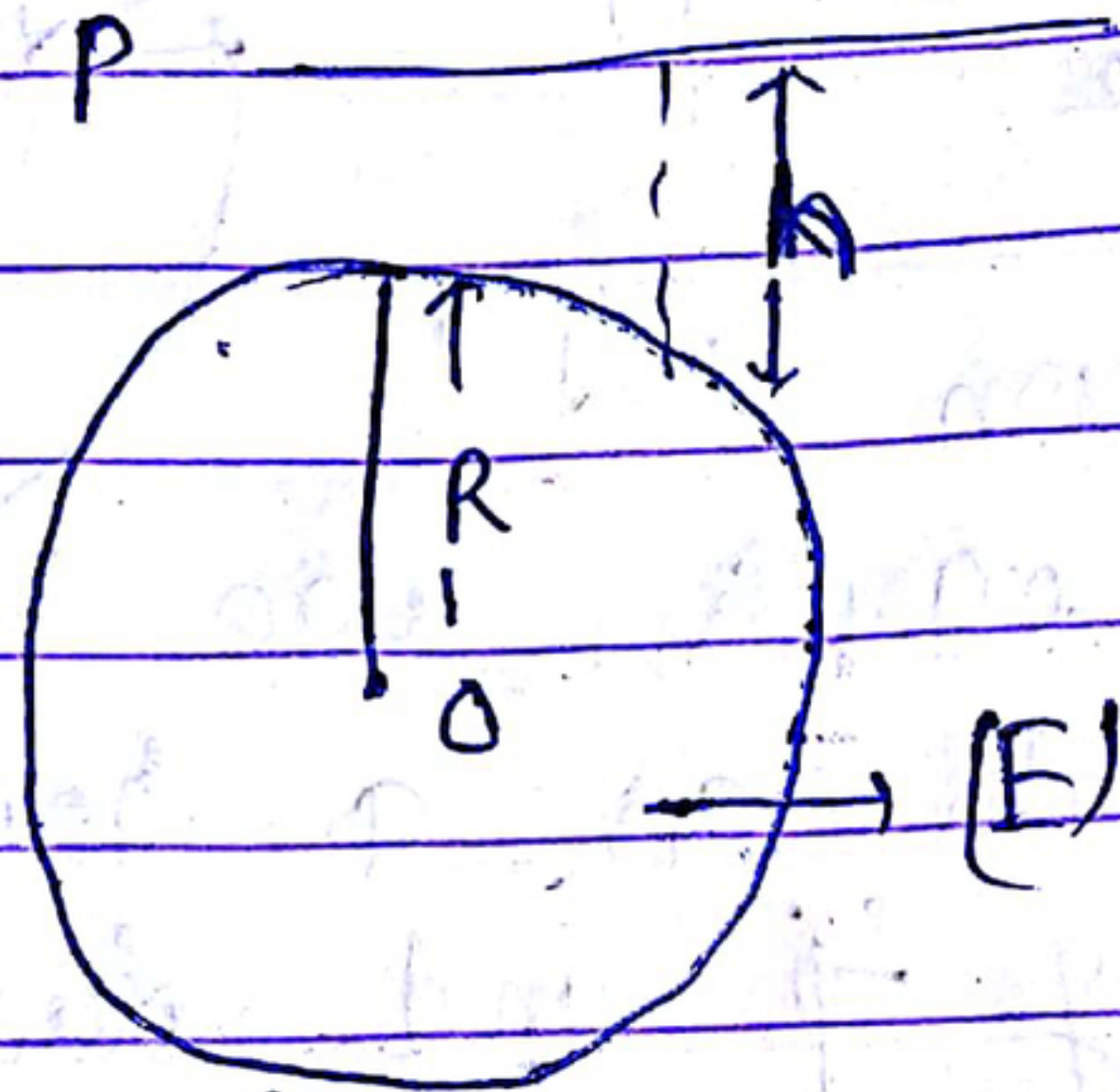
Variation of Acceleration Due to Gravity

A) Acceleration due to 'Gravity' above the surface of Earth :-

So $g = \frac{GM}{R^2}$ — (i)

Now at 'h' height above

$$g_h = \frac{GM}{(R+h)^2} \text{ — (ii)}$$



Dividing (ii) by (i)

$$\frac{g_h}{g} = \frac{GM}{(R+h)^2} \times \frac{R^2}{GM}$$

$$g_h = g \left(1 + \frac{h}{R}\right)^{-2}$$

If $h \ll R$

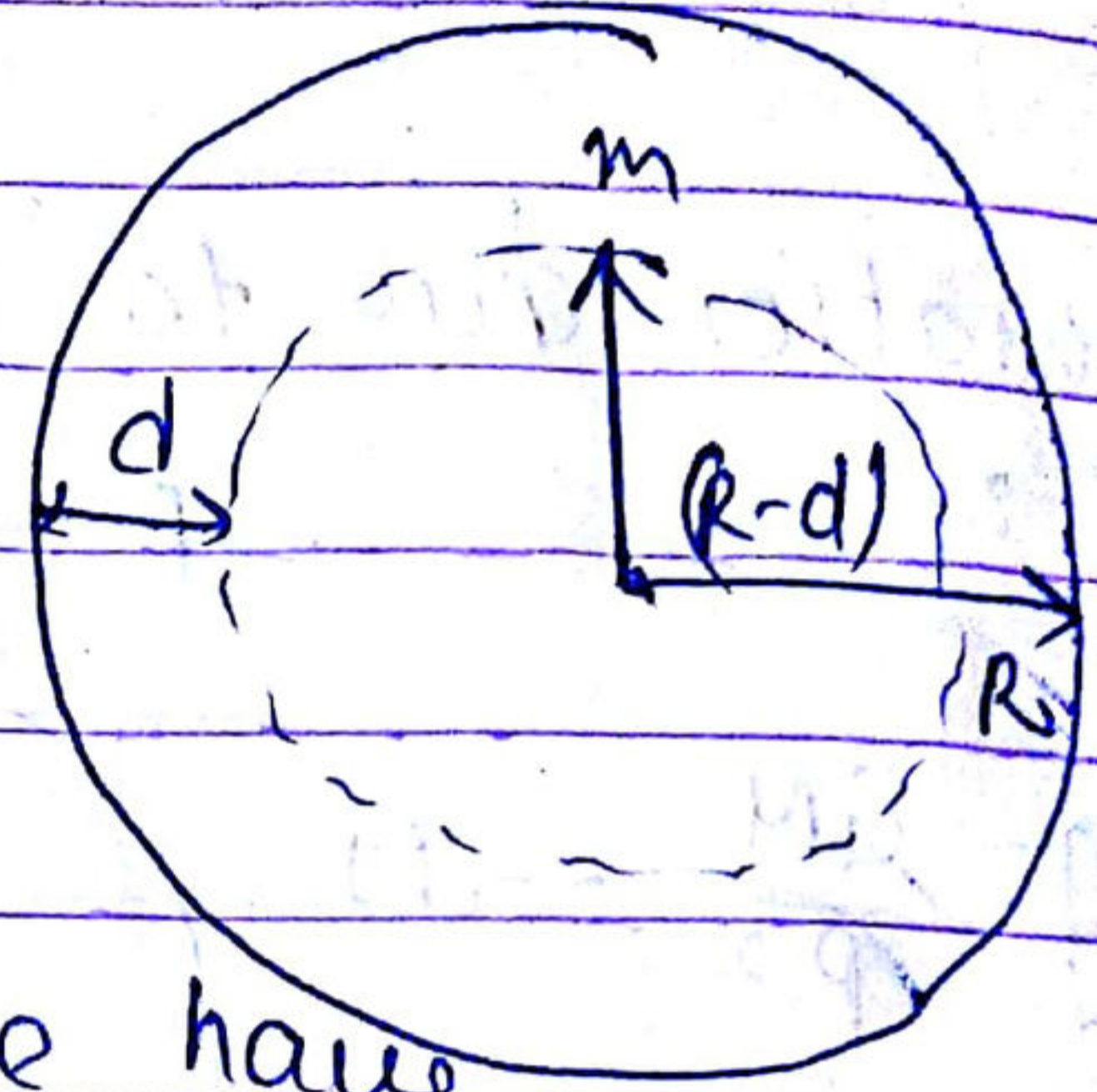
$$g_h = g \left(1 - \frac{2h}{R}\right) \rightarrow \text{from Binomial}$$

Acceleration due to gravity

Earth:

Soln

$$g = \frac{GM}{R^2} \quad \text{--- (i)}$$



If we go down 'd' depth into earth, we have to suppose earth as a homogeneous sphere of uniform density ρ and radius (R) .

$$\text{Mass of earth } (M) = V \times \rho$$

$$M = \frac{4}{3} \pi R^3 \times \rho$$

$$\Rightarrow g = \frac{G \times \frac{4}{3} \pi R^3 \rho}{R^2}$$

$$g = \frac{4}{3} \pi G R \rho$$

जब 'd' depth आ जायेगा,

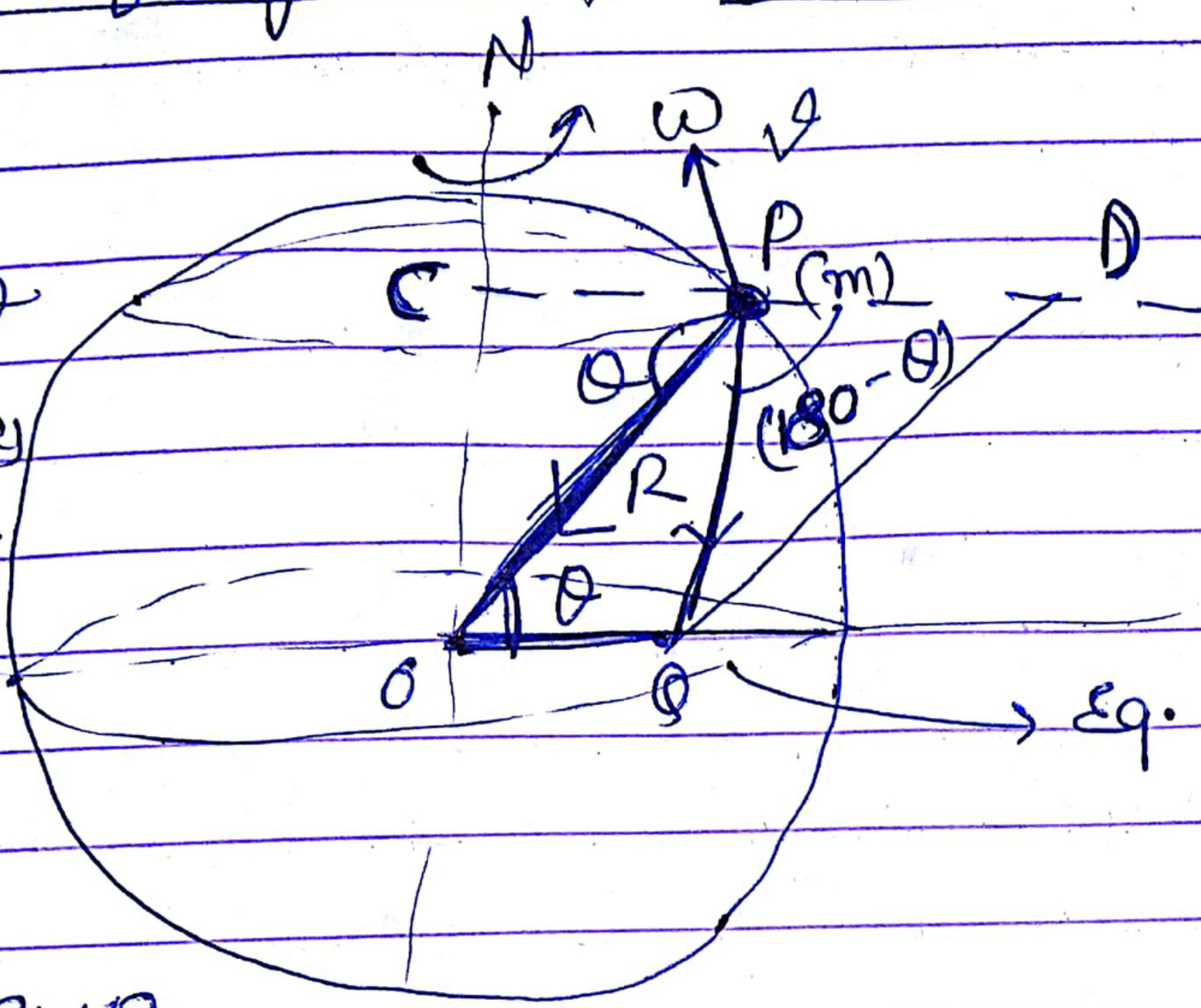
$$g_d = \frac{4}{3} \pi G (R-d) \rho \quad \text{--- (iii)}$$

Dividing (iii) by (ii)

$$g_d = g \left(1 - \frac{d}{R}\right)$$

iii) Variation of g' with Rotation of Earth

$V = (PC)\omega$
 Earth rotates
 and compl.
 1 rev in
24 hours.



$$PC = PO \cos \theta$$

$$PC = R \cos \theta$$

$$v = R \omega \cos \theta$$

Centrifugal force acting on 'm'
 $F_c = \frac{mv^2}{r} = \frac{m(R\omega \cos \theta)^2}{R \cos \theta}$

$$F_c = m \omega^2 R \cos \theta$$

$$g' = g \left[1 - \frac{R \omega^2 \cos^2 \theta}{g} \right]$$

at Poles: $\theta = 90^\circ$, $g_{\text{pole}} = g$

at equator: $\theta = 0^\circ$, $g_{\text{eq}} = g \left[1 - \frac{R \omega^2}{g} \right]$