

**UNIT 3**  
**EQUATION “CHEAT SHEET”**

| Name  | Equation                              | Variables   |
|---|---------------------------------------|---|
| Circumference   | $C = 2\pi r$                          | C: circumference<br>r: radius of the circle   |
| Linear rotation speed   | $v = \frac{n \cdot C}{t}$             | v: linear rotation speed<br>n: number of times around circle<br>C: circumference<br>t: time   |
| Centripetal Acceleration  | $a_c = \frac{v^2}{r}$                 | a <sub>c</sub> : centripetal acceleration<br>v: linear rotation speed<br>r: radius of the circular path   |
| Centripetal Force<br>(Newton’s 2 <sup>nd</sup> Law for Uniform Circular Motion)       | $F_c = m \cdot a_c$                   | F <sub>c</sub> : centripetal force<br>m: mass<br>a <sub>c</sub> : centripetal acceleration  |
| Freefall Kinematic Equation<br>(Find final velocity, given initial velocity and time) | $v_f = v_i - gt$                      | v <sub>f</sub> : final velocity<br>v <sub>i</sub> : initial velocity<br>g: 9.81 m/s <sup>2</sup><br>t: time   |
| Freefall Kinematic Equation<br>(Find displacement, given initial velocity and time)   | $\Delta y = v_i t - \frac{1}{2} gt^2$ | Δy: change in position (displacement)<br>v <sub>i</sub> : initial velocity<br>g: 9.81 m/s <sup>2</sup><br>t: time   |
| Law of Universal Gravitation  | $F_g = G \frac{m_1 \cdot m_2}{d^2}$   | F <sub>g</sub> : force of gravity<br>G: 6.67×10 <sup>-11</sup> N m <sup>2</sup> /kg <sup>2</sup><br>m <sub>1</sub> : mass of object 1<br>m <sub>2</sub> : mass of object 2<br>d: distance between objects |
| Gravitational Field Strength  | $g = G \frac{M}{r^2}$                 | g: gravitational field strength<br>G: 6.67×10 <sup>-11</sup> N m <sup>2</sup> /kg <sup>2</sup><br>M: mass of planet<br>r: distance from center of planet  |
| Weight  | $F_g = mg$                            | F <sub>g</sub> : weight<br>m: mass<br>g: 9.81 m/s <sup>2</sup>  |