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Linear Motion Formulas

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List of 16 Linear Motion Formulas

Linear Motion

Motion under Force of Gravity

1) Distance Travelled in Free Fall under Gravity given Initial Velocity and Time

Open Calculator

fx $$d = u \cdot t + \frac{1}{2} \cdot [g] \cdot t^2$$

ex $$457.2629\text{m} = 31\text{m/s} \cdot (7\text{s}) + \frac{1}{2} \cdot [g] \cdot (7\text{s})^2$$

2) Distance Travelled when Particle is Projected Upwards using Initial Velocity and Time

Open Calculator

fx $$d = -u \cdot t + \frac{1}{2} \cdot [g] \cdot t^2$$

ex $$23.26292\text{m} = -31\text{m/s} \cdot (7\text{s}) + \frac{1}{2} \cdot [g] \cdot (7\text{s})^2$$

3) Final Velocity in Free Fall under Gravity given Initial Velocity and Displacement

Open Calculator

fx $v_f = \sqrt{u^2 + 2 \cdot [g] \cdot d}$

ex $53.60314\text{m/s} = \sqrt{(31\text{m/s})^2 + 2 \cdot [g] \cdot 97.5\text{m}}$

4) Final Velocity in Free Fall under Gravity given Initial Velocity and Time

Open Calculator

fx $v_f = u + [g] \cdot t$

ex $99.64655\text{m/s} = 31\text{m/s} + [g] \cdot 7\text{s}$

5) Final Velocity when Particle is Projected Upwards using Initial Velocity and Time

Open Calculator

fx $v_f = -u + [g] \cdot t$

ex $37.64655\text{m/s} = -31\text{m/s} + [g] \cdot 7\text{s}$

Motion under Uniform Acceleration

6) Average Velocity

Open Calculator

fx $v_{avg} = \frac{u + v_f}{2}$

ex $37.5\text{m/s} = \frac{31\text{m/s} + 44\text{m/s}}{2}$

7) Displacement of Particle

Open Calculator

fx $$d = \frac{v_f^2 - u^2}{2 \cdot a}$$

ex $$97.5\text{m} = \frac{(44\text{m/s})^2 - (31\text{m/s})^2}{2 \cdot 5\text{m/s}^2}$$

8) Distance Traveled by Particle given Average Velocity

Open Calculator

fx $$D = v_{avg} \cdot t$$

ex $$262.5\text{m} = 37.5\text{m/s} \cdot 7\text{s}$$

9) Distance Travelled by Particle

Open Calculator

fx $$D = \left(\frac{u + v_f}{2}\right) \cdot t$$

ex $$262.5\text{m} = \left(\frac{31\text{m/s} + 44\text{m/s}}{2}\right) \cdot 7\text{s}$$

10) Distance Travelled in n Seconds

Open Calculator

fx $$d = n \cdot u + \frac{1}{2} \cdot a \cdot n^2$$

ex $$164\text{m} = (4\text{s}) \cdot 31\text{m/s} + \frac{1}{2} \cdot 5\text{m/s}^2 \cdot (4\text{s})^2$$

11) Distance Travelled in n-1 Seconds

Open Calculator

fx $$d = u \cdot (n - 1) + \frac{1}{2} \cdot a \cdot (n - 1)^2$$

ex $$115.5\text{m} = 31\text{m/s} \cdot (4\text{s} - 1) + \frac{1}{2} \cdot 5\text{m/s}^2 \cdot (4\text{s} - 1)^2$$

12) Distance Travelled in nth Second

Open Calculator

fx $$d = u + \frac{a}{2} \cdot (2 \cdot n - 1)$$

ex $$48.5\text{m} = 31\text{m/s} + \frac{5\text{m/s}^2}{2} \cdot (2 \cdot 4\text{s} - 1)$$

13) Final Velocity given Displacement, Uniform Acceleration and Initial Velocity of Particle

Open Calculator

fx $$v_f = \sqrt{u^2 + 2 \cdot a \cdot d}$$

ex $$44\text{m/s} = \sqrt{(31\text{m/s})^2 + 2 \cdot 5\text{m/s}^2 \cdot 97.5\text{m}}$$

14) Initial Velocity given Displacement, Uniform Acceleration and Final Velocity of Particle

Open Calculator

fx $$u = \sqrt{v_f^2 - 2 \cdot a \cdot d}$$

ex $$31\text{m/s} = \sqrt{(44\text{m/s})^2 - 2 \cdot 5\text{m/s}^2 \cdot 97.5\text{m}}$$

15) Time Taken by Particle to Change its Initial Velocity to Final Velocity

Open Calculator

fx $$t = \frac{v_f - u}{a}$$

ex $$2.6\text{s} = \frac{44\text{m/s} - 31\text{m/s}}{5\text{m/s}^2}$$

16) Velocity of Particle after Certain Time

Open Calculator

fx $$v = u + a \cdot t$$

ex $$66\text{m/s} = 31\text{m/s} + 5\text{m/s}^2 \cdot 7\text{s}$$

Variables Used

- **a** Acceleration *(Meter per Square Second)*
- **d** Displacement *(Meter)*
- **D** Distance Traveled *(Meter)*
- **n** Number of Seconds *(Second)*
- **t** Time *(Second)*
- **u** Initial Velocity *(Meter per Second)*
- **v** Velocity *(Meter per Second)*
- v_{avg} Average Velocity *(Meter per Second)*
- v_f Final Velocity *(Meter per Second)*

Constants, Functions, Measurements used

- Constant: **[g]**, 9.80665 Meter/Second²
  Gravitational acceleration on Earth
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Acceleration** in Meter per Square Second (m/s²)
  Acceleration Unit Conversion

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