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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

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

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa_img.jpg\)](#)

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



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

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

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

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

Motion under Uniform Acceleration


6) Average Velocity

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

[Open Calculator !\[\]\(84f47badaad7772cd95667a7c387a639_img.jpg\)](#)

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



7) Displacement of Particle 

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

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

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

8) Distance Traveled by Particle given Average Velocity 

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

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$ex \quad 262.5m = 37.5m/s \cdot 7s$$

9) Distance Travelled by Particle 

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

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

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

10) Distance Travelled in n Seconds 

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

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

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



11) Distance Travelled in n-1 Seconds

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

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

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

12) Distance Travelled in nth Second

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

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

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


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

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

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80_img.jpg\)](#)

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




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

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

[Open Calculator](#) 

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

16) Velocity of Particle after Certain Time 

$$\text{fx } v = u + a \cdot t$$

[Open Calculator](#) 

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







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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