calculatoratoz.com

unitsconverters.com

Vehicle Collision Formulas

Calculators! Examples! Conversions!

Bookmark **calculatoratoz.com**, **unitsconverters.com**

Widest Coverage of Calculators and Growing - **30,000+ Calculators!**
Calculate With a Different Unit for Each Variable - **In built Unit Conversion!**
Widest Collection of Measurements and Units - **250+ Measurements!**

Feel free to SHARE this document with your friends!

Please leave your feedback here...

List of 21 Vehicle Collision Formulas

Vehicle Collision

1) Acceleration of Airbag

Open Calculator

fx $$a = \frac{V_f^2 - V_i^2}{2 \cdot d_t}$$

ex $$13500\text{m/s}^2 = \frac{(90\text{m/s})^2 - (0.03\text{m/s})^2}{2 \cdot 0.30\text{m}}$$

2) Constant Deceleration of Vehicle during Collision

Open Calculator

fx $$A_v = 0.5 \cdot \frac{V_o^2}{d}$$

ex $$200.9967\text{m/s}^2 = 0.5 \cdot \frac{(11\text{m/s})^2}{0.301\text{m}}$$

3) Direction of Final Velocity of Vehicles after Collision

Open Calculator

fx $$\theta = a\tan\left(\frac{V_{fy}}{V_{fx}}\right)$$

ex $$56.3496^\circ = a\tan\left(\frac{6.67\text{m/s}}{4.44\text{m/s}}\right)$$

4) Force Exerted on Airbag after Collision

Open Calculator

fx $$F = m \cdot a$$

ex $$33750\text{N} = 2.50\text{kg} \cdot 13500\text{m/s}^2$$

5) Impact Force on Vehicle after Crash

Open Calculator

fx $$F_{avg} = \frac{0.5 \cdot M \cdot v^2}{d}$$

ex $$5.9\text{E}\hat{}7\text{N} = \frac{0.5 \cdot 14230\text{N} \cdot (50\text{m/s})^2}{0.301\text{m}}$$

6) Kinetic Energy after Collision of Vehicles

Open Calculator

fx $$K_f = \left(\frac{m1}{m1 + m2}\right) \cdot K_i$$

ex $$22500\text{J} = \left(\frac{1.5\text{kg}}{1.5\text{kg} + 2.5\text{kg}}\right) \cdot 60000\text{J}$$

7) Magnitude of Resultant Final Velocity after Collision of Two Vehicles

Open Calculator

fx $$V_{final} = \sqrt{V_{fx}^2 + V_{fy}^2}$$

ex $$8.012646\text{m/s} = \sqrt{(4.44\text{m/s})^2 + (6.67\text{m/s})^2}$$

8) Stopping Distance of Vehicle after Collision

Open Calculator

fx $$d = 0.5 \cdot V_o \cdot T_v$$

ex $$0.30085\text{m} = 0.5 \cdot 11\text{m/s} \cdot 0.0547\text{s}$$

9) Stopping Time of Vehicle after Collision

Open Calculator

fx $$T_v = \frac{V_o}{A_v}$$

ex $$0.054726\text{s} = \frac{11\text{m/s}}{201\text{m/s}^2}$$

10) Time of Occupant to Stop after Contacting Interiors during Collision

Open Calculator

fx $$T_c = \sqrt{\frac{2 \cdot \delta_{occ}}{A_v}}$$

ex $$0.046253\text{s} = \sqrt{\frac{2 \cdot 0.215\text{m}}{201\text{m/s}^2}}$$

11) Total Momentum in x-Direction before Collision of Two Vehicles

Open Calculator

fx $$Ptot_{ix} = P1_{ix} + P2_{ix}$$

ex $$10000.02\text{kg*m/s} = 10000\text{kg*m/s} + 0.02$$

12) Total Momentum in y-Direction before Collision of Two Vehicles

Open Calculator

fx $$\mathrm{Ptot_{iy}} = \mathrm{P1_{iy}} + \mathrm{P2_{iy}}$$

ex $$18000.01\mathrm{kg*m/s} = 0.01\mathrm{kg*m/s} + 18000\mathrm{kg*m/s}$$

13) Velocity of Occupant with Respect to Vehicle after Collision

Open Calculator

fx $$\mathrm{V_r} = \mathrm{V_o} \cdot \sqrt{\frac{\delta_{\mathrm{occ}}}{\mathrm{d}}}$$

ex $$9.296697\mathrm{m/s} = 11\mathrm{m/s} \cdot \sqrt{\frac{0.215\mathrm{m}}{0.301\mathrm{m}}}$$

Final Velocity

14) Final Velocity after Collision in x-Direction

Open Calculator

fx $$\mathrm{V_{fx}} = \frac{\mathrm{Ptot_{fx}}}{\mathrm{M_{total}}}$$

ex $$2.962963\mathrm{m/s} = \frac{8000\mathrm{kg*m/s}}{2700\mathrm{kg}}$$

15) Final Velocity after Collision in y-Direction

Open Calculator

fx $$\mathrm{V_{fy}} = \frac{\mathrm{Ptot_{fy}}}{\mathrm{M_{total}}}$$

ex $$6.851852\mathrm{m/s} = \frac{18500\mathrm{kg*m/s}}{2700\mathrm{kg}}$$

16) Final Velocity of Vehicle after Collision

Open Calculator

fx $$\mathrm{Vf} = \frac{\mathrm{Ptot_f}}{\mathrm{M_{tot}}}$$

ex $$-1.0625\mathrm{m/s} = \frac{-4.25\mathrm{kg*m/s}}{4\mathrm{kg}}$$

Momentum

17) Momentum of First Vehicle before Collision

Open Calculator

fx $$\mathrm{P1_i} = \mathrm{m1} \cdot \mathrm{V1_i}$$

ex $$3\mathrm{kg*m/s} = 1.5\mathrm{kg} \cdot 2\mathrm{m/s}$$

18) Momentum of First Vehicle before Collision in x-Direction

Open Calculator

fx $$\mathrm{P1_{ix}} = \mathrm{m1} \cdot \mathrm{V1_{ix}}$$

ex $$10000.05\mathrm{kg*m/s} = 1.5\mathrm{kg} \cdot 6666.7\mathrm{m/s}$$

19) Momentum of Second Vehicle before Collision

Open Calculator

fx $$\mathrm{P2_i} = \mathrm{m2} \cdot \mathrm{V2_i}$$

ex $$-7.5\mathrm{kg*m/s} = 2.5\mathrm{kg} \cdot -3\mathrm{m/s}$$

20) Momentum of Second Vehicle before Collision in y-Direction

Open Calculator

fx $$P2_{iy} = m2 \cdot V2_{iy}$$

ex $$18000\text{kg*m/s} = 2.5\text{kg} \cdot 7200\text{m/s}$$

21) Momentum of Two Vehicles before Collision

Open Calculator

fx $$Ptot_{i} = P1_{i} + P2_{i}$$

ex $$\text{-}4.5\text{kg*m/s} = 3\text{kg*m/s} + \text{-}7.5\text{kg*m/s}$$

Variables Used

- **a** Acceleration of Airbag *(Meter per Square Second)*
- **A_v** Constant Deceleration of Vehicle *(Meter per Square Second)*
- **d** Stopping Distance of Vehicle *(Meter)*
- **d_t** Distance Traveled by Airbag *(Meter)*
- **F** Force Exerted on Airbag *(Newton)*
- **F_{avg}** Impact Force on Vehicle after Crash *(Newton)*
- **K_f** Kinetic Energy after Collision of Vehicles *(Joule)*
- **K_i** Kinetic Energy before Collision of Vehicles *(Joule)*
- **m** Mass of Airbag *(Kilogram)*
- **M** Vehicle Mass *(Newton)*
- **M_{tot}** Total Mass of Two Vehicles *(Kilogram)*
- **M_{total}** Total Mass of Colliding Vehicles *(Kilogram)*
- **m1** Mass of First Vehicle before Collision *(Kilogram)*
- **m2** Mass of Second Vehicle before Collision *(Kilogram)*
- **$P1_i$** Momentum of First Vehicle before Collision *(Kilogram Meter per Second)*
- **$P1_{ix}$** Total Momentum of First Vehicle in X-Direction *(Kilogram Meter per Second)*
- **$P1_{iy}$** Momentum of First Car before Collision in Y-Dir *(Kilogram Meter per Second)*
- **$P2_i$** Momentum of Second Vehicle before Collision *(Kilogram Meter per Second)*
- **$P2_{ix}$** Total Momentum Second Vehicle in X-Direction

- $P2_{iy}$ Momentum of Second Car before Collision in Y-Dir *(Kilogram Meter per Second)*
- $Ptot_{f}$ Momentum of Two Vehicles after Collision *(Kilogram Meter per Second)*
- $Ptot_{fx}$ Total Momentum X-Direction after Collision *(Kilogram Meter per Second)*
- $Ptot_{fy}$ Total Momentum in Y-Direction after Collision *(Kilogram Meter per Second)*
- $Ptot_{i}$ Momentum of Two Vehicles before Collision *(Kilogram Meter per Second)*
- $Ptot_{ix}$ Total Momentum in X-Direction before Collision *(Kilogram Meter per Second)*
- $Ptot_{iy}$ Total Momentum in Y-Direction before Collision *(Kilogram Meter per Second)*
- T_{c} Time of Occupant to Stop *(Second)*
- T_{v} Stopping Time of Vehicle *(Second)*
- v Forward Velocity of Vehicle *(Meter per Second)*
- V_{f} Final Velocity of Airbag *(Meter per Second)*
- V_{final} Magnitude of Resultant Final Velocity *(Meter per Second)*
- V_{fx} Final Velocity after Collision in X-Direction *(Meter per Second)*
- V_{fy} Final Velocity after Collision in Y-Direction *(Meter per Second)*
- V_{i} Initial Velocity of Airbag *(Meter per Second)*
- V_{o} Initial Velocity before Collision *(Meter per Second)*
- V_{r} Relative Velocity of Occupant after Collision *(Meter per Second)*
- $V1_{i}$ Velocity of First Vehicle before Collision *(Meter per Second)*

- $V1_{ix}$ X-Direction Velocity of First Car before Collision *(Meter per Second)*
- $V2_{i}$ Velocity of Second Vehicle before Collision *(Meter per Second)*
- $V2_{iy}$ Y-Direction Velocity of Sec Car before Collision *(Meter per Second)*
- Vf Final Velocity of Vehicle after Collision *(Meter per Second)*
- δ_{occ} Stopping Distance of Occupant *(Meter)*
- θ Direction of Final Velocity *(Degree)*

Constants, Functions, Measurements used

- Function: **atan**, atan(Number)
  Inverse trigonometric tangent function
- Function: **sqrt**, sqrt(Number)
  Square root function
- Function: **tan**, tan(Angle)
  Trigonometric tangent function
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Weight** in Kilogram (kg)
  Weight 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
- Measurement: **Energy** in Joule (J)
  Energy Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Momentum** in Kilogram Meter per Second (kg*m/s)
  Momentum Unit Conversion

Check other formula lists

- **Driveline Formulas**
- **Suspension Geometry Formulas**
- **Vehicle Collision Formulas**

Feel free to SHARE this document with your friends!

PDF Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

11/22/2023 | 11:45:27 PM UTC

Please leave your feedback here...