How to Find Change in Velocity: Why It's 7, Not 3

Physics with Tiaotiao 跳跳 · Kinematics · High School Physics

Study sheet for the video "How to Find Change in Velocity": key ideas, practice questions, answers

Matches: NCERT Class 11 Ch 2 Motion in a Straight Line · FSc Part 1 Ch 3 Motion and Force · AS & A Level 9702 · WAEC/JAMB · HSC · College Physics · AP Physics 1 Unit 1

Key ideas

Change = final − initial. Pocket money goes from 3000 to 4000: the change is **+1000**. Coins go from 100 to 98: the change is **−2**. Never use initial − final.
The **sign** tells you whether it went up or down. The **number** tells you by how much.

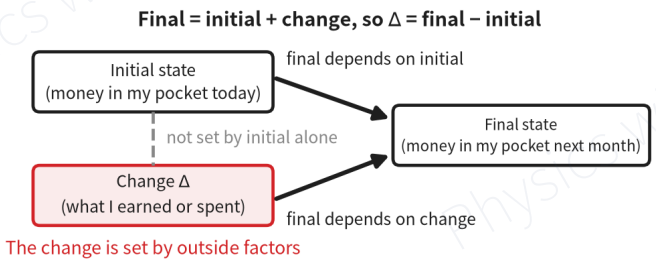
"Depends on" goes one way. The final state depends on the initial state and on the change: **final = initial + change**. So the change is found from a subtraction, but it **does not depend on the initial or final velocity alone**.

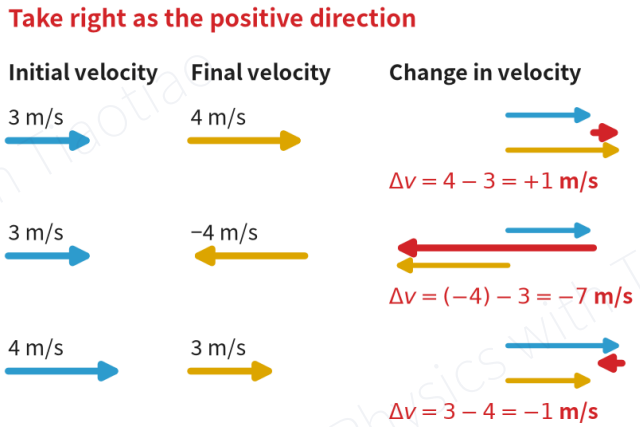
Being able to calculate a quantity is not the same as it depending on that quantity. The change is set by outside factors, for example the brake or the gas pedal.

Change in velocity Δv is an arrow (a vector). $\Delta v = v_t - v_0$, where v_0 is the initial velocity and v_t is the final velocity.
If Δv points the **same way** as v_0, the object speeds up. If Δv points the **opposite way**, the object slows down **only when the opposite arrow is shorter than the initial velocity arrow**. A longer opposite arrow means the object turns around.

Steps on a straight line.
1. Choose the positive direction (usually the direction of the initial velocity).
2. Give v_0 and v_t their signs.
3. Compute $\Delta v = v_t - v_0$.

The signs are ordinary math signs. A + sign can be dropped; a − sign cannot. On a line you only need + and −. A curve has infinitely many directions.





Practice

Try these before checking the answers on the next page.

1. Take right as positive and find Δv for each motorcycle (in km/h).

(a) It speeds up from 30 km/h rightward to 100 km/h.

(b) It slows down from 80 km/h rightward to 20 km/h rightward.

(c) It brakes and turns around, from 40 km/h rightward to 20 km/h the other way.

(a) Δv = _____ (b) Δv = _____ (c) Δv = _____

2. True or false? Write ✓ or ✗.

(1) Velocity is a vector, and change in velocity is a scalar. _____

(2) The velocity points right, and the change in velocity may point left. _____

(3) The greater the velocity, the greater the change in velocity. _____

(4) The change in velocity always points in the same direction as the final velocity. _____

(5) The greater the change in velocity, the greater the velocity. _____

3. Which statement about change in velocity (Δv) is correct? ( ) (more than one may be correct)

A. Δv is a vector; in straight-line motion, + / − signs show its direction

B. The larger the Δv, the greater the object's velocity

C. If the final velocity points right, Δv may point left

D. Δv tells how fast the velocity changes

Answer: _____ Reason:

4. A ball hits the ground at 5 m/s, moving straight down. It bounces and rises for a while, and its speed is then 2 m/s. During this process: ( ) (more than one may be correct)

A. The magnitude of Δv is 7 m/s B. The magnitude of Δv is 3 m/s

C. Δv points downward D. Δv points upward

Answer: _____ Working:

5. A particle moves in a straight line. The magnitude of its initial velocity is 2 m/s and the magnitude of its final velocity is 4 m/s. Then ( ) (more than one may be correct)

A. The magnitude of the change in velocity may be 6 m/s

B. The magnitude of the change in velocity may be 4 m/s

C. The change in velocity may point the same way as the initial velocity

D. The change in velocity may point opposite to the initial velocity

Answer: _____ Working:

Answers and explanations

Tap a blue time to jump to the part of the video that explains the question.

1. (a) +70 km/h, (b) −60 km/h, (c) −60 km/h. Right is positive.
(a) $v_0 = +30$, $v_t = +100$, so $\Delta v = 100 - 30 = 70$ km/h. (b) $v_0 = +80$, $v_t = +20$, so $\Delta v = 20 - 80 = -60$ km/h.
(c) $v_0 = +40$, $v_t = -20$, so $\Delta v = -20 - 40 = -60$ km/h.

Same Δv as (b), different motion. A + sign can be dropped; a − sign cannot.

▶ **Watch 31:30, Example 1**

2. ✗ ✓ ✗ ✗ ✗ (items 1 to 5).
(1) ✗: change in velocity is also a vector, so it has a direction. (2) ✓: the velocity points right, and braking gives a Δv that points left. (3) ✗: a bullet train is fast but moves at constant velocity, so Δv = 0. (4) ✗: Δv does not have to point the way the final velocity points. For 4 m/s to 3 m/s rightward, Δv = −1 m/s points left. (5) ✗: going from 0 to 5 m/s gives a bigger Δv than going from 100 to 99 m/s, but the velocity is far smaller.

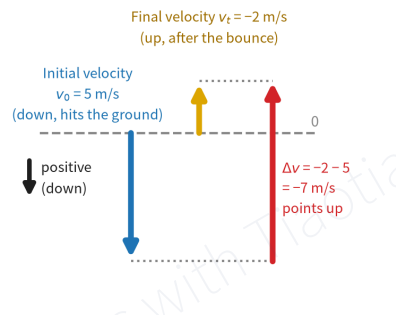
Δv is set by outside factors: think brake and gas pedal.

▶ **Watch 34:15, Example 2**

3. A and C. A is correct: Δv is a vector, and on a line the sign shows direction. C is correct: a final velocity to the right can come with a Δv to the left, for example 3 m/s right to 1 m/s right. B is wrong: Δv does not depend on the velocity alone. D is wrong: Δv is how much the velocity changes. How fast it changes is acceleration, next lesson.

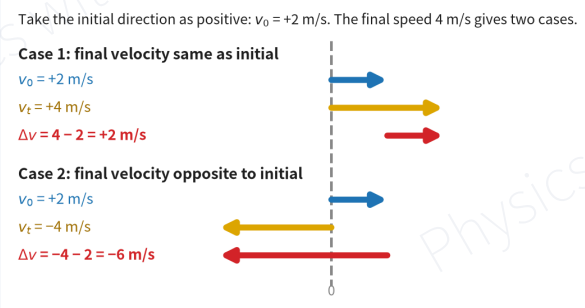
▶ **Watch 36:08, Example 3**

4. A and D. Take down as positive. $v_0 = +5$ m/s and $v_t = -2$ m/s (up is opposite to positive, so negative). $\Delta v = -2 - 5 = -7$ m/s. The magnitude is 7 m/s, and the minus sign means Δv points up.



▶ **Watch 36:58, Example 4**

5. A, C and D. Take the initial direction as positive, so $v_0 = +2$ m/s. Only magnitudes are given, so check several cases. Case 1: $v_t = +4$ m/s, so $\Delta v = 4 - 2 = +2$ m/s, the same way as v_0 (C). Case 2: $v_t = -4$ m/s, so $\Delta v = -4 - 2 = -6$ m/s, opposite to v_0 (D) with magnitude 6 m/s (A). A magnitude of 4 m/s never happens (B is wrong).



Only magnitudes given? Watch for several cases.

▶ **Watch 38:15, Example 5**

One-line summary

Change in velocity = final − initial: pick a positive direction, give both velocities their signs, subtract, and remember that outside factors set Δv.

Key terms

Term	Meaning	Chinese
change in velocity (Δv)	final velocity minus initial velocity	速度变化量 sùdù biànhuàliàng
initial velocity	the velocity at the start	初速度 chū sùdù
final velocity	the velocity at the end	末速度 mò sùdù
positive direction	the direction you choose to call +	正方向 zhèng fāngxiàng
vector / scalar	has direction / has no direction	矢量 / 标量 shǐliàng / biāoliàng
magnitude	the number part, without direction	大小 dàxiǎo