

## Constant Acceleration Problems

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- A car on the highway constantly accelerates from an initial speed of 20 m/s to a final speed of 30 m/s over a time of 5 seconds.
  - What was the car's acceleration?
  - What was the car's average speed?
  - How far did the car travel during this 5 seconds?
- A Boeing 767 airplane can accelerate at a rate of  $3.3 \text{ m/s}^2$ . If a 767 starts from rest,
  - How many seconds will it take to reach a take-off speed of 100 m/s?
  - What would be the average speed of the plane over this interval?
  - How far would it travel in that time?
- Bill constantly accelerates from rest, covering a distance of 20 meters in a time of 3.0 seconds.
  - What was his final velocity? (Hint: find the average speed first.)
  - What was Bill's acceleration?
- Emily is riding her bike with a speed of 5 m/s. She then constantly accelerates at a rate of  $2 \text{ m/s}^2$  until she reaches a speed of 10 m/s.
  - How long will it take her to reach a speed of 10 m/s?
  - What is her average speed for this interval?
  - How far will she travel in that time?
- Chelsea is rollerblading down Charter Road with a velocity of 18 m/s when a small child jumps out in front of her, and she attempts to stop. If her acceleration was a constant rate of  $-1.5 \text{ m/s}^2$ ,
  - After 4 seconds, how fast is Chelsea going?
  - How many total seconds will it take her to stop?
  - How far does she travel before she comes to rest?
  - Why is her acceleration negative?

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6. John is on a skateboard in the gym. His initial velocity is zero. Ernie comes along and pushes John with a constant acceleration across the gym floor. John travels a distance of 20 m in 8 s.
- What is John's average velocity?
  - What is John's final velocity after the 8 seconds?
  - What is John's acceleration across the gym floor?
7. You're driving your car across a flat parking lot. You're traveling at 20 m/s when you shift into neutral and coast to a stop. You're experiencing a constant acceleration due to the force of friction and air resistance. You stop 8.0 seconds after shifting into neutral.
- What is the average velocity of the car?
  - What is the acceleration of the car?
  - Why is the acceleration negative?
  - How far did the car coast?
8. Jocko the clown is on a sled initially at rest at the top of the hill. Due to the pull of gravity, he comes down the hill with constant acceleration. At the bottom of the hill he reaches a maximum speed. Then, he coasts to a stop after traveling 40 m across the flats in 8.0 seconds.
- Draw a picture of the situation. Show where the speed is 0, where the maximum speed is, and where the 40 m and 8 seconds are.
  - What is his average velocity across the flats?
  - What is his velocity at the bottom of the hill? (This is the same as the initial velocity across the flats.)
  - If it takes Jocko 4.0 s to accelerate down the hill, what is his acceleration down the hill?

Answers:

1. a) $2 \text{ m/s}^2$	b) $25 \text{ m/s}$	c) $125 \text{ m}$	2. a) $30.3 \text{ s}$	b.) $50 \text{ m/s}$	c) $1515 \text{ m}$	
3. a) $13.2 \text{ m/s}$	b) $4.4 \text{ m/s}^2$	4. a) $2.5 \text{ s}$	b) $7.5 \text{ m/s}$	c) $18.75 \text{ m}$	5. a) $12 \text{ m/s}$	b) $12 \text{ s}$
c) $108 \text{ m}$	6. a) $2.5 \text{ m/s}$	b) $5.0 \text{ m/s}$	c) $0.63 \text{ m/s}^2$	7. a) $10 \text{ m/s}$	b) $-2.5 \text{ m/s}^2$	d) $80 \text{ m}$
8. b) $5 \text{ m/s}$	c) $10 \text{ m/s}$	d) $2.5 \text{ m/s}^2$				