Acceleration Equation

Solve the following equation for the missing variables:

Example: $v_f = 5$, $v_0 = 26$, t=??, a= -7

$$\bar{a} = \frac{\Delta v}{\Delta t} = \frac{v_f - v_o}{\Delta t} \quad \text{so} \quad -7 = \frac{5-26}{\Delta t} \rightarrow -7\Delta t = -21 \rightarrow -7\Delta t = -21 \rightarrow \Delta t = \frac{-21}{-7} = 3$$

1. $v_f = 10$, $v_0 = 25$, t=5, a=?

2. $v_f = 12$, $v_0 = -6$, t=?, a=6

3. $v_f = ?$, $v_0 = 9$, t=7, a=3

4. $v_f = 80$, $v_0 = 30$, t=?, a=10

5. $v_f = 25$, $v_0 = ?$, t=4, a= - 3

Solve the following equation for the missing variables:

1. In 1977 off the coast of Australia, the fastest velocity by a vessel on the water was achieved. If this vessel were to undergo an average acceleration of 1.80 m/s^2, it would go from rest to its top velocity in 85.6 s.
   a. What was the top velocity of the vessel?

   b. If the vessel accelerates for 60 second, what will its velocity be after that minute?

2. In 1935, a French destroyer, *La Terrible*, attained one of the fastest velocities for any standard warship. Suppose it took 2.0 min (120 seconds) at a constant acceleration of 0.19 m/s^2 for the ship to reach its top velocity after starting from rest. Calculate the ship's final velocity.

3. In 1934, the wind velocity on Mt.Washington in New Hampshire reached a record high. Suppose a very sturdy glider is launched in this wind, so that in 45.0 s the glider reaches the velocity of the wind. If the glider undergoes a constant acceleration of 2.29 m/s^2, what is the wind's velocity? Assume that the glider is initially at rest.

4. In 1992, Maurizio Damilano, of Italy, walked 29 752 m in 2.00 h (7200 seconds).
    a. Calculate Damilano's average velocity in m/s.

    b. Suppose Damilano slows down to 3.00 m/s at the midpoint in his journey, but then picks up the pace and accelerates to the velocity calculated in (a). It takes Damilano 30.0 s to accelerate. Find the magnitude of the average acceleration during this time interval.

5. South African frogs are capable of jumping as far as 10.0 m in one hop. Suppose one of these frogs makes exactly 15 of these jumps in a time interval of 60.0 s.
    a. What is the frog's average velocity?

    b. If the frog lands with a velocity equal to its average velocity and comes to a full stop 0.25 s later, what is the frog's average acceleration?

6. In 1991 at Smith College, in Massachusetts, Ferdie Adoboe ran 1.00×10^2 m backward in 13.6s. Suppose it takes Adoboe 2.00 s to achieve a velocity equal to her average velocity during the run. Find her average acceleration during the first 2.00 s.

7. In the 1992 Summer Olympics, the German four-man kayak team covered 1 km in just under 3 minutes. Suppose that between the starting point and the 150 m mark the kayak steadily increases its velocity from 0.0 m/s to 6.0 m/s, so that its average velocity is 3.0 m/s.
    a. How long does it take to cover the 150 m?

    b. What is the magnitude of the average acceleration during that part of the course?

8. The highest velocity ever achieved on a bicycle was reached by John Howard of the United States. The bicycle, which was accelerated by being towed by a vehicle, reached a velocity of +245 km/h. Suppose Howard wants to slow down, and applies the brakes on his now freely moving bicycle. If the average acceleration of the bicycle during braking is –3.0 m/s^2 (38,880 km/h^2), how long will it take for the bicycle's velocity to decrease to 80% of his original speed?

9. In 1993, bicyclist Rebecca Twigg of the United States traveled 3000 m in 217.347 s. Suppose Twigg travels the entire distance at her average velocity and that she then accelerates at –1.72 m/s^2 to come to a complete stop after crossing the finish line. How long does it take Twigg to come to a stop?

10. A certain car can accelerate from 0 to 100 km/hr in 6.0 seconds. What is the average acceleration of that car in m/s^2?

11. If a car accelerates at 4.0 m/s^2, how long will it take to reach a velocity of 80 km/hr (22 m/s), starting from rest?