

1. The position of a particle moving horizontally on a line is given by  $s(t) = t^3 - 9t^2 + 15t + 10$ , where  $t$  is in seconds and  $s(t)$  is in centimeters.
- (a) Find a formula for the velocity at time  $t$ .
  - (b) What is the velocity after 3 seconds?
  - (c) When is the particle at rest?
  - (d) Draw a diagram to represent the motion of the particle for  $0 \leq t \leq 6$ .
  - (e) When is the particle moving to the right? To the left?
  - (f) Find the total distance traveled by the particle in the first 6 seconds.
  - (g) Find a formula for the acceleration of the particle at time  $t$ .
  - (h) When is the particle speeding up? When is it slowing down?

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2. A population of flies is growing in a large container. The number of flies  $P$  (in hundreds) after  $t$  weeks is given by  $P(t) = 12t^2 - t^4 + 5$ .

(a) Find  $P'(1)$ . What does this mean in the context of this situation?

(b) When does the fly population stop growing?

3. Two track runners are set to run the 100-meter dash. The distances  $s_1(t)$  and  $s_2(t)$  that each will run after  $t$  seconds are given by  $s_1(t) = \frac{1}{5}t^2 + 10t$  and  $s_2(t) = \frac{1100t}{t+100}$  for  $t \geq 0$ .

(a) Which runner is faster out of the starting block (greater initial velocity)?

(b) Which runner wins the race?

(c) What is the speed of each runner at the finish line?