AP Calculus
More Motion on a line

A particle moves along a line according to a law of motion $t \geq 0$, where t is measured in seconds and s(t) is measured in meters.

a.   When does the particle change direction? Justify.
b.   When is the particle moving to the right? Left? Justify.
c.   Is the particle slowing down or speeding up at t = 0.5? Justify.
d.   Is the velocity increasing or decreasing at t = 2.5? Justify.

1. $s(t) = -t^3 + 12t^2 - 36t$

2. $s(t) = \cos\left(\dfrac{\pi t}{4}\right)$, $[0,6]$

3. $s(t) = (t-3)^3(t-1)$

Answers

1a   t = 2, 6; because v(t) = 0 at t = 2,6 and v(t) changes signs at these times.
1b   right: (2, 6) because v(t) > 0 on this interval
       left: (0, 2) and (6, inf) because v(t) < 0 on these intervals
1c   slowing down at t = 0.5 because v(t) and a(t) have opposite signs
1d   velocity increasing because a(t) > 0 at t = 2.5

2a   t = 4 because v(t) = 0 at t = 4 and v(t) changes signs at this time
2b   right: (4, 6) because v(t) > 0 on this interval
       left: (0, 4) because v(t) < 0 on this interval
2c   speeding up at t = 0.5 because v(t) and a(t) have same signs
2d   velocity increasing because a(t) < 0 at t = 2.5

3a   t = 3/2: because v(t) = 0 and v(t) changes signs at this time
3b   right: (3/2, 3) and (3, inf) because v(t) > 0 on these intervals
       left: (0, 3/2) because v(t) < 0 on this interval
3c   slowing down at t = 0.5 because v(t) and a(t) have opposite signs
3d   velocity decreasing because a(t) < 0 at t = 2.5