1. A particle's position along the $x$-axis is measured by $x(t) = t^4 - 4t^3 + 2$ where $t > 0$. Find the intervals where the particle is speeding up. Find intervals where the particle is slowing down.

2. A particle's position along the $y$-axis is measured by $y(t) = 3t^2 - 2t^3$ for $t \geq 0$. Find the intervals where the particle is speeding up. Find intervals where the particle is slowing down.

**For each table, selected values of $x$ and $f(x)$ are given. Assume that $f'(x)$ and $f''(x)$ do not change signs. Answer the questions for each table.**

3.

| $x$ | $f(x)$ |
|-----|--------|
| $-3$ | $-3$ |
| $-2$ | $2$ |
| $-1$ | $5$ |
| $0$ | $6$ |

   a. Is $f(x)$ increasing or decreasing?

   b. Is $f(x)$ concave up or concave down?

4.

| $x$ | $f(x)$ |
|-----|--------|
| $-8$ | $-5$ |
| $-7$ | $-3$ |
| $-6$ | $0$ |
| $-5$ | $4$ |

   a. Is $f(x)$ increasing or decreasing?

   b. Is $f(x)$ concave up or concave down?

5. Given the function $g(x) = x^3 - \frac{9}{2}x^2 - 12x + 5$, find the interval(s) when $g$ is concave **down** and **decreasing** at the same time.

6. Given the function $h(x) = -2x^3 + 2x^2 + 3$, find the interval(s) when $h$ is concave **up** and **increasing** at the same time.

Answers to 5.9 CA #2

| 1. Speeding up: $(0, 2)$ and $(3, \infty)$ Slowing down: $(2, 3)$ | 2. Speeding up: $\left(0, \frac{1}{2}\right)$ and $(1, \infty)$ Slowing down: $\left(\frac{1}{2}, 1\right)$ | 3a. Increasing 3b. Concave down |
|---|---|---|
| 4a. increasing 4b. Concave up | 5. $\left(-1, \frac{3}{2}\right)$ | 6. $\left(0, \frac{1}{3}\right)$ |