4.2b / Practice workbook

Speed: Speeding Up and Slowing Down

Practice

Problems 1–5 / Show your reasoning

1 A particle moves along a line with velocity $v(t) = t^3 - 3t^2$. At $t = 1$, which of the following is true?

A. The speed is increasing, because $a(1) < 0$.

B. The speed is increasing, because $v(1)$ and $a(1)$ are both negative.

C. The speed is decreasing, because $v(1) < 0$.

D. The speed is decreasing, because $a(1) < 0$.

4.2b / AP-style free response

Problem 2 ➤ */ Show the work and the reasons a grader looks for.*

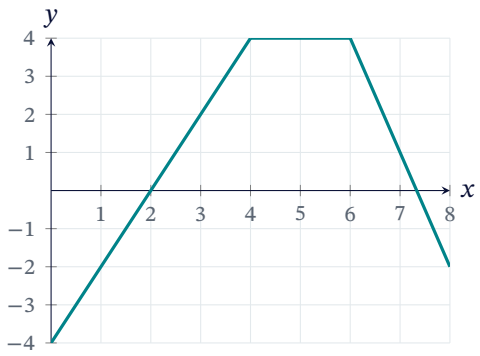
A particle moves along the x-axis with position $x(t) = 2t^3 - 21t^2 + 60t$ for $0 < t < 6$.

(a) Find the speed of the particle at $t = 3$.

(b) Is the speed increasing or decreasing at $t = 3$? Give a reason.

(c) On what intervals is the particle speeding up? Justify your answer.

3 The graph of the velocity $v(t)$ of a particle, $0 \le t \le 8$, is made of segments. On which interval is the speed of the particle decreasing?



A. $0 < t < 2$
B. $2 < t < 4$
C. $4 < t < 6$
D. $7.5 < t < 8$

4 A particle moves along a line with velocity $v(t) = \cos(2t)$. At $t = \frac{\pi}{3}$, the particle is

A. moving left and speeding up
B. moving left and slowing down
C. moving right and speeding up
D. moving right and slowing down

4.2b / AP-style free response

Problem 5 ➤ */ Show the work and the reasons a grader looks for.*

A particle moves along a line with velocity $v(t) = (t - 4)\sqrt{t}$ for $t > 0$.

(a) Find $a(1)$.

(b) Is the speed of the particle increasing or decreasing at $t = 1$? Give a reason.

4.2b / Answer key

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1 (B)

2 (a) 12; (b) increasing: $v(3) = -12 < 0$ and $a(3) = -6 < 0$; (c) $\left(2, \frac{7}{2}\right)$ and $(5, 6)$

3 (A)

4 (A)

5 (a) $-\frac{1}{2}$; (b) increasing: $v(1) = -3 < 0$ and $a(1) = -\frac{1}{2} < 0$, the same signs