

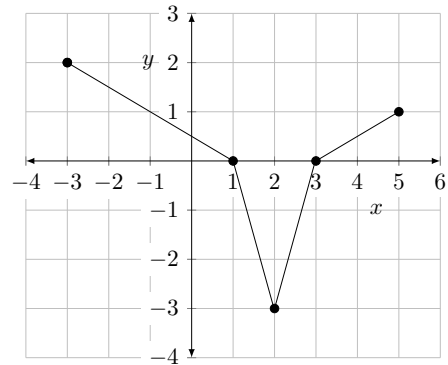
Name: \_\_\_\_\_

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**Mini-math Div 3/4: Monday, November 20, 2023 (15 minutes)**

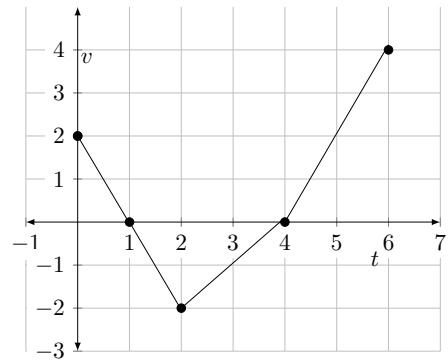
1. (2 points) The graph of the piecewise linear function  $f$  is shown in the figure to the right. What is the average value of  $f$  over  $[-3, 5]$ ?

- A.  $-1$
- B.  $-1/8$
- C.  $0$
- D.  $1/4$
- E.  $2$



2. (2 points) The graph of the velocity of a function is the piecewise linear function shown in the figure to the right. The initial position of the particle at time  $t = 0$  is  $x = 1$ . What is the total distance the particle travels from  $t = 0$  to  $t = 6$ ?

- A.  $2$
- B.  $3$
- C.  $4$
- D.  $8$
- E.  $9$



3. (2 points) The acceleration of a particle is modelled by  $a(t) = 2t + 3$  for  $t \geq 0$ . At  $t = 0$ , the velocity of the particle is  $-2$  and its position is  $2.5$ . What is the change in displacement of the particle from  $t = 0$  to  $t = 3$ ?

- A. 9                      B. 16                      C. 16.5                      D. 19                      E. 22.5

4. (2 points) Suppose  $f$  is a differentiable function. Which of the following statements are true:

- (I) The average value of the derivative of  $f$  over  $[a, b]$  is the same as the average rate of change of  $f$  over  $[a, b]$ .  
(II) There exists a  $c \in [a, b]$  for which  $f(c)$  equals the average value of  $f$  over  $[a, b]$ .

- A. (I) only              B. (II) only              C. Both (I) and (II)              D. Neither (I) nor (II)

E. The truth of both statements depend on the specific choice of  $f$

5. (2 points) Water is leaking out of a tub at a rate modelled by  $r(t) = \frac{1}{t^2 + 1}$  cm<sup>3</sup>/min, where  $t$  is in minutes. If the initial volume of the tub is 160 000 cm<sup>3</sup>, which of the following represents the volume of the tub at time  $t$ ?

A.  $160000 + \int_0^t r(x) dx$

B.  $160000 - \int_0^t r(x) dx$

C.  $160000 - \frac{1}{t^2 + 1}$

D.  $160000 + \frac{r(t)}{t^2 + 1}$

E.  $\frac{1}{t^2 + 1}$

6. (2 points) Find the area of the bounded region in the first quadrant below both  $y = x^2$  and  $y = 2 - x$  and above the  $x$ -axis.

A.  $2/3$

B.  $5/6$

C.  $1$

D.  $7/6$

E.  $3$

7. (4 points) Write an integral (or integrals) to calculate the area of the finite region(s) bounded by the given curves.

$$x + y = 1, \quad 2x - y = -1, \quad 4x - y = 4$$