Homework 1.5 – Rectilinear Motion

1. **(1 pt) alfredLibrary/AUCI/chapter1/lesson5/billsally1pet.pg**
(Include ***units*** *in your answers!)*

For this problem east will be considered the positive direction.

Suppose Bill and Sally are returning from vacation traveling WESTWARD at a constant SPEED of 45 mi/hr. We will compute the displacement using two different methods.

(a) **METHOD 1: Area bounded by the velocity curve.**

From time 5 hr to time 7 hr, the displacement is given by

$$\_\_\int\_\_ \quad \_\_\_\_ \quad dt = \quad \_\_\_\_\_\_\_\_ \Big| \_\_\_\_\_ \quad = \quad \_\_\_\_\_\_$$

(b) **METHOD 2: Net change in position.**

If Bill and Sally started 1500 miles east of home, then their position function is

$s(t) =$ _________.

Therefore,

$s(5 \text{ hr}) =$ _________ and $s(7 \text{ hr}) =$ _________.

From time 5 hr to time 7 hr, the displacement is given by

$s(7 \text{ hr}) - s(5 \text{ hr}) =$_________.

NOTE: Parts (a) and (b) yield the same answer according to the Fundamental Theorem.

2. **(1 pt) alfredLibrary/AUCI/chapter1/lesson5/quiz-/speedanddistance30p.pg**

(You do not need units for part (a), but you do need to include 'dt.')

(a) If an object travels along a line with constant velocity $-34\ \frac{\text{m}}{\text{s}}$, then the general formula for the position of the object is

$s(t) = \int$ _____ = _________.

(All of your answers from here on require ***units.****)*

(b) If the object has an initial position of 498 m, then we can find the unknown constant C. In this case, the particular position function is

$s(t) =$ _________.

From this position function, we find that the object is at the origin at time $t =$ ____.

(c) The net change in the object's position (i.e., the displacement) from time 3.25 s to time 18.25 s is

$$s(\ \_\_\ ) - s(\ \_\_\ ) = \_\_\int\_\_ \quad \_\_\_\_ \quad dt =$$

(d) The total distance traveled over the same time period is

$$\_\_\int\_\_ \quad \_\_\_\_ \quad dt = \quad \_\_\_\_\_\_\_\_ \Big| \_\_\_\_\_ \quad = \quad \_$$

(HINT: Integrate the speed.)

3. **(1 pt) alfredLibrary/AUCI/chapter1/lesson5/quiz-/DisplAndTotalDist.pg**
Suppose $v(t) = 4 - 2t$ is the velocity (in meters per second) of an object in rectilinear motion.

(a) Sketch the graph of v on the interval $[-1, 3]$.

(b) The t-intercept of $v(t)$ is the time at which the velocity is zero. In this case, the t-intercept is

$t =$ ______________ s.

(c) Use the graph of $v(t) = 4 - 2t$ and geometry to find the displacement of the object on $[-1, 3]$.

$\int_{-1}^{3} (4 - 2t)\, dt =$ ______________ m.

(d) Use the graph of $|v(t)| = |4 - 2t|$ and geometry to find the total distance traveled by the object on $[-1, 3]$.

$\int_{-1}^{3} |4-2t|\, dt =$ ______________ m.

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4. **(1 pt) alfredLibrary/AUCI/chapter1/lesson5/reservoir1pet.pg**

Let t be time in seconds and let $r(t)$ be the RATE (not the total amount), in gallons per second, at which water enters a reservoir:

$r(t) = 800 - 35t$ gal/s

(a) Evaluate the expression $r(5) =$ ______________

(b) Which one of the statements below best describes the physical meaning of the value of $r(5)$?

- A. The rate at which the rate of the water entering the reservoir is decreasing when 5 gallons remain in the reservoir.
- B. How many seconds until the water is entering to reservoir at a rate of 5 gallons per second.
- C. The rate, in gallons per second, at which the water is entering reservoir after 5 seconds.
- D. The total amount, in gallons, of water in the reservoir after 5 seconds.
- E. None of the above.

(c) For each of the following two mathematical expressions, match one of the statements A - E from the list below which best explains its meaning in practical terms.

___1. The horizontal intercept of the graph of $r(t)$.
___2. The vertical intercept of the graph of $r(t)$.

A. How many seconds it takes until there is no longer any water in the reservoir.
B. The rate at which the rate of water entering the reservoir is decreasing in gallons per second squared.
C. The initial amount of water, in gallons, in the reservoir.
D. After how many seconds the water stops flowing into the reservoir and starts to drain out.
E. The rate, in gallons per second, at which the water is initially entering the reservoir.

(d) For $0 \le t \le 40$, when does the reservoir have the most water? (Hint: The net area bounded by the rate graph represents the displacement in water on the given interval.)

When $t =$ _____ s

(e) For $0 \le t \le 40$, when does the reservoir have the least water? (Hint: The net area bounded by the rate graph represents displacement in water on the given interval.)

When $t =$ _____ s

(f) If the domain of $r(t)$ is $0 \le t \le 40$, what is the range of $r(t)$ over this domain?

______________ (help on using **interval notation**)